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Expectation in Visual Symbolic Processing of Environmental Symbols in People with Fluent Aphasia

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EXPECTATION IN VISUAL SYMBOLIC PROCESSING OF ENVIRONMENTAL SYMBOLS IN PEOPLE WITH FLUENT APHASIA

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TABLE OF CONTENTS

ACKNOWLEDGMENTS …………………………………………….... ii

LIST OF TABLES………………………………………………………. v

LIST OF FIGURES……………………………………………………… vi

ABSTRACT……………………………………………………………… vii

INTRODUCTION……………………………………………………….. 1

REVIEW OF LITERATURE……………………………………………. 3

Definition of Aphasia……………………………………………. 3

Aphasia Subtypes………………………………………………… 3

Theories of Symbolic Processing in Aphasia………………………. 5

Aphasia and Symbol Processing……………………………………. 8

Visual Agnosia and Isolated System Damage……………………….... 13

Symbol Use in Therapy………………………………………….. 16

Inference and Expectation…………………………………………. 19

Inference in Aphasia………………………………………………. 21

Summary………………………………………………………… 24

CURRENT RESEARCH………………………………………………… 26

METHODS………………………………………………………………. 27

Subjects………………………………………………………….. 27

Instrumentation………………………………………………….. 29

Creation of Stimuli……………………………………………….. 31

Simple Symbolic Conditions …..…………………………………... 32

Complex Symbolic Conditions……………………………………… 33

Simple Lexical Conditions……………………………………….. 33

Complex Lexical Conditions……………………………………… 34

Procedures……………………………………………………….. 34

Participants with Aphasia………………………………… 34

Non-Neurologically Damaged Participants…………………. 36

Data Analysis……………………………………………………… 37

RESULTS and DISCUSSION…………………………………………… 38

Results……………………………………………………………….. 38

Discussion…………………………………………………………… 43

SUMMARY……………………………………………………………….. 47

Summary…………………………………………………………….. 47

Interesting Observations……………………………………………… 48
Limitations of the Study and Directions for Future Research……….. 48

REFERENCES………………………………………………………………… 50

APPENDIX
A: PARTICIPANT QUESTIONNAIRE……………………….………….. 56

B: EDIBRUGH HANDEDNESS INVENTORY……….………….……. 57

C: ROSENBAUM VISON POCKET SCREENER……...…………… 58

D: APHASIA DIAGNOSTIC PROFILES……………..…………….. 59

E: THE MINI-MENTAL STATE EXAMINATION…………………. 75

F: MIAMI VETERAN'S ADMINISTRATION MEDICAL CENTER COMMUNICATION SCREENER…………………………………….. 76

G: FIGURES G1-G6……………………………………………….. 79

VITA………………………………………………………………………… 86

LIST OF TABLES

1. Results of literature review for possible combinations of impaired and spared recognition of faces, common objects, and words (Farah, 1992)……………………………………15

2. Biographical and Descriptive Information for Participants with Aphasia ……..…..…...27

3. Aphasia Diagnostic Profile Scores for Participants with Aphasia……………………….28

4. Biographical and Descriptive Information for Non-neurologically Damaged Participants ……………………………………………………………………………28

5. Kruskal-Wallis Test Statistics…………………………………………………………38

6. Descriptive Statistics and Standard Deviations (SD) for Percent Correct for Each Group in Each Condition…………………………………………………………………..39

7. Descriptive Statistics and Standard Deviations (SD) for Incongruent Percent Correct for Each Group in Each Condition…………………………………………………………..40

8. Descriptive Statistics and Standard Deviations (SD) for Reaction Times for Each Group in Each Condition…………………………………………………………………..40

9. Motoric Baseline Reaction Times…………………………………………………….41

10. A Priori Paired Samples Test for Individuals with Aphasia………………………….....42

11. Paired Sample Correlations for Individuals with Aphasia……………………………….43

LIST OF FIGURES

1. Example Simple Expected and Unexpected Visual Sequences…………….…………32

2. Example Complex Expected and Unexpected Visual Sequences………….…………..33

G1: Individual Performance on SV versus SLV…………………………………………...80

G2: Individual Performance on SVPC versus SLVPC……………………………………81

G3: Individual Performance on SVIP versus SLVIP………………………………………82

G4: Individual Performance on CV versus CLV…………………………………………..83

G5: Individual Performance on CVPC versus CLVPC……………………………………84

G6: Individual Performance on CVIP versus CLVIP……………………………….……..85

ABSTRACT

The purpose of this study was to examine aspects of visual symbolic processing in those individuals with fluent aphasia, and how it compares to that of their lexical ability. Two groups of participants were examined: a group with fluent aphasia, and a group of non-neurologically damaged controls. Participants were administered four computer based expectation tasks, two of which were symbolic, and two which were lexical. Each task contained a simple and a complex level. Participants were required to determine if the final stimulus, within a set of four, was congruent or incongruent. The measures taken included both reaction time and accuracy. Results suggest significant differences in reaction times for individuals with aphasia and non-neurologically damaged individuals. Individuals with aphasia also identified fewer incongruent stimuli correctly. Within the aphasia group, statistical significance was approached between the simple symbolic condition and simple lexical condition. If this study were completed with a larger sample size, results could indicate a relative preservation of the non-verbal symbolic system as compared to the lexical system for simple conditions. Strong correlations were also noted for several opposing non-verbal and lexical conditions.

INTRODUCTION

Many patients with fluent aphasia demonstrate impaired abilities in auditory and reading comprehension, but have relatively fluent, though paraphasic speech (Davis, 2000). Due to comprehension deficits, and potentially non-functional verbal output (Brookshire, 1997), communication with these patients is problematic, and calls for alternative methods and communication and for potential revision of the foci of language therapy. Symbols can be used as a mode of alternative communication within and outside the therapy setting (Fox & Fried-Oken, 1996). By examining processing of visual symbolic stimuli, the degree of preservation of the nonverbal symbolic system will be more completely understood. Further, though more generalized symbolic deficits may be apparent in people with fluent aphasia, to identify those with mild symbolic deficits, examining higher level processing skills, such as formulating expectations, may be warranted.

The purpose of this study is to examine the preservation of the symbolic system of those with fluent aphasia. The introduction is divided into seven sections. First, since the primary focus of the paper is on people with aphasia, specifically fluent, it is necessary to set forth a definition of aphasia and discuss the subtypes of fluent aphasia. First we must understand how people with aphasia process symbols and then examine the research on symbolic processing. Next, visual agnosia is considered to present the case that if specific impairments of such an isolated system can occur, then it needs to be determined if this isolated system can be spared. Then, a review is presented of how symbols have been used in therapy to demonstrate that people with aphasia can effectively use symbols as an enhancement or ulterior mode of communication For later comparison of the participants with aphasia to the non-neurologically

damaged population, review of normal individuals abilities in formulating expectations will be presented in section five, followed by those with aphasias abilities in section six. The final section will discuss the need for further research in these areas. Within this section, the questions and predictions of the proposed research are specified.

REVIEW OF LITERATURE

Definition of Aphasia

Aphasia is defined as "an acquired impairment in language comprehension, production, and the other cognitive processes that underlie language" (Murray & Chapey, 2001, p. 55). Aphasia occurs secondary to brain damage, including tumor, aneurysm, or most frequently stroke. Aphasia is considered a multi-modality disorder because it affects several systems including; listening, speaking, reading, writing, and gesturing in varying degrees depending on modality (Murray & Chapey, 2001). Because of the numerous language modalities possibly affected, sub-categories have been proposed to increase effectiveness of documentation and treatment. The neoclassical terminology associated with the 'Boston School' led by Goodglass and other clinicians at the Veterans Hospital in Boston is based on the phrase length of the patient and is on a dichotomous scale of fluent versus non-fluent (Edwards, 2005). Non-fluent aphasia is synonymous with anterior aphasia, as fluent is with posterior aphasia. As with the Boston model, later researchers began to describe aphasia in terms of both language ability and site of anatomical lesion (Damasio, 2001). Though much debate has arisen about both validity and necessity, the broad-based categorizations of individuals with aphasia has been useful in describing language abilities and anatomical sites of lesion. For the purpose of this study, the terms fluent and non-fluent aphasia will be used because of their descriptions of behavior as opposed to site of lesion.

Aphasia Subtypes

People with non-fluent aphasia tend to exhibit lesions in or near the left temporal lobe. The deficits resulting from damage to this area often lead to poor articulation, limited

vocabulary, agrammatism, and mild to moderate disruption in auditory comprehension and reading ability (Goodglass & Kaplan, 1983).

People with fluent aphasia are described as having disproportionately impaired auditory comprehension in comparison to their fluent speech. Sites of lesions for people with fluent aphasia tend to be in the left primary auditory cortex (Heschl's gyrus), and portions of the second temporal gyri (Damasio, 2002). Because the focus of this paper is fluent aphasia, subdivisions of this classification will be discussed. Subdivisions include transcortical sensory aphasia, anomia, and the more common Wernicke's aphasia and conduction aphasia. Conduction aphasia is characterized by poor repetition skills, the severity of which far exceeds comprehension and spontaneous speech disruptions. Conversely, transcortical sensory aphasia is typified by good repetition skills. Comprehension deficits in conduction and transcortical sensory aphasias are not as severe as Wernicke's aphasia. Anomic aphasia is characterized by fluent speech and good comprehension, but also with deficits in accessing lexical items (Edwards, 2005). Wernicke's aphasia is the most severe form of fluent aphasia. These patients have poor language comprehension, may produce semantic and neologistic paraphasias, and sometimes jargon. They may also exhibit a lack of awareness of their disorder (Davis, 2000). "The fluent jargon has recognizable sentence structure, indicative of a dissociation of word-finding from fundamental syntactic construction. A patient may continue talking when it is his turn to listen, known as press for speech" (Davis, 2000, p. 37).

According to Edwards (2005), although fluent aphasia is common, there is relatively little research on it as compared to non-fluent aphasia, or Broca's aphasia. Wallesch, Bak, and Schulle-Mouting (1992) found that the majority of patients who survived one-year post-brain trauma had a fluent aphasia. The lack of literature makes it unclear how best to provide support

and therapy to individuals with fluent aphasia. The high occurrence of fluent aphasia contributes to the need for innovative therapeutic strategies and improved methods of communication.

Theories of Symbolic Processing in Aphasia

Language is not the only means of communication. The ability to use nonverbal stimuli is an important faculty that allows us to move about our environments easily. Symbolic understanding is what allows us to navigate surroundings that are laden with both arbitrary and related figures. Controversy arises over the localization within the hemispheres for processing symbolic stimuli. Traditionally, it was thought that symbolic information was processed in the right hemisphere, but more current research suggests that this non-linguistic aspect of language may be represented bilaterally (Yaegar & Rubin, 2005). As stated by Gardner (1974) "The capacity to employ symbolic materials is of crucial importance in contemporary society. Individuals must deal with words, numbers, trade marks and insignias, as well as pictoral materials like maps, diagrams, and paintings" (p.141).

What happens under the condition of brain damage to the ability to process symbols is subject to debate. In the past, the debate focused on the extent of impairment of symbolic processing in persons with aphasia, and whether impairment was isolated to linguistic symbols or affects a full array of symbol systems (Bay, 1962; Gardner, 1974 (a); Gardner, 1974 (b); Head, 1926; Jackson, 1932; Thorburn, Newhoff, & Rubin 1995; Wapner & Gardener, 1981). It is clinically significant to identify the degree to which processing of linguistic and non-linguistic symbols are impaired to enhance communication with people with aphasia.

Two schools of thought have formed on the processing of symbols. One school of thought, the "unitary" position holds that aphasia results in an overall reduction in the ability to use symbols. Bay (1962) supported this view by stating that aphasia is the result of disrupted

conceptual thinking. Other supporters (Duffy & Duffy, 1975) maintained that aphasia was an impairment of central symbolic ability. Supporters of this position pose that brain-damaged patients should display difficulty in processing all types of visual symbols. However, this view seems weak based on evidence showing patients with aphasias' ability to employ symbols to navigate symbol laden environments. (Luria 1970, Goodglas and Kaplan, 1972). Another school of thought is the "pluralistic" position, which accounts for varying degrees of symbolic impairment including asymbolia and visual agnosia, and which may occur without the diagnosis of aphasia (Geschwind, 1965; Farah, 1990). Supporters of this school propose that people with aphasia may have individually based abilities and deficits in symbolic processing due to their severity level, site of lesion, and other variables.

This debate is difficult to resolve since there is such a wide swath of approaches to understanding the processing of symbols, which include philosophical, psychological, and methodological issues. The philosophical aspect of symbol processing contends that there are different types of symbols which include iconic and arbitrary symbols (Goodman, 1968). Often, psychologists focus upon symbol processing and whether or not subjects respond appropriately when presented with different types of symbols (Pollio, 1974), and how our minds encode or manipulate different symbolic information (Fodor, 1975). There are also methodological issues associated with the study of symbol processing on just how to successfully assess symbolic competence (Harnad, Steklis, & Lancaster, 1976).

To further address measures of symbolic competence, Wapner and Gardner (1981) studied knowledge of visual symbols by probing the meaning directly without having the participants correctly name or categorize the symbol. To test the differences between hemisphere pathologies, persons with aphasias and right-hemisphere disordered patients were

compared on their symbolic performance. In conjunction with the pluralistic hypothesis, it was predicted that left and right-hemisphere disordered patients would demonstrate different abilities based on the types of symbols (i.e. linguistic or pictographic).

Included in the study were thirty-two participants with left-hemisphere damage, fourteen with anterior lesions, sixteen with posterior lesions, fifteen patients with right-hemisphere disorders, and ten non-neurologically damaged matched adults. Stimuli included seven categories of symbols: pictured objects, signs conventionally used with numbers, common traffic signs, two sets of familiar commercial trademarks, and two sets of linguistic forms. In six of the conditions, four symbols, either alone or in context, were presented to each patient who was asked to identify the target. In the seventh condition, the patient was simultaneously shown either one word and four pictures or one picture and four words and asked to correctly match them.

A significant difference was found between the groups, attributable to the superior performance of the non-neurologically damaged subjects over the two groups with brain damage. Although there was no difference in the overall success between the right-hemisphere patients and the patients with aphasia, the right-hemisphere patients performed better than the patients with fluent aphasia, but not the patients with non-fluent aphasia. Further, it was found that the right-hemisphere group was superior on the purely linguistic tasks compared to the group with aphasia, which had the most difficulty with the task. The groups with right and left-hemisphere brain damaged had equal scores on the trademark conditions. Their performance suggested that there are two ways to process these types of symbols, linguistically or pictorially. Right-hemisphere patients may process trademarks as linguistic symbols, while left-hemisphere patients may process these symbols pictorially. When performances of patients with Broca's

aphasia, patients with alexia, and patients with Wernicke's aphasia were compared, the patients with Broca's aphasia were the most successful and the patients with Werrnicke's aphasia were the least successful (Wapner & Garner, 1981).

Findings from Wapner and Gardner (1981) suggest that patients with aphasia display an array of impairments with different types of symbol systems to differing degrees. Although their findings support the pluralistic school of thought, they call for modifying the theory because the patterns found within and across their groups do not indicate clear dissociation in symbol systems.

Aphasia and Symbol Processing

In the past, Augmentative and Alternative Communication (AAC) has been used with people who have sustained brain damage to improve their communicative function (Van De Sandt-Koenderman, 2004; Jacobs, Drew, Ogletree, & Pierce, 2004; Cress & King, 1999; Beck & Fritz, 1998; Fox & Fried-Oken, 1996). Further, symbol systems have been used with AAC to enhance communicative abilities in non-speaking individuals (Glass, Gazzaniga, & Premack, 1973; Shklovsky, Vizel, & Borovenko, 1982; Johannsen-Horbach, Cegle, Mager, & Schempp, 1985). Although it is clear that this population has been able to learn and use a symbol system, it is not known to what extent certain variables affect the acquisition and retention of these symbols. Gardner (1974) examined the kinds of errors made in naming different objects and symbols and evaluated effects of operativity on naming. Operativity was defined by Gardner (1974) as "the extent to which elements can be transformed and involved in a variety of sensory and motor schemes" (p. 133).

The naming portion of this study was tested with the following subjects: twenty-two aphasia patients with focal brain damage, forty preschool children, with an age range of 3-4;11

and eleven control adults. The subjects with aphasia were divided into groups of eleven non-fluent and eleven fluent patients with focal lesions in the dominant hemisphere. Subjects were shown a picture and asked to name a certain item present in that picture indicated by a pointer. If after thirty seconds a subject did not respond, four verbally presented choices were offered and the subjects then could indicate a response by naming or pointing to one of four fingers corresponding to the choices (Gardner,1974).

People in the control group correctly answered nearly 100% of the time. Subjects with aphasia required multiple choices for 26% of the items and of those items they missed 10%. Semantic errors were the most frequently occurring errors exhibited. Overall, people with aphasia demonstrated more difficulty in the naming of objects compared to non-neurologically damaged subjects. However, the number of correct items named did not differ significantly between the two groups. Operativity and frequency positively influenced the subjects' with aphasias ability to name objects. Children required 40% of the items to be presented with choices, in which they consequently missed 49%. Of the 795 items presented, children made semantic errors 282 times. Performance on naming by subjects with aphasia was positively influenced by operativity and frequency.

A second study by Gardener (1974), examined the naming of symbols with the following subjects: forty right-handed males with aphasia, fifteen patients with non-fluent aphasia, fifteen patients with fluent aphasia, ten patients with global aphasia, ten non-neurologically damaged age matched adults, and forty children 3-4 years of age. Most, but not all subjects participated in the first study.

Symbolic stimuli represented on index cards consisted of colors, numbers, letters, and animals. Each stimulus was presented and the subjects were given fifteen seconds to name it.

After fifteen seconds, the category to which the item belonged was given as a cue. After thirty seconds, subjects with aphasia were given multiple choices. Non-neurologically damaged subjects answered immediately and correctly nearly 100% of the time on questions. Multiple choices were needed on approximately 1.5 items per category with subjects with aphasia. Subjects with aphasia required the fewest cues for numbers; they required the most for colors and animals. Conversely, children required the least cues to name colors and animals; they required the most for numbers (Gardner, 1974).

Results revealed there was clinical difference between an adult who had sustained an incomplete loss of an acquired ability and a normal child who had not completely acquired the same ability. Results from this study indicate the use of over-learned symbols will have the greatest impact on communication and rehabilitation in patients with aphasia (Gardner 1974). The results also suggest that subjects with aphasia are able to name items that are somewhat automatic, such as numbers. However, these results did not differentiate the performance of those with fluent or non-fluent aphasias.

After comparing the symbolic abilities of children and individuals with aphasia, Gardener (1974) followed this study by an examination of patients with aphasia and alexia and their naming and recognition abilities of different types of symbolic stimuli. Gardner (1974) examined how aphasia affects naming and recognition of symbols and if alexia is restricted to verbal symbolic materials. In this study symbols were defined as “any mark which performs a referential function (denoting, representing, or exemplifying an element, object, or concept). Subjects included forty right-handed males with aphasia, fifteen with non-fluent aphasia, fifteen with fluent aphasia, and ten with global aphasia. There were also ten non-neurologically damaged age matched adults. An additional fifteen control patients with brain damage and no

discernable language difficulties also took the test. Six subjects diagnosed with alexia were also given part-one of the test. Five of these subjects were given part-two of the test as well.

Stimuli consisted of 200 symbols in eleven categories. Categories for part-one were: numbers, letters, animals, and colors. Categories for part-two were: punctuation marks, objects, number related signs, faces, printed words, words in various settings or fonts, and miscellaneous signs. Stimuli were presented by asking the subjects to name the item, and after fifteen seconds they were given a category cue. If after an additional fifteen seconds the item still was not named, three choices were provided.

Participants with non-fluent and fluent aphasia performed significantly worse than either control group. There were no significant differences between the performances of those with non-fluent or fluent aphasia. Of the 66 items, those with non-fluent aphasia required choices on 21.4 items and those with fluent aphasia required choices on 29.7 items. Subjects with alexia required choices on 32 out of 66 items.

Subjects with fluent aphasia had more difficulty recognizing symbols than those with non-fluent aphasia. Subjects with alexia had difficulty across all categories. Though the overall number of errors between the fluent and non-fluent subjects with aphasia was not much different, the large gap in errors in the recognition task demonstrated the comprehension deficits exemplified in fluent aphasia.

Many people with aphasia have learned a symbol system, and certain symbols' attributes may contribute to their ease of acquisition. Koul and Lloyd (1998) attempted to isolate the variables that affect symbol comprehension and use. Their study compared people with aphasia and right hemisphere brain damaged people across time. They also examined the effects of translucency and complexity on the recognition of Blissymbols. Blissymbolics is a

communication system originally developed for international communication. It is a non-phonetic, flexible, and expandable communication system consisting of over 3000 symbols. In the early 1970's, Blissymbols were used as a nonverbal communication system for children with physical disabilities at the Ontario Crippled Children's Center (Bliss, 1965; McNaughton, & Kates, 1980). More recently, Blissymbols have been used in the communication treatment of people with aphasia (Johannsen-Horbach, Cegla, Mager, & Schempp, 1985; Koul & Lloyd, 1998).

According to Koul and Lloyd (1998), a translucent symbol is one that may not be easily guessed when it appears without its referent, but can be easily discerned when the symbol and referent appear together. In an early study on Blissymbolics by Luftig and Bersani (1985), complexity was defined as "the number of physical elements/strokes or semantic components which contribute to depiction of a given Blissymbol" (Koul & Lloyd, 1998, p.400).

Subjects chosen for this study met these criteria: etiology confined to a CVA, six months post CVA, unilateral left or right cerebral hemisphere damage documented by CT or MRI scans, presence of reliable pointing skills, no uncorrected peripheral auditory or visual impairment, absence of visual field defects and visual agnosia, absence of visual neglect, adequate visual discrimination skills, alertness and ability to pay attention and participate in a task for 45 minutes, ability to comprehend all stimuli, and no major co-existing psychological disorders (Koul & Lloyd, 1998). Twenty-eight subjects participated in the study, eight with unilateral right hemisphere pathology, ten with moderately-severe aphasia due to unilateral left hemisphere pathology, and ten neurologically normal controls. A paired-associate learning paradigm was used to teach symbol-referent pairs to subjects. Subjects were seen over two experimental sessions one week apart. Session one contained a guessability trial in which non-trained

Blissymbols were tested for their obvious meaning. Three consecutive trials in the same session examined the degree to which Blissymbols can be learned. The second experimental session, approximately one week later, consisted of three trials. The first trial examined retention of the symbols, and the second and third trials again looked at learning. Correct responses were recorded when subjects pointed to the symbol which corresponded to the symbol name called out by the experimenter (Koul & Lloyd, 1998).

Non-neurologically damaged adults and those with aphasia were found to have little difference in their ability to learn and recall graphic symbols. However, right-hemisphere brain damaged people answered noticeably fewer questions correctly. These results indicate that right hemisphere damage may influence the associative learning of graphic symbols. All subject groups performed well when identifying high translucency symbols (Koul & Lloyd, 1998). Because of the difficulty in determining the residual language abilities in people with aphasia, it is essential for effective non-speech rehabilitation to evaluate how people understand nonverbal concepts at varying levels. Koul and Lloyd (1998) suggest that symbols should play a significant role in communicative rehabilitation, but replacing the whole language system with symbols would not generalize well to natural settings. This research provided evidence that people with aphasia can learn and use nonverbal symbols; therefore, symbols should be employed in treatment to enhance their communicative attempts. If individual people with significant aphasia are found to have the capability of acquiring and attainting a symbolic system, then graphic symbols also should be used in therapy for communicative functions.

<u>Visual Agnosia & Isolated System Damage</u>

The theory that the visual recognition system is an integrated comprehensive structure is widely debated. Cognitive theorists such as Biederman (1987) proposed that at the basic object

level, all visual stimuli are recognized by a shared set of mechanisms. Other theorists such as Konoroski (1967) have proposed that a series of specific systems manage different types of visual stimuli. Konoroski (1967) suggested that there were as many as nine separate subsystems that manage visual processing. Finding the number of subsystems, and types of subsystems for processing was the purpose of a study by Farah (1992). Damage to the visual processing system can render people unable to identify objects, a condition known as visual agnosia. Farah defined people with visual agnosia as having the ability to “retain full knowledge of the nonverbal aspect of an object, enabling them to recognize it by touching it or hearing any characteristic sound it might make” (Farah, 1992, p. 164).

Because of the rarity of the condition, large case studies describing the agnosias in any comprehensive form do not exist. A compiling of single case studies has provided the best reference for the appearance of deficits in these individuals. While reviewing the literature of several case studies, Farah isolated three specific visual processing deficits and their prevalence of co-occurrence. The first agnosia Farah examined was propasagnosia, defined here as a specific impairment of facial recognition. A second specific deficit, pure word alexia, an impairment in recognition of printed words was examined. Finally, Farah examined the prevalence of what she called common object agnosia, the inability to identify an object by sight (Farah, 1992).

Farah reviewed the literature on 99 cases of associative agnosia. Associative agnosias are those in which full representation of the stimulus exists at the sensory level, though the information is unable to be associated with knowledge of the stimulus (Farah, 1992). In each

case, the patient's ability to recognize faces, words, and objects was recorded. The results of this literature review were as follows:

Table 1:

Results of literature review for possible combinations of impaired and spared recognition of faces, common objects, and words

Impaired and Spared recognition classes of stimuli		Number of Cases
Impaired: faces	Spared: objects, words	27
Impaired: faces, objects	Spared: words	15
Impaired: faces, objects, words	Spared: -	22
Impaired: words	Spared: faces, objects	Not included
Impaired: objects, words	Spared: faces	16
Impaired: objects	Spared: faces, words	1?*
Impaired: faces, words	Spared: objects	1?*

* "?" indicates only one case found that appeared to substantiate the pattern. Cases also reported inconsistent data.

The results of her findings indicated two, not three separate systems existing for visual recognition. The first system is essential for the recognition of faces, is useful for objects, and not needed for words. Conversely, the second system is essential for words, useful for objects, and not at all needed for faces. The case in which object recognition is either wholly spared or destroyed was not included because no clear patient existed (Farah, 1992). Varying degrees of object recognition deficit exists in all forms of the associative agnosias. Farah's study supported her theory that there is a difference between word and non-word recognition as well as between face and non-face recognition. This is consistent with the theory of a divided system for object recognition, with different subsystems needed, depending on the type of stimulus. Farah suggested that further research needs to be done to determine exactly how these systems breakdown stimuli and why certain decompositions of some symbol types prove useless in the decomposition of others (Farah, 1992).

Farah's research suggested that delineation in the symbolic processing system exists. The occurrence of specific impairments in any single system leads one to conclude that these

abilities are at least partially isolated. Though abilities to recognize visual stimuli vary in people with aphasia, the existence of agnosias, leads to the notion that these abilities can be spared in those within aphasia. If a system can be isolated and damaged, is it possible for this system to also be spared in the face of other impaired systems?

Symbol Use in Therapy

Augmentative and Alternative Communication (AAC) strategies are used to enhance the communicative abilities of persons with speech and language difficulties. In persons with aphasia, AAC strategies can improve communication abilities by supplementing, replacing, or scaffolding residual language. There are various AAC techniques which include: gestures, drawing pictures, pointing to photos, using a symbol system, and use of electronic equipment (Fox & Fried-Oken, 1996). It has been found that people with severe aphasia are able to learn and use, to some extent, an artificial language system composed of symbols.

In the most severe form of aphasia, an artificial language system has proven effective. Glass, Gazzaniga, and Premack (1972) examined the extent to which the capacity for symbolization exists in people with global aphasia. On some nonverbal tests, people with aphasia have demonstrated the ability for abstraction and have demonstrated no more deficit in function than those with other brain damage (Bauer & Becka, 1954; Doehring & Reitan, 1953). Seven people with global aphasia from the Institute for Rehabilitation Medicine were used as subjects in the Glass et al. study (1972). All seven patients experienced global aphasia following a left cerebrovascular accident. No patient had any functional expressive language output, or reliable auditory comprehension skills. Ages ranged from 59 to 84 (Glass et al., 1972).

In a pre-experimental assessment to make sure that the patients were qualified for the artificial language training, patients' verbal and nonverbal capabilities were assessed. A natural

language assessment was carried out to determine the absence of any functional language and to determine if primitive language functions still existed. A series of tests examining syntactic function were also given to determine if the residual language was in any way functional and could be usable in a syntactic context. A perceptual cognitive assessment was given to examine residual nonverbal language. Patients were able to notice incongruencies, use objects appropriately, and categorize pictures (Glass et al., 1972).

Seven patients were trained in varying degrees with the artificial language system. The system was originally developed by Premack (1972) for chimpanzees. The symbol system consisted of symbols/words cut out of colored paper that varied in color, shape and size. “The subject was always taught a new word as the only unknown, in a string of known words” (Glass et al., 1972, p. 98).

Glass et al. (1972) found that even with striking language and functional communication deficits, people with global aphasia were able to demonstrate the capacity to learn and use an artificial language system. They further emphasized that though the constructions produced were relatively elementary, complex knowledge was required for their production, requiring the application of same-different and identity-nonidentity concepts. With the demonstration of artificial language learning in people with global aphasia, Glass et al. (1972) point to the possible conclusion that aphasia impairs the symbolization system but does not totally abolish it.

Johannsen-Horbach, Cegla, Mager, and Schempp (1985) studied the communication treatment of patients with global aphasia in learning and using Blissymbolics. Previous research by Lane and Samples (1981) examined the effect to which patients with global aphasia could learn Blissymbols in a group therapy setting. They reported that it was somewhat beneficial to

these patients. Johannsen-Horbach et al. (1985) further researched use of Blissymbolics by training them during individual therapy sessions and including their families.

Johannsen-Horbach et al. (1985) participants were four patients with global aphasia who previously had been engaged in six months of traditional aphasia therapy. Therapy focusing on the use of Blissymbolics was attended by the patients with aphasia two times per week for two months. Goals of therapy by Johannsen-Horbach et al. (1985) were to help patients develop an individually tailored lexicon, to have the patient learn and successfully use simple sentences with Blissymbols, and to have the family members be versed in the symbol system in order to communicate with the patient outside of therapy. Verbal utterances were not required; neither were they discouraged. In therapy, symbols were presented to the patients on cardboard squares. Symbols and their captions were sent home for use outside therapy. Symbols were introduced to the patients by presenting the symbol along with the corresponding picture, object, or gesture by the therapist. The first task was to have the patient correlate the symbol and picture by using a multiple choice format. This step was considered mastered when all answers were correct in ten trials over two consecutive sessions. Words were introduced in the following order: nouns, verbs, function words, and pronouns. Symbol knowledge was assessed at the beginning of each therapy session and new symbols were added accordingly. Patients were asked to use the symbols in response to questions and in some conversation. Proficiency in symbol use was determined by the number of correct answers to questions using the Blissymbols and the use of symbols outside of therapy. Family members watched each therapy session and there were regular meetings for the relatives.

One patient was dropped from the study because of problems with perseveration. The three other patients all acquired a symbolic lexicon and could use correct Blissyntax. Two of the

three used these symbols at home for communication with their family, while the other used phrases. According to Johannsen-Horbach et al. (1985) three of the patients sometimes articulated the word in conjunction with pointing to the correct picture.

Johannsen-Horbach et al. (1985) found that Blissymbolics can be trained and used at a surprisingly quick rate to enhance the communicative abilities of those patients with severe aphasia. Based on the research by Johannsen-Horbach et al. (1985) it has been found that people with severe aphasia may have, to some degree, enduring language capacities to process non-linguistic information, such as symbols, and use them as an alternative mode of communication.

Inference and Expectation

Merriam-Webster Collegiate Dictionary defines inference as "the act of passing from one proposition, statement, or judgment considered as true to another whose truth is believed to follow from that of the former" (p. 598) Expectation is defined as, "to consider probable or certain, or to consider reasonable" (Merriam-Webster, 1998, p. 408). These abilities are necessary for daily life activities. One must be able to expect or infer meaning from everyday situations such as seeing a crosswalk, yellow traffic light, hearing a siren, or flashing lights. The ability to know what happens next based on commonly occurring situations, world knowledge, and training allows us to navigate our world and not be surprised at outcomes.

Compared to younger-adults, older-adults demonstrate impaired abilities in memory, cognition, and linguistic abilities. Certain declines in functions are associated with normal aging. Declining abilities in working memory have been well documented (Brebion, Ehrlich, & Tardieu, 1995; Grant & Dagenbach, 2000). Additionally, much research has focused on the decline of written language comprehension (Cohen, 1979; Light, 1990; Light & Anderson, 1985), auditory-verbal discourse comprehension (North, Ulatowska, Macaluso-Haynes, & Bell,

1986), speed of processing (Kemper, Jackson, Cheung, & Anagnopoulus, 1993), and inferencing (Hamm & Hasher, 1992; Ultawska, Cannito, Hayashi, & Flemming, 1986).

Though it is important for individuals to be able to read, it is equally if not more important for individuals to have functional auditory-comprehension. This requires higher-level cognition skills such as inferencing, as well as memory and attention. Whether inferencing in older adults is negatively affected by storage and recall mechanisms or by an overall decrease in cognitive efficiency is debated. Related to this issue, Wright and Newhoff (2002) investigated the inferencing abilities of older adults through the auditory processing mode. The study used fifteen normally aging adults and fifteen young adults. The mean age for the aging group was 69.87 years, while the mean age for the younger group was 22.33 years. All participants had no history of neurological damage, English speakers, had normal IQs, and visual and hearing skills within normal limits (Wright & Newhoff, 2002). Participants were given a pair of sentences and required to answer four questions about each, two of which were comprehension questions, and two which required inference. All questions required yes/no responses.

Though older adults did not complete the inference tasks as well as the young adults they performed significantly better than expected. The aging group scored a mean of 26.13 incorrect while the young-adults received a mean of 13.86 incorrect. Wright and Newhoff (2002) attributed possible success by the older-adults due to presentation form and decreased complexity with increased priming. Their findings are consistent with past research, suggesting that older adults have a greater difficulty making inferences than younger adults. Another conclusion that can be drawn from the results is that older-adults are more successful at auditory inferencing tasks than written inferencing tasks. This would seem logical based on the proven deficits in written language abilities (Wright & Newhoff, 2002).

Though it is shown that older adults do have deficits in inference processing and revision, it is also important to note their relative success on this particular task. More research must be done to examine the role of inhibition, processing speed, and working memory in aging adults, and the ways that these variables may affect inferential processing. Aging negatively effects a person's ability to perform higher cognitive tasks, such as inference, and though this deficit could be attributed to several areas of processing decline, the general cognitive deterioration attributed to aging leads to diminished abilities to accurately perform the higher-cognitive tasks required for a complete understanding and manipulation of the complexity of one's environment.

Inference in Aphasia

The ability to comprehend sentences and discourse often requires the employment of inferences. The well documented comprehension problem in aphasia, particularly fluent aphasia, would suggest that processing problems may potentially affect the ability to inference. Several studies examining people with aphasia's ability to generate inference have been conducted (Cutler & Swinney, 1978; Swinny & Osterhout, 1990; Long, Oppy & Seely, 1994).

Wright and Newhoff (2004) investigated the nature of people with aphasias processing breakdowns, by examining inference process revision (the ability to revise a previously made inference). A lexical priming task was employed to elicit inference revision. Thirty adults participated in the study, ten non-neurologically damaged adults and twenty with unilateral left-hemisphere damage. Ten of the neurologically impaired adults were classified as having a non-fluent aphasia and ten as having a fluent aphasia as confirmed by performance on the Western Aphasia Battery (Wright & Newhoff, 2004).

In an inference revision task coupled with a cross-modal lexical priming paradigm, sentence pairs were presented auditorily in which the pair required an inference revision in order

to obtain correct meaning. Following the presentation, participants were asked to complete a visual lexical decision task. Four yes/no questions were asked pertaining to the first inference, second inference, and created meanings of the sentence pair (Wright & Newhoff, 2004).

Their results showed that both non-neurologically damaged individual adults and the non-fluent aphasia group were able to activate the intended meaning of the sentence pair. The fluent aphasia group however, was able to activate the initial inference, but was unable to revise this into the correct second inference. Wright and Newhoff (2004) suggest that the strategic processing mechanisms required to generate cognitive inferences no longer exist in most people with fluent aphasia (Wright & Newhoff, 2004).

Results of the comprehension tasks demonstrated that, as expected, people with aphasia performed far worse than non-neurologically damaged individual adults. Though the amount of items missed were significant and indicated overall comprehension deficits, the participants with aphasia scored only mild-moderately impaired above chance on this task. This suggests that comprehension of the sentence pair was possible, however inconsistent, and that the task was not sensitive enough to detect the subtle differences in comprehension performance in adults with aphasia (Wright & Newhoff, 2004).

Wright and Newhoff (2004) conclude their study by commenting on the variable nature of performance in individuals with aphasia and the further need for investigation into the processing abilities of people with fluent aphasias. By noting that individuals with fluent aphasia have the ability to activate but not to revise an inference, suggests the more high-level the task and more processing required, the less likely the success by a person with aphasia.

Puskaric and Pierce (1997) examined the influence of constraint and expectation on sentence reading comprehension in patients with aphasia. When performing a task that requires

the logical completion of a sentence, three factors have been identified to influence performance in non-neurologically damaged individuals. These factors include: congruence, constraint, and expectation (Schwanenflugel & LaCount, 1988; Schwanenflugel & Shoben, 1985). Congruence refers to whether a given word is the logical completion to a sentence. Constraint is whether the sentence to be completed can be completed by many words or just a limited amount. Expectation refers to whether the final word in an open-ended sentence is a likely completion. Pierce (1988) and Pierce and Beekman (1985) found that patients with aphasias performance on sentence completion tasks were enhanced when the target word was highly constrained and predicted. However, comprehension decreases in patients with aphasia when sentences are introduced that have the possibility of having more than one semantically correct answer (Pierce & DeStefano, 1987).

In a study by Puskaric and Pierce (1997), participants included sixteen patients with aphasia, ten with a non-fluent aphasia, and six with a fluent aphasia. Constraint and expectation were established in the experimental sentences by first testing thirty-six non-neurologically damaged individuals to determine the number of different nouns they produced (constraint) and the relative frequency of each noun (expectation). Puskaric and Pierce (1997) used a design composed of four experimental conditions, they were: 1) high-constraint, expected response; 2) high-constraint, unexpected response; 3) low-constraint, expected response; 4) low-constraint, unexpected response. Participants were presented with the stimulus sentence and four choices, and then asked to point to the word that best completed each sentence.

Puskaric and Pierce (1997) found that patients with aphasia performed the worst on low-constraint, unexpected responses. Their performance significantly improved on completion of sentences with increased constraint and increased likelihood. Therefore, the fewer possible

correct choices, and the more the choices were expected as sentence completions, the more likely patients with aphasia were able to correctly perform the task. If this is the case with lexical information, then there is a call for future research to determine how inferencing abilities are affected in non-linguistic information in people with aphasia.

Summary

Several concerns have been consistently identified within the literature on aphasia and symbolic abilities. One is the number of different explanations offered to account for patients with aphasia's ability to process symbolic materials. Another is the ability to recall and learn symbols. A final concern addresses individuals with aphasia's ability to use an artificial language system incorporating symbols.

In regard to competing theories in symbolic processing abilities in aphasia, numerous researchers have debated whether aphasia results in complete damage to the symbolic system, or whether symbolic processing abilities are available on an individual basis depending on site of lesion, type of aphasia, and other factors. No cohesive agreement exists on nonverbal ability in aphasia, and some researchers go as far as saying that the nonverbal system will be damaged to the same degree as the verbal system (Saygin et. al., 2003). For this reason, it is important to investigate the preservation of the symbolic system as an ulterior mode of both communication and comprehension.

Addressing individuals with aphasias' ability to recall and learn a symbol system, it is well documented that even in severe aphasia, symbolic processing abilities are relatively preserved. However, the type of symbol and its characteristics, may affect the ability and ease to which the symbol or icon can be learned and recalled.

By demonstrating that those with aphasia can learn an artificial language system that

consists of wholly symbolic material, suggests that even in severe nonverbal aphasia, the use of symbols can be used as an alternative or augmentative communication system. The use of nonverbal, non-linguistic materials can be the most beneficial mean for communication post stroke.

Literature in agnosia has demonstrated that specific subsystems of the symbolic system exist, and can therefore be impaired. If such fine impairments can exist in symbolic processing we may assume that these fine systems could also be spared depending on type of brain damage and site of lesion. This is an important detail to note because it means that though aphasia may result in widespread loss of language ability, it may not result in the complete loss of nonverbal skills, such as symbolic processing.

Research on inference and expectation has also raised issues concerning performance of those with aphasia. A general reduction in inferencing abilities, and higher level language skills, has been identified in the aging population. Further, aphasia has been tied to damage of high-level processing skills, including inference, particularly in those with fluent aphasia. Though these abilities have been shown to be compromised in aphasia, testing has been primarily focused on linguistic inferencing and expectation. Since inferencing is not isolated to only the linguistic system, it is important to determine the amount of preservation in other types of symbolic processing within the neurologically damaged population. Since inferencing abilities are a high-level skill, this ability, when examined nonverbally, will give a more complete picture of the preservation of the overall symbolic system in aphasia.

CURRENT RESEARCH

Currently the ability of people with aphasia to process environmental symbolic material has not been fully investigated. Some research indicated that there may be deficits in the ability to process this type of stimuli (Gardner, 1974). Other research has demonstrated that individuals with aphasia have the ability to learn and use a symbol system (Johannsen-Horbach et al., 1985; Koul & Lloyd, 1998). It may be that paradigms involving simple processing of symbols do not truly evaluate the depth of damage that the system may or may not have. Previous paradigms have also not isolated the system, and have relied to a great extent on linguistic variables.

The purpose of the current study is to examine how subjects with fluent aphasia are able to infer nonverbal visual symbolic items, as a way of looking at the preservation of the nonverbal symbolic system. This study intends to investigate the integrity of the nonverbal symbolic system in a way that minimizes lexical interaction.

The current research addresses the following questions: (a) do subjects with aphasia demonstrate processing of nonverbal visual symbolic incongruencies as effectively as those without aphasia, (b) will variability exist among subject with aphasia in their ability to process nonverbal visual symbolic material, and (c) is it that the nonverbal visual symbolic system is more resilient to neurological damage causing fluent aphasia?

From these research questions, it is hypothesized that people with aphasia will take longer to process and react to incongruent symbolic stimuli than non-neurologically damaged individuals. It is also hypothesized that variability will exist in processing abilities among those subjects with aphasia, and that people with aphasia will perform with greater accuracy and efficiency to visual symbolic stimuli as compared to lexical stimuli.

METHODS

Subjects

The participants of this study included three people with fluent aphasia and three non-neurologically damaged adults. The two groups of participants were age matched (+/- 2 years), gender matched, and educationally matched by level of completion (some high school, high school graduate, some college, etc.). Participants met the following criteria: were right handed as determined by the Edinburgh Handiness Inventory (+40 or greater; Oldfield, 1971), passed a hearing screening at 40dB SPL @ 500, 1000, 2000, and 4000 Hz, had vision sufficient to perform the task (corrected or uncorrected) as assessed by the Rosenbaum Vision Pocket Screening (20/200; Rosenbaum, 1982), and were a native English speaker.

Table 2:
Biographical and Descriptive Information for Participants with Aphasia

Number	Gender	Age	Educ[a]	Edin[b]	Taps[c]
1.0	Male	60.0	18	100	119
2.0	Female	61.0	16	100	142
3.0	Female	60.0	14	100	155
Mean (SD)		60.3(0.5)	16(2)	100(0)	138.7(18.2)

a-Years of Education
b-Edinburgh Handiness Inventory Score
c-Number of Finger Taps per 30 Seconds

Participants with aphasia were fluent as classified by the Aphasia Diagnostic Profile (Helm-Estabrooks, 1992).

Table 3:
Aphasia Diagnostic Profile Scores for Participants with Aphasia

Number	ADP-AS[a]	ADP-LR[b]	ADP-AC[c]	Class[d]
1.0	111	14	121	Fluent
2.0	104	11	95	Fluent
3.0	118	14	101	Fluent
Mean (SD)	111(7)	13(1.7)	105.7(13.6)	

a-Aphasia Diagnostic Profile-Aphasia Severity Standard Score
b-Aphasia Diagnostic Profile-Lexical Retrieval Standard Score (M= 10 SD= 3)
c-Aphasia Diagnostic Profile-Alternative Communication Standard Score
d- Aphasia Classification as Determined by Aphasia Diagnostic Profile

Non-neurologically damaged participants were included based on a score of 26 and above on the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975) and a passing score on the Miami Veteran's Administration Medical Center Communication Screener (Bollinger, 1988).

Table 4:
Biographical and Descriptive Information for Non-neurologically Damaged Participants

Number	Gender	Age	Educ[a]	Taps[c]
1.0	Male	61	18	192
2.0	Female	60	16	154
3.0	Female	61	14	152
Mean (SD)		60.7(0.5)	16(2)	166(22.5)

Number	Edin[b]	MMSE[d]	Miami[e]
1.0	100	30	Pass
2.0	80	30	Pass
3.0	90	30	Pass
Mean (SD)	90(10)	30(0)	Pass

a-Years of Education
b-Edinburgh Handiness Inventory Score
c-Number of Finger Taps per 30 Seconds
d-Mini Mental State Examination
e-Miami Veteran's Administration Communication Screener

All participants had no history of prior neurological damage other than aphasia, no previous history of language/learning problems, no history of long tern drug/alcohol abuse, and no psychological disturbances in the past five years. All subjects with aphasia were at least one year post onset of symptoms.

Participants were recruited from Louisiana State University (LSU)-Baton Rouge. Ads were placed in local newspapers in Baton Rouge. Flyers were displayed in public places. Brochures were given to Neurologists/other doctor's offices, churches, and volunteer centers.

Instrumentation

The following measures were used for classification of aphasia type and screening purposes: Aphasia Diagnostic Profile (Helm-Estabrooks, 1992), Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975), Miami Veteran's Administration Medical Center Communication Screener (Bollinger, 1988), Rosenbaum Vision Pocket Screening (Rosenbaum, 1982), Edinburgh Handedness Inventory (Oldfield, 1971), and a pure tone screening.

- The Aphasia Diagnostic Profile (ADP) (Helm-Estabrooks, 1992) is a test devised to assess language and communication impairments associated with aphasia. The ADP consists of a number of small tests which check different areas of communication including: reading, speaking, and writing abilities to provide personal information (like where participant lives); various areas of talking including describing and naming pictures, repeating words, phrases, sentences, singing, and conveying experiences of the participant and others; understanding words, sentences, and stories told aloud, and making gestures to verbal commands. Scores from the subtests are used to obtain standard scores, percentile ranks, and aphasia classification type.

- The Mini-Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) is a brief measure used to assess cognitive status in adults. It is also used to screen for any cognitive impairment and to approximate degree of severity.
- The Miami Veteran's Administration Medical Center Communication Screener (Bollinger, 1988) is used to rule out the presence of cognitive deficits such as dementia and Alzheimer's in otherwise neurologically non-neurologically damaged individuals adults.
- The Rosenbaum Vision Pocket Screening (Rosenbaum, 1982) is a card displaying letters and numbers used to assess visual acuity. This is used to rule out any participants who have near sighted vision problems who do wear corrective lenses (20/200).
- The Edinburgh Handedness Inventory (Oldfield, 1971) is a questionnaire that determines handedness. This brief questionnaire is used to rule out any participants who are not right-handed as indicated by a score below (+40).
- Pure tone screenings are conducted at 40 dB SPL @ 500, 1000, 2000, and 4000 Hz using a portable audiometer.
- A laptop computer was used to present stimuli and measure response times. The laptop computer was a Dell Inspiron 5160 with Pentium III processor and E-prime software installed. E-prime software, version 1.0 Beta 4.4 (Schneider, Eschman, & Zuccolotto, 2002) is a program used for the presentation of visual and auditory stimuli. Responses were recorded using green and red buttons located on the laptop computer mouse click buttons.

Creation of Stimuli

Stimuli for the study were created by the investigator, which included the following types: Simple Visual (SV), Complex Visual (CV), Simple Lexical Visual (SLV), and Complex Lexical Visual (CLV). The environmental visual symbolic stimuli were assembled from a variety of therapy materials including: DLM Visual Discrimination Materials, Books 1-3 (1965), Super Duper Serial Recall Fun Deck (2003), pictures from Therasimplicity, a speech pathology resource website, and Therasimplicity therapy sequences (HYPERLINK "http://www.therasimplicity.com" www.therasimplicity.com). All pictures were either scanned into the Dell Inspiron 5160 computer using a Dell Photo AIO Printer 942, or downloaded directly from www.therasimplicity.com and cropped in Dell Picture Studio v2.0.

Lexical items in SLV consisted of sequences of words belonging to the same category. Lexical items in CLV consisted of sentences that ended a Dolch noun (http://www.amug.org/~jbpratt/education/langarts/dolchnouns.pdf). Dolch nouns were chosen because of their equally high frequency of occurrence in the English Language. Dolch nouns were originally identified by Edward William Dolch, Ph.D in 1948. The list of nouns was originally published in his book "Problems in Reading," (1948). Dolch compiled the list based on children's books of his era. The lists contain words that have to be easily recognized in order to achieve reading fluency.

All sequences were standardized by using undergraduate classes at Louisiana State University. Approximately 50 students participated in each standardization. Acceptance level for a stimulus sequence was 80% agreement.

Simple Symbolic Conditions

Simple environmental symbols were presented visually on the computer screen. Symbols consisted of black and white line drawings and color pictures occurring in equal proportions. Symbolic stimuli consisted of 1500 millisecond presentations occurring sequentially. The fourth picture in each sequence (the target) had a thick yellow border, indicating that it was the target item to respond to. Simple symbolic expected sequences consisted of four environmental symbols belonging to the same category (ex. car, bus, plane, **train**). Simple symbolic unexpected sequences consisted of three environmental symbols belonging to the same category and the fourth being incongruent (ex. car, bus, plane, **dog**).

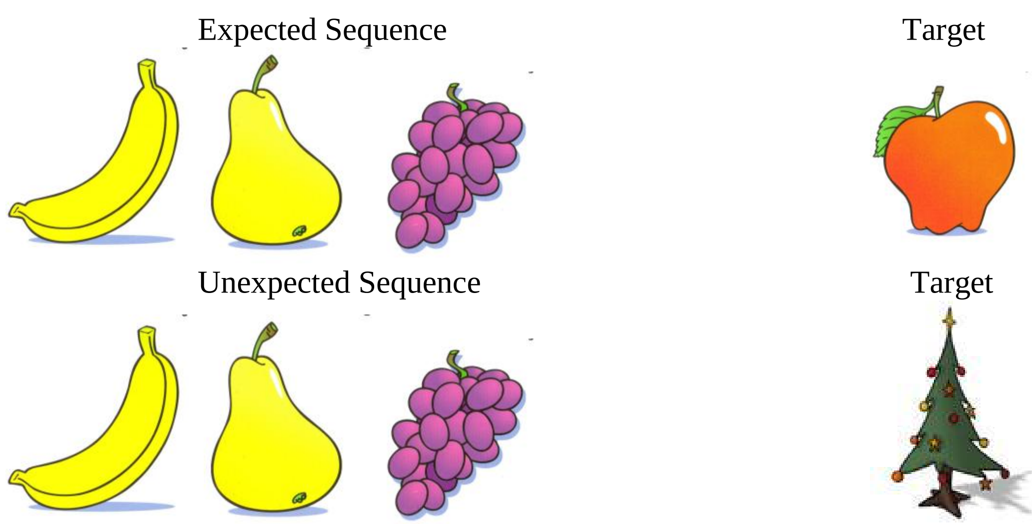

Figure 1:
Example Simple Expected and Unexpected Visual Sequences

Complex Symbolic Conditions

Complex environmental symbols were presented visually on the computer screen. Symbols consisted of black and white line drawings, color pictures, and photographs. Symbolic stimuli consisted of 1500 millisecond presentations occurring sequentially. The fourth picture in each sequence (the target) had a thick yellow border, indicating that it was the target item to

respond to. Complex symbolic expected sequences consisted of four sequentially occurring environmental scenes (ex: seed, seed sprouting, seed growing, **blooming**). Unexpected sequences consisted of three sequentially occurring environmental scenes and the fourth being incongruent (ex: seed, seed sprouting, seed growing, **stapler**).

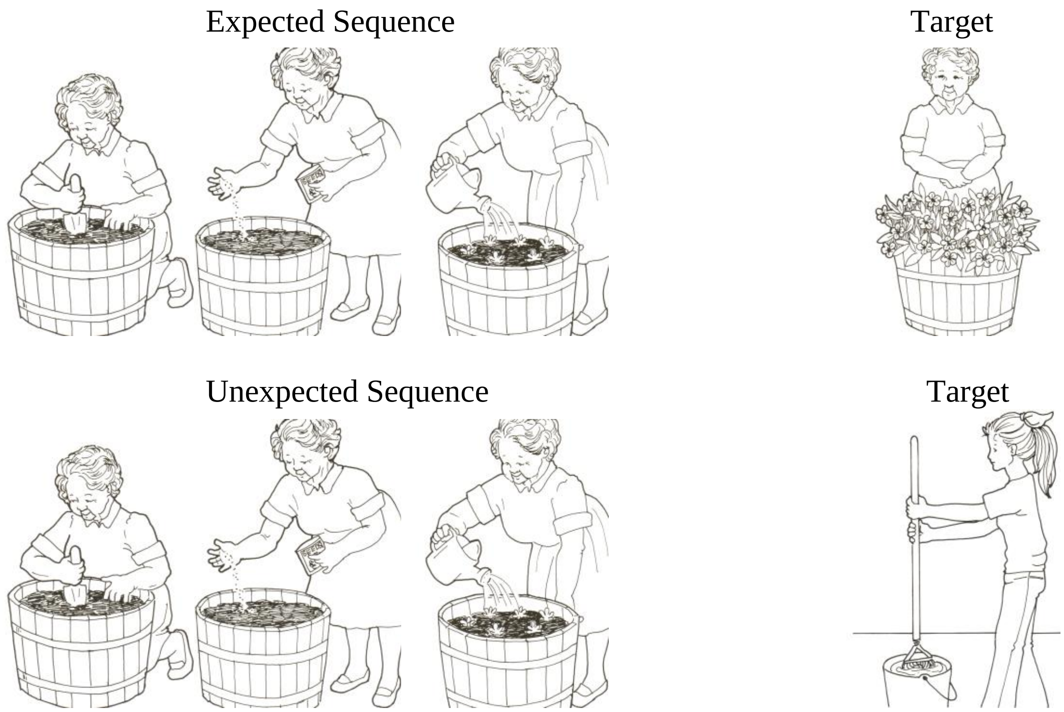

Figure 2:
Example Complex Expected and Unexpected Visual Sequences

<u>Simple Lexical Conditions</u>

Four simple words were visually presented on the computer screen. Each word appeared on the screen alone and in black type on a white background. Lexical symbolic stimuli consisted of 1500 millisecond presentations occurring sequentially. The fourth word in each sequence (the target) had a thick yellow border, indicating that it was the target item to respond to. Lexical symbolic expected sequences consisted of four words belonging to the same category (ex. dog,

cat, bird, **cow**). Lexical symbolic unexpected sequences consisted of three words belonging to the same category and the four being incongruent (ex. dog, cat, bird, **plane**).

Complex Lexical Conditions

Sentences were displayed on the computer screen. Sentences appeared on the screen alone in black print on a white background. Lexical symbolic stimuli consisted of 1500 millisecond presentations occurring sequentially. The word in the sentence was capitalized, indicating that it was the target item to respond to. Each sentences final target was a Dolch noun. Dolch nouns were used to ensure participant knowledge because of their equally high frequency of occurrence. The complex lexical symbolic expected sentences final word was a Dolch noun (ex. The mom picked up the **baby**). The complex lexical unexpected sentences contained an incongruent Dolch noun for its target (ex. The mom picked up the **day**).

Procedures

Participants with Aphasia

The first session for participants with aphasia began by having a consent form and questionnaire, pertaining to background information, completed by the participant. A brief vision screening was administered using the Rosenbaum Vision Pocket Screening (Rosenbaum, 1982) and a hearing screening was performed using a portable audiometer. Then the participant answered questions from the Edinburgh Handedness Inventory (Oldfield, 1971). Once all paperwork was completed, and the participant had demonstrated an understanding of the study, the Aphasia Diagnostic Profile (Helm-Estabrooks, 1992) was administered.

At the beginning of each of the experimental sessions, a training session took place. Prior to each condition’s administration, verbal directions were accompanied by hand gestures specific to that task as well as a demonstration and physical training. During this explanation the

experimenter sat at the computer and demonstrated task items using gestures. The experimenter said, “Watch the four items, the fourth one will either make sense or it won’t. If you think that it makes sense, press the green button as fast as you can. If you think it doesn’t make sense, press the red button as fast as you can.” During this explanation the experimenter pointed to the appropriate buttons on the laptop. The experimenter then demonstrated two task items by initiating the computer sequences. The experimenter gestured to watch as each item was presented on the screen. When the fourth item was presented, the experimenter said, “This makes sense!” and pressed the green button (exaggeratedly). Another sequence was presented in the same fashion, the fourth item being unexpected. After the presentation of the fourth item the examiner said, “This one doesn’t fit!” and pressed the red button (exaggeratedly). Following the experimenters demonstration, the subject then practiced on eight training sequences; four of the sequences were expected during the training, while four were unexpected. If after eight sequences, the experimenter judged the participant to adequately understand the task, then the initiation of the experiment began. If after eight training sequences, the experimenter judged the subjects understanding of the task to be insufficient, then the eight sequences were repeated. If after the repeated training, the participant still did not demonstrate a reliable understanding of the task, the experimenter would have discharged the subject due to inadequate comprehension skills to complete the experiment. This did not occur. The responses on the training sections were not calculated into the results.

Each experimental section consisted of 80 total sequences, 60 of which ended in expected targets, and 20 of which did not. Each sequence was presented three times, two times with an expected ending and one time with an unexpected ending. This arrangement was chosen to reduce the participant’s ability to guess whether the ending target would be expected or

unexpected based on prior presentations. The symbolic portion of the study included the simple visual (SV), complex visual (CV), simple lexical visual (SLV), and complex lexical visual (CLV) conditions, all presented on the computer screen. After participants saw a sequence a green button was pressed on the laptop if it was believed the final stimulus was expected or the red button if it was believed that the final stimulus was unexpected. Experimental procedures remained identical throughout all testing sections. Administration of SV, CV, SLV, and CLV were quasi-randomized to avoid an order effect.

Subjects also participated in a parallel study examining environmental auditory expectation (Expectation in Auditory Processing of Environmental Sounds in People with Fluent Aphasia by Meghan Collins). Presentations of the auditory and symbolic experimental sections were quasi-randomized to avoid an order effect.

Non-Neurologically Damaged Individuals

The session for non-neurologically damaged participants began by completing a consent form and questionnaire pertaining to background information. A brief vision screening was administered using the Rosenbaum Vision Pocket Screening (Rosenbaum, 1982) and a hearing screening was performed using a portable audiometer. Then the participant answered questions from the Edinburgh Handedness Inventory (Oldfield, 1971). Once all paperwork was completed and the participant demonstrated an understanding of the study, the Mini Mental State Examination (Folstein, Folstein, & McHugh, 1975) and the Miami Veteran's Administration Medical Center Communication Screener (Bollinger, 1988) was administered to ensure no neurological deficits. Following the administration of qualifying materials, the experimental conditions of the study were conducted in a quasi-randomized order. Experimental procedures were identical to those used for the subjects with aphasia.

Data Analysis

A non-parametric Kruskal-Wallis procedure with chi-squared statistic was used to differentiate variance between the groups for each of the experimental conditions. Due to the small N, effect size indicators were used to examine for practical relationships between variables given a lack of statistical significance (Cohen, 1988). The two outcome measures compared across groups is reaction-time speed (in milliseconds, ms) and accuracy of response (% correct). The repeated-measures include each of the 4 experimental procedures. A series of a-priori pair-wise comparisons were be made examining differences between groups for each of the 4 experimental procedures (SV, SLV, CV, CLV). An alpha level was set at .05 for statistical significance ($p < .05$).

RESULTS AND DISCUSSION

Results

A non-parametric Kruskal-Wallis procedure with chi-squared statistic was used to differentiate variance between the groups for each of the experimental conditions. Due to the small N, effect size indicators were used to examine for practical relationships between variables given a lack of statistical significance (Cohen, 1988)

Table 5:
Kruskal-Wallis Test Statistics

Condition	Chi-Square	DF	Sig.
CV	1.19	1	.275
SV	.05	1	.827
CLV	2.33	1	.127
SLV	2.33	1	.127
CVPC	4.36	1	.037
SVPC	1.23	1	.268
CLVPC	3.97	1	.046
SLVPC	3.86	1	.050
CVIP	2.4	1	.121
SVIP	3.14	1	.077
CLVIP	3.97	1	.046
SLVIP	3.23	1	.072

CV-Complex Visual
SV-Simple Visual
CLV-Complex Lexical Visual
SLV-Simple Lexical Visual
CVPC-Complex Visual Percent Correct
SVPC-Simple Visual Percent Correct
CLVPC-Complex Lexical Visual Percent Correct
SLVPC-Simple Lexical Visual Percent Correct
CVIP-Complex Visual Incongruent Percent
SVIP-Simple Visual Incongruent Percent
CLVIP-Complex Lexical Visual Incongruent Percent
SLVIP-Simple Lexical Visual Incongruent Percent

There was a significant difference between the groups the Complex Visual Percent Correct (CVPC) with the patients with aphasia scoring lower (M=87.92,SD=8.32) than the non-neurologically damaged individuals (M=97.50,SD=.00) [$X^2(1)=4.36, p=.037$].

Table 6:
Descriptive Statistics and Standard Deviations (SD) for Percent Correct for Each Group in Each Condition

Condition	Group 1(Control)	Group 2(Aphasia)
CVPC	97.50 (.00)	87.92 (8.32)
SVPC	93.75 (4.33)	88.75 (6.96)
CLVPC	99.58 (.72)	79.17 (22.09)
SLVPC	97.92 (1.91)	75.83 (11.61)

CVPC-Complex Visual Percent Correct
SVPC-Simple Visual Percent Correct
CLVPC-Complex Lexical Visual Percent Correct
SLVPC-Simple Lexical Visual Percent Correct

There was also a significant difference between the groups for the Complex Lexical Visual Percent Correct (CLVPC) with the patients with aphasia scoring lower (M=79.17,SD=22.09) than the non-neurologically damaged individuals(M=99.58,SD=.72) [$X^2(1)=3.97, p=.046$].

A significant relationship was found between the groups for the Simple Lexical Visual Percent Correct (SLVPC) with the patients with aphasia scoring lower (M=75.83,SD=11.61) than the non-neurologically damaged individuals(M=97.92,SD=1.91) [$X^2(1)=3.86, p=.05$].

There was a significant difference between the groups for the Complex Lexical Visual Incongruent Percent Correct (CLVIP) with the patients with aphasia scoring lower (M=68.33,SD=24.66) on unexpected stimuli than the non-neurologically damaged individuals(M=98.33,SD=2.89) [$X^2(1)=3.97, p=.046$]. No other analyses approached statistical significance.

Table 7:
Descriptive Statistics and Standard Deviations (SD) for Incongruent Percent Correct for Each Group in Each Condition

Condition	Group 1(Control)	Group 2(Aphasia)
CVIP	90.00 (.00)	76.67 (12.58)
SVIP	95.00 (.00)	76.67 (18.93)
CLVIP	98.33 (2.89)	68.33 (24.66)
SLVIP	95.00 (8.66)	68.33 (15.28)

CVIP-Complex Visual Incongruent Percent
SVIP-Simple Visual Incongruent Percent
CLVIP-Complex Lexical Visual Incongruent Percent
SLVIP-Simple Lexical Visual Incongruent Percent

Though the analysis did not yield statistical significance, there appeared to be a functional difference between the groups for the Simple Lexical Visual (SLV) with the patients with aphasia demonstrating longer reaction times (M=1247.19,SD=534.22), than the non-neurologically damaged individuals (M=768.35,SD=289.45) [$X^2(1)=2.33, p=.127$].

Table 8:
Descriptive Statistics and Standard Deviations (SD) for Reaction Times for Each Group in Each Condition

Condition	Group 1(Control)	Group 2(Aphasia)
CV	770.45 (57.56)	969.70 (208.84)
SV	933.72 (294.15)	911.19 (153.47)
CLV	704.86 (224.17)	1108.33 (414.77)
SLV	768.35 (289.45)	1247.19 (534.22)

CV-Complex Visual
SV-Simple Visual
CLV-Complex Lexical Visual
SLV-Simple Lexical Visual

There also appeared to be a functional difference between the groups for the Complex Lexical Visual (CLV) with the patients with aphasia demonstrating longer reaction times (M=1108.33,SD=414.77), than the non-neurologically damaged individuals (M=704.86,SD=224.17) [$X^2(1)=2.33, p=.127$].

Though the analysis did not yield statistical significance, there appeared to be a functional difference between the groups for the Simple Visual Incongruent Percent Correct (SVIP) with the patients with aphasia scoring lower (M=76.67,SD=18.93) on unexpected stimuli than the non-neurologically damaged individuals (M=95.0,SD=5.0) [$X^2(1)=3.14, p=.08$].

Though no statistical significance was reached, there did appeared to be a functional difference between the groups for the Simple Lexical Visual Incongruent Percent Correct (SLVIP) with the patients with aphasia scoring lower (M=68.33,SD=15.28) on unexpected stimuli than the non-neurologically damaged individuals (M=95.0,SD=8.66) [$X^2(1)=3.23, p=.07$].

An analysis of baseline motoric reaction time was performed with an independent sample t-test. There was a non-significant difference of baseline motoric reaction time, $t(4)=.406$, $p=.559$.

Table 9:
Motoric Baseline Reaction Times (ms)

Group	Mean	Std. Dev.	Std. Error mean
Aphasia	138.67	18.23	10.53
Normal	166	22.54	13.01

A priori paired-sample t-tests were performed in an attempt to answer the research questions. One comparison approached significance. Using percent correct scores of opposing conditions, a paired-sample t-test between SVPC versus SLVPC $t(2)=2.36$, $p=.14$ $r_{pb}^2= .7$, non-significant results were evident for the following: CV versus. CLV $t(2)=-1.14$, $p=.37$, SV versus SLV $t(2)=-.85$, $p=.49$, CVPC versus CLVPC $t(2)=1.08$, $p=.40$, CVIP versus CLVIP $t(2)=.52$, $p=.65$, SVIP versus SLVIP $t(2)=1.39$, $p=.30$.

Table 10:
A Priori Paired Samples Test for Individuals with Aphasia

Condition		Mean	N	Std. Dev.	Std. Error Mean
Pair 1	CV	969.70	3	208.84	120.58
	CLV	1108.33	3	414.77	239.47
Pair 2	SV	911.19	3	153.47	88.6
	SLV	1247.19	3	534.22	308.43
Pair 3	CVPC	87.92	3	8.32	4.81
	CLVPC	79.17	3	22.09	12.75
Pair 4	SVPC	88.75	3	6.96	4.02
	SLCPC	75.83	3	11.61	6.71
Pair 5	CVIP	76.67	3	12.58	7.26
	CLVIP	68.33	3	24.66	14.24
Pair 6	SVIP	76.67	3	18.93	10.93
	SLVIP	68.33	3	15.28	8.82

CV-Complex Visual
SV-Simple Visual
CLV-Complex Lexical Visual
SLV-Simple Lexical Visual
CVPC-Complex Visual Percent Correct
SVPC-Simple Visual Percent Correct
CLVPC-Complex Lexical Visual Percent Correct
SLVPC-Simple Lexical Visual Percent Correct
CVIP-Complex Visual Incongruent Percent
SVIP-Simple Visual Incongruent Percent
CLVIP-Complex Lexical Visual Incongruent Percent
SLVIP-Simple Lexical Visual Incongruent Percent

To examine the relationship between conditions within the group with aphasia, paired sample correlations were conducted. High correlations, approaching significance were evident for the following: CV versus CLV (.990, p=.089), SV versus SLV (-.98,p=.1240), CVPC versus CLVPC (.98,p=.14). A strong correlation was also evident for SVIP versus SLVIP (.84, p=.37).

Table 11
Paired Sample Correlations

Condition	N	Correlation	Sig
		Individuals with Aphasia	
Pair 1 CV & CLV	3	.99	.089
Pair 2 SV & SLV	3	-.98	.124
Pair 3 CVPC & CLVPC	3	.98	.140
Pair 4 SVPC & SLVPC	3	.58	.606
Pair 5 CVIP & CLVIP	3	.01	.991
Pair 6 SVIP & SLVIP	3	.84	.370

CV-Complex Visual
SV-Simple Visual
CLV-Complex Lexical Visual
SLV-Simple Lexical Visual
CVPC-Complex Visual Percent Correct
SVPC-Simple Visual Percent Correct
CLVPC-Complex Lexical Visual Percent Correct
SLVPC-Simple Lexical Visual Percent Correct
CVIP-Complex Visual Incongruent Percent
SVIP-Simple Visual Incongruent Percent
CLVIP-Complex Lexical Visual Incongruent Percent
SLVIP-Simple Lexical Visual Incongruent Percent

Discussion

In this section, findings will be addressed as they relate to the research questions and hypotheses presented in this study. Performance patterns and possible explanations of outcomes will be given for each condition for each task. Also, in this chapter there will be a section on interesting observations. Finally, there will be a section on limitations and directions for further research.

The statistical analysis revealed a significant difference between groups within the conditions CVPC, CLVPC, and SLVPC (see figures 3 & 6). These results suggest that non-neurologically damaged individuals were more accurate at identifying congruent and incongruent endings of both lexical and visual sequences. In the condition CVPC, it is proposed that the individuals with aphasia performed significantly lower than those without aphasia due to the

high level of complexity entailed in the task. In this task, stimuli were composed of a collection of images as opposed to a single item, as in the simple visual task. This additional complexity may have contributed to the individuals with aphasias difficulty in recognizing the pertinent information as it occurred in a sequence. The significant differences in the conditions CLVPC and SLVPC suggest that individuals with aphasia have greater difficulty recognizing congruencies in lexical tasks as compared to non-neurologically damaged individuals. These results may be due to the documented difficulties individuals with fluent aphasia have with reading tasks and the occurrence of alexia post stroke (Nadeau, Rothi, & Crosson; 2000).

The lack the statistically significant findings for the condition SVPC was not expected. This could be due to the low level nature of the symbolic task, suggesting a preserved ability to recognize congruencies within simple visual sequences. If these trends were continued with a larger N, it could suggest that there was a relative sparing of simple symbolic ability in individuals with fluent aphasia, whereas simple lexical ability was more impaired in individuals with fluent aphasia.

Statistical analyses also revealed significance between the two groups for the condition CLVIP, indicating that individuals with aphasia may be less likely to identify incongruent stimuli when occurring in a sequence. These results may imply that people with aphasia are less likely to be able to identify a word that does not logically complete a sentence. These results could give further support to the occurrence of alexia and reading difficulties in people with fluent aphasia (Nadeau, Rothi, & Crosson; 2000). If these trends were continued with a larger sample size, these results could indicate an overall decline in lexical processing, thus making reading a task critical during language rehabilitation post stroke. On the other hand, because of the increased difficulty in reading, alternative modes of learning and communication should become

primary means of therapeutic intervention to avoid fatigue and frustration and to increase maximum communicative ability.

Though statistical significance was not reached in all conditions, several conditions appeared to demonstrate a functional difference. If a repeated study with a larger sample size was conducted these results may have been statistically significant. For the conditions SLV and CLV, results between groups were approaching significance for response reaction times. No baseline motoric differences were determined between groups, and if this study were completed with a larger N, and yielded significance in these conditions it could indicate delayed processing of lexical information in individuals with fluent aphasia as compared to non-neurologically damaged adults.

Statistical significance was not evident for the conditions SVIP and SLVIP, but both conditions showed functional differences. If this study were repeated with a larger sample size, and trends continued, results may indicate that individuals with fluent aphasia are less likely to recognize an incongruent item within a sequence. This may signal a deficit in the ability of an individual with fluent aphasia to identify words and symbols in the environment that are illogical or incorrect.

A Priori analyses were used to answer the questions posed within this research study. Comparisons within the aphasia group were conducted for percent correct between conditions. No condition yielded statistical significance, but SVPC versus SLVPC approached significance with individuals with aphasia scoring more accurately on nonverbal stimuli than lexical stimuli. If these trends continued in a study with a larger number of participants, it could imply that individuals with aphasia can more easily process nonverbal materials as opposed to lexical materials. All figures presented in Appendix N.

Correlations were conducted to measure the relationships between conditions. Very high positive correlations were noted for the following conditions: CV versus CLV, CVPC versus CLVPC, and SVIP versus SLVIP. By examining a group's performance on one of these conditions, the corresponding condition would be determinable based on predictable pattern of correlation. As one performance increased or decreased per that condition the other condition would follow the same pattern of change. A negative correlation was noted for the conditions SV versus SLV. This means that as one condition increased the other decreased in a predictable pattern. With these highly correlated conditions, it is implied that the individual's success could be determined on other tasks based on their performance on one. If these correlations continued to be strong in a larger sample size, it would indicate an opportunity to reduce extensive testing in clinical trials and therapy.

Examination of the individual scores within the group of individuals with aphasia revealed variability in individual performance. Because of variability in severity of aphasia, sites of lesions, years in therapy, and other factors, it is likely that individuals with aphasia will perform with some degree of inconsistency on tasks. Scores of patient one in the aphasia group compared to scores of patient three, reveal differences in ability. Though overall, the group of individuals with aphasia scored with the same relative strengths and weaknesses in testing, it is evident in looking at their individual scores that differences do exist in performance, and these variations will be evident in their activities of daily living.

SUMMARY

Summary

Several research questions were proposed in this study. First, do subjects with aphasia demonstrate processing of nonverbal symbolic incongruencies as effectively as those without aphasia? It was concluded that individuals with aphasia did not exhibit as equally accurate processing of incongruencies as non-neurologically damaged individuals. This could indicate a reduced processing ability overall for incongruencies.

Second, will variability exist among subject with aphasia in their ability to process nonverbal symbolic material? It was concluded that variability did exist among the participants with aphasia in their ability to process nonverbal stimuli. This variability is important to distinguish per individual because it can help direct therapy, reduce frustration, and increase success in activities of daily living. Whether nonverbal skills are an area that needs to be addressed in therapy to improve world navigation, or whether it is a skill that could reduce the use of more taxing modalities, it is appears essential to determine the individual’s ability in this area.

Finally, is it that the nonverbal symbolic system is more resilient to the neurological damage causing fluent aphasia? The study revealed that simple symbolic ability was more preserved in relation to simple lexical ability. At the complex level, there was no difference in success on the tasks. This implies that individuals with aphasia may be more successful at simple nonverbal tasks than lexical tasks. This lends itself to the inclusion of more symbolic material in therapy and diagnostic tool. This ability could be used as a tool to help bolster the overall lexical system, and reduce frustration of reading, and writing tasks. Using simple symbols as an alternative mode of communication with individuals with fluent aphasia, as

opposed to written notes, could increase comprehension and reduce frustration. In essence, nonverbal materials need to be included in the daily lives of people with aphasia, both as a tool and as a focus in therapy.

Interesting Observations

Several interesting observations were noted throughout testing. During the testing process it would appear as though participants were merely responding in an automatic style in reply to the response screen. However, when redirected to the task at hand, participants would begin responding more accurately. It appeared as though some of the individuals with aphasia were responding in a preservative manner or demonstrated delayed processing skills. Throughout study, it was noted that both individuals with aphasia and non-neurologically damaged individuals would verbally comment when they had just made an error in response. Perhaps this could be attributed to a faster motoric response time as opposed to processing time.

Limitations of the Study and Directions for Future Research

There were several limitations to the study. First, a small number of participants were included in the study. This was problematic for several reasons. The small number of participants negatively impacted the statistical power of the study. There was also a participant in each group that performed notably different than the rest of their group, and the small N did not allow for a potential outlier to have less impact on the means and standard deviations of the data. Second, sets of stimuli were created with a sixty to twenty ratio of congruent to incongruent stimuli. This was done in order to lessen the degree of predictability of the incongruent stimuli, but made the conditions lengthy. Because of the known fatigue effects and preservations in individuals with aphasia, (Duffy, 2001) these long periods of testing may have affected their performance accuracy.

Several directions for future research could be derived from the current study. More information is needed about the integrity of the nonverbal system following a stroke. Replicating the study with a larger sample size could increase the statistical significance of the difference between conditions. It would also be interesting to determine if individuals with other types of aphasia or neurological disorders show similar patterns if nonverbal processing. Furthermore, it is essential to determine whether the use of nonverbal materials would be beneficial in therapy in individuals with aphasia.

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APPENDIX A

PARTICIPANT QUESTIONNAIRE

Subject #_______

Questionnaire
Background Information

Thank you for participating in this research. You should have already read and signed the Consent Form. Please ask the examiner if you have any questions about your participation in this study, or is you have questions about any part of this questionnaire. Please do not write your name on this form. Participation is completely voluntary.

Sex (circle one) male female
Date of Birth (mm/dd/yy)______________________
Highest level of education completed (circle one)
Elementary school High school Some college Technical School
College Graduate Post graduate studies Graduate degree
Where do you currently love? City____________________ State___________
If you have lived at this location for less than 5 years, where did you previously reside?
City____________________ State___________
Is English your primary language? Yes No
If NO, what is your primary language?____
What is your occupation?____

Do you have normal vision? (circle one) Yes No
If NOT, is it corrected by contact lenses or glasses?____________________________________

Have you ever had a stroke? (circle one) Yes No If YES, when________________________
If yes, please describe (include date) ____
____
____
____

Have you been diagnosed with "aphasia" Yes No

Have you ever had a head injury Yes No If YES, how long ago_________________
If yes, please describe (include date) ____
____
____

Are you currently taking any medications? Yes No If YES, please list name and dose____
____

Do you have any history of the following (circle either Yes or No for each)

Learning Disability Yes No Seizure Disorder Yes No
Language Disorder Yes No Psychiatric Illness Yes No
Drug or Alcohol Abuse Yes No

If yes to any of the above, please explain____
____
____

Your responses to this questionnaire will only be identifiable by Subject Number and will be kept completely confidential.

Thank you again for your participation.

APPENDIX B

EDINBURGH HANDEDNESS INVENTORY

Edinburgh Handedness Inventory

Please indicate your preferences in the use of hands in the following activities *by putting a check in the appropriate column*. Where the preference is so strong that you would never try to use the other hand, unless absolutely forced to, *put 2 checks*. If in any case you are really indifferent, *put a check in both columns*.

Some of the activities listed below require the use of both hands. In these cases, the part of the task, or object, for which hand preference is wanted is indicated in parentheses.

Please try and answer all of the questions, and only leave a blank if you have no experience at all with the object or task.

	Left	Right
1. Writing	☐ ☐	☐ ☐
2. Drawing	☐ ☐	☐ ☐
3. Throwing	☐ ☐	☐ ☐
4. Scissors	☐ ☐	☐ ☐
5. Toothbrush	☐ ☐	☐ ☐
6. Knife (without fork)	☐ ☐	☐ ☐
7. Spoon	☐ ☐	☐ ☐
8. Broom (upper hand)	☐ ☐	☐ ☐
9. Striking Match (match)	☐ ☐	☐ ☐
10. Opening box (lid)	☐ ☐	☐ ☐
TOTAL(count checks in both columns)		

Difference	Cumulative TOTAL	Result

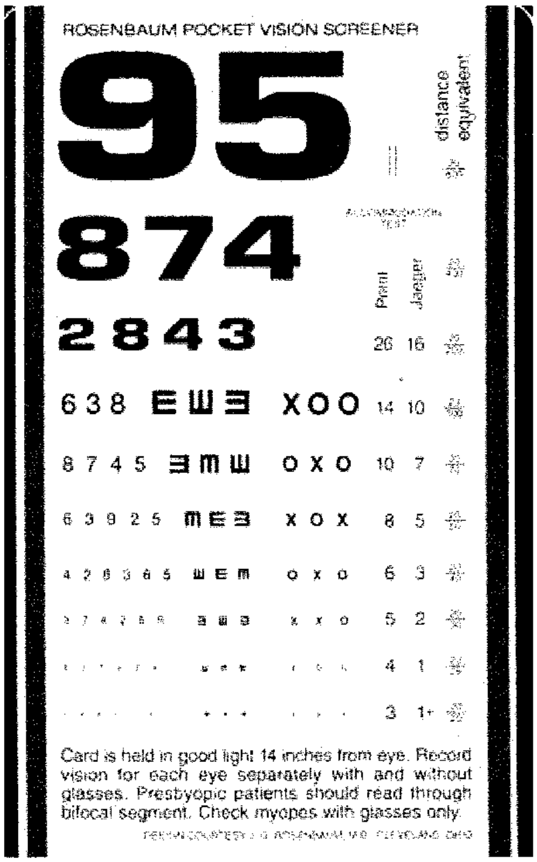
Scoring:
Add up the number of checks in the “Left” and “Right” columns and enter in the “TOTAL” row for each column. Add the left total and the right total and enter in the “Cumulative TOTAL” cell. Subtract the left total from the right total and enter in the “Difference” cell. Divide the “Difference” cell by the “Cumulative TOTAL” cell (round to 2 digits if necessary) and multiply by 100; enter the result in the “Result” cell.

Interpretation (based on Result):

- below -40 = left-handed
- between -40 and +40 = ambidextrous
- above +40 = right-handed

APPENDIX C

ROSENBAUM VISON POCKET SCREENER



APPENDIX D

APHASIA DIAGNOSTIC PROFILES

ADP

Normed Edition

Nancy Helm-Estabrooks

RECORD FORM

Name ______________________________

Address ______________________ Telephone ______________

Date of Birth ______________ Age ________ Sex ________ Soc. Sec. No. ________

Test Date ____________ Examiner's Name ______________________

Time Exam Began ________ Time Exam Finished ________ Test Conditions ______________

Diagnosis ______________________________

____

Site of Lesion ______________________ Onset Date ____________

Dominant Hand __________ Presence/Side of Hemiparesis __________ Family Handedness __________

Present/Former Occupation ______________________________

Years of Education __________ Marital Status __________ Military Duty __________

Native Language ____________ Other Languages ______________________

Other Medical Problems ______________________________

____

Current Medications ______________________________

Names and Ages of Immediate Family (including siblings and children) ______________

____

____

Contact Person ______________________ Phone ____________

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GENERAL INSTRUCTIONS FOR ADMINISTERING, RECORDING, AND SCORING

ADMINISTERING ADP

Present all questions and stimuli using normal, conversational rate and stress patterns. All instructions and items to be read by the clinician are printed in *blue, boldface, italic type.*

When using stimulus cards for Fluency Item 2, Naming, Comprehension of Single Words, and Singing, present the cards one at a time. Do not allow the patient to hold cards.

RECORDING RESPONSES

Record all responses verbatim, either at the time of testing or from an audiotape if used. (This includes Naming and Repetition responses.) Note any correct representational gestures made on the Naming subtest.

SCORING

Space is provided on each page for scoring responses. Score all verbal responses (except for those made during the Auditory Language Comprehension subtest and the Singing subtest) according to the following system:

3 = immediately, fully correct
2 = mostly correct immediately, fully correct with prolonged delay, or self-corrected
1 = some correct
0 = fully incorrect
N = no response

Other codes not related to assigning a score should be used to more fully describe the administration or patient's responses:

G = correct representational gesture (Naming subtest) (*Note: Do not score gestures)*
R = repeated stimulus (Auditory Language Comprehension, Repetition subtests)

The scoring systems for Auditory Language Comprehension (pages 10-11) and Singing (page 13) are explained on the pages with those subtests.

Classify all errors made on the Naming subtest, on Comprehension of Single Words, and on the Repetition subtest according to the error categories marked for each. More than one error type may be produced and recorded for a single item.

RECORDING AND ANALYZING RESPONSES ON FLUENCY SUBTEST (pages 6–8)

Transcribe the patient's responses verbatim. It is important to note all significant pauses in order to determine average longest phrase length and classify the speech output as fluent vs. nonfluent. The phrase length is based on the number of words that occur in a breath unit, that is, without significant pause. It is not necessarily the number of words in a sentence. For example, one nonfluent patient said, "The cans [pause] are straight," two 2-word phrases.

For each of the three passages, find the three longest phrases. Then find the average of the their lengths. For example, one patient said, "There's a bad boy [4] ... knocked over eggs [3]. The woman is reaching for a cup or soup can [10]. Butcher [1] ... cut his finger [3]. Igloo with eskimos in front [5]." In this passage, the three longest phrases are 4, 10, and 5 words long, respectively. Their average is $4 + 10 + 5 = 19 \div 3 = 6.3$.

After calculating the average longest phrase length for each of the three passages, determine the best score (highest average). If no task has 3 or more phrases, use the 3 longest phrases across all 3 tasks to compute the average longest phrase length. The highest average longest phrase length is used in determining speech fluency.

When making the written transcript, record all clinician probes at the points at which they were used. Note that only neutral probes should be used.

PROFILES

Transfer raw scores from each subtest to the Scoring Worksheet (page 16). Look up the appropriate standard scores (and percentile ranks if desired) in the Norms Tables in the **ADP** *Manual.* Use the standard scores in computing all composite and profile scores, which may be plotted on the Score Summary on page 16. Information from the individual ADP subtests can be used in the following Profiles:

1. **Aphasia Severity Profile** (page 16)—Use Lexical Retrival Standard Score (based on Personal Information, Information Units from Fluency subtest, and Naming), Auditory Language Comprehension Standard Score, and Repetition Standard Score.
2. **Error Profiles** (page 14)—Use error information from Naming, Comprehension of Single Words, and Repetition.
3. **Classification Profile** (page 15)—Use Lexical Retrieval Standard Score (Personal Information, Information Units from Fluency subtest, and Naming), ADP Phrase Length Standard Score, Auditory Language Comprehension Standard Score, and Repetition Standard Score to determine if the patient displays a classifiable form of aphasia.
4. **Alternative Communication Profile** (page 16)—Use Writing Standard Score, Reading Standard Score, Elicited Gestures Standard Score, and Singing Standard Score.
5. **Behavioral Profile** (page 14)—As soon as testing is finished, complete the Behavioral Profile as instructed. Use observations made during administration of all subtests and information from conversation with the patient.

PERSONAL INFORMATION

After greeting the patient and making him or her comfortable, give the following instructions: *"I'd like to start out with some general information about you."*

3 = Immediately, Fully Correct **2** = Mostly Correct Immediately, Fully Correct with Prolonged Delay, or Self-Corrected **1** = Some Correct **0** = Fully Incorrect **N** = No Response

Item/Response	Score					
1. *What is your full name?*	3	2	1	0	N	
2. *And what is your current address?*	3	2	1	0	N	
3. *How old are you now?*	3	2	1	0	N	
4. *Can you tell me your exact birthdate?*	3	2	1	0	N	
5. *And where were you born?*	3	2	1	0	N	
6. *What languages do you speak?*	3	2	1	0	N	
7. *What do [did] you do for a living?*	3	2	1	0	N	
8. *How many years of education did you have?*	3	2	1	0	N	
Column Totals						
Personal Information Score (Transfer to page 16, Scoring Worksheet.)	/24					

"Say, why don't I just let you fill in this form?" Hand the patient the Patient Information Form on page 5 of this Record Form and a black, medium-point felt-tipped pen. (Do not use a pencil.) **If the patient cannot write, ask him or her to complete the multiple-choice sections of the form by indicating choices.** This is a reading comprehension test. Do not read aloud to the patient. When the patient is done, take the form back and turn to page 6.

SCORING THE PATIENT INFORMATION SHEET **(Facing Page)**

The Patient Information Sheet is a brief test of functional writing and reading skills.

3 = Immediately, Fully Correct
2 = Mostly Correct Immediately, Fully Correct with Prolonged Delay, or Self-Corrected
1 = Some Correct
0 = Fully Incorrect
N = No Response

WRITING

Item/Response	Writing				
1. Name	3	2	1	0	N
2. Street	3	2	1	0	N
3. City	3	2	1	0	N
4. State	3	2	1	0	N
5. ZIP Code	3	2	1	0	N
6. Birth Date	3	2	1	0	N
7. Social Security Number	3	2	1	0	N
8. Telephone Number	3	2	1	0	N
9. Signature	3	2	1	0	N
10. Date	3	2	1	0	N
Column Totals					
Writing Score (Transfer to page 16, Scoring Worksheet.)	/30				

Hand Used for Writing: ____________

READING

Item	Reading				
1. Sex	3	2	1	0	N
2. Hand Preference	3	2	1	0	N
3. Age	3	2	1	0	N
4. Siblings	3	2	1	0	N
5. Education	3	2	1	0	N
6. Marital Status	3	2	1	0	N
7. Children	3	2	1	0	N
8. Veteran	3	2	1	0	N
9. Employment	3	2	1	0	N
10. Permission	3	2	1	0	N
Column Totals					
Reading Score (Transfer to page 16, Scoring Worksheet.)	/30				

PATIENT INFORMATION SHEET

NAME (Please Print) ______________________________

ADDRESS ______________________________
Street

______________ ______________ ______________
City State ZIP Code

BIRTH DATE ______________ SOC. SEC. NO. _____-____-_____ TELEPHONE NO. (___)__________

CHOOSE ONE IN EACH CATEGORY:

1. SEX: Male Female
2. ORIGINAL HAND PREFERENCE: Right Left Ambidextrous
3. AGE BRACKET: 20–29 30–39 40–49 50–59 60–69 70–79 80–89 90 or older
4. BROTHERS AND SISTERS: 0 1 2 3 4 5 6 7 8 9 ___
5. EDUCATION COMPLETED: Grammar School Junior High High School College Graduate School
6. MARITAL STATUS: Single Married Divorced Separated Widowed
7. CHILDREN: 0 1 2 3 4 5 6 7 8 9 ___
8. VETERAN OF ARMED SERVICES: Yes No
9. EMPLOYMENT STATUS: Employed Unemployed Retired Disabled

10. **Indicate the correct choice** so that the following statement reflects your wishes:

I give my permission — I do not give my permission — for tape recording my speech for evaluating my language skills.

SIGNATURE: ______________________________ TODAY'S DATE: ______________

FLUENCY

1. After the patient has filled out the Patient Information Form, say, *"Well, now that that's out of the way, I'm going to turn on the tape recorder"* (if permission for taping was granted). *"Now I'd like you to tell me exactly what happened to you."* Neutral probes such as *"And then what happened?"* or *"Can you tell me more?"* may be used. Use the grid below to record the patient's response *verbatim*. On each line write the words uttered without a significant pause or breath. Number each phrase and count the words in each.

Phrase Number	Phrase	Phrase Length

Average of 3 Longest Phrase Lengths: [ ]

6

2. After asking the patient to describe what happened to him or her, continue to tape record. Present Card 1, The Grocery Store, and give the following instruction: *"I have a picture here. As you see, there's lots going on. Look it over and tell me about it."* If the patient leaves out some important details, use neutral probes such as "Any other details?" or *"What about here?"* (pointing to the butcher). Never use nonneutral probes such as, "What is the woman doing?"

Phrase Number	Phrase	Phrase Length

Average of 3 Longest Phrase Lengths: ______

OTHER VARIABLES (Scored from Picture Description)

Total Number of Words: Count every word produced in response to the initial prompt. Also count responses to neutral probes. Do not count hesitation noises and interjections ("um," "er," "hmm") or fragments that are false starts on a word that is eventually produced ("bu, bu, butcher"). Do count fragments that seem to be broken-off words, along with incorrect words, repetitions, jargon words, irrelevant statements, digressions, frame statements ("Let's see, now..."), and comments ("This is a strange picture").

Total Number of Words: ________

Number of Correct Information Units: ________
(Transfer to page 16, Scoring Worksheet.)

Number of Correct Information Units: Count the number of new pieces of **correct** information about the picture given by the patient. If the patient repeats, count only the best mention of a particular element (e.g., "the eggs" rather than "the egg"). (A list of acceptable information units can be found in the **ADP** *Manual*.)

Number of Probes: Count the number of additional neutral probes used after the initial presentation of the item.

Number of Probes Used: ________

Index of Wordiness (Total Words Divided by Correct Information Units): ________

3. Say to the patient, *"That's fine. Now I want to test your memory a little. Do you remember President Kennedy? What can you tell me about him?"* Again, neutral probes such as "Can you tell me more?" may be used.

Phrase Number	Phrase	Phrase Length

Average of 3 Longest Phrase Lengths: ☐

ADP Phrase Length: ☐
(Transfer to page 16, Scoring Worksheet.)

When testing is complete, compare the averages of the 3 longest phrase lengths from the three samples transcribed on pages 6, 7, and 8. Find the highest average, called the **"ADP Phrase Length."** Transfer to the Scoring Worksheet (page 16); look up the standard score equivalent. Use that standard score in the Classification Profile. If no sample has at least three phrases, average across samples.

NAMING

Say to the patient, *"Here are some pictures that might be a little easier for you. What is this?"* Present cards 2-13. Do not cue the patient. Record any spontaneous use of correct representational gestures such as throwing the dart. If the patient gives a phrase instead of one word, say, *"Just give me one word."* Classify all errors and note delays. *Do NOT score gestures.*

3 = Immediately, Fully Correct
2 = Mostly Correct Immediately, Fully Correct with Prolonged Delay, or Self-Corrected
1 = Some Correct
0 = Fully Incorrect
G = Correct Representational Gesture
N = No Response

ph Phonemic Paraphasia ("kack" for jack)
sm Semantic Paraphasia ("clock" for watch)
aug Augmentation ("sojie watch" for watch)
pw Part Word ("noculars" for binoculars)
cir Circumlocution/Description ("blow it" for whistle)
ps Phonemic Error on Semantic Paraphasia ("miskroscope" for binoculars)
neo Neologistic Paraphasia ("kargy" for whistle)
urw Unrelated Real Words ("thunder time" for scissors)
ste Stereotypy ("bukky, bukky" for wrench)
per Perseveration (after naming scissors, "sistle" for whistle)
o Other ("I know this one but I can't think of the word")
un Unintelligible, nontranscribable
vp Visual Perceptual ("trash cans" for binoculars)

Card	Item/Response	Score						Error Type												
2.	1. Watch	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
3.	2. Gun [pistol, revolver, firearm]	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
4.	3. Key	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	rel	ste	per	o	un	vp
5.	4. Dart	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
6.	5. Jack	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
7.	6. Scissors [shears]	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
8.	7. Whistle	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
9.	8. Tweezers	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
10.	9. Binoculars [field glasses]	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
11.	10. Wrench	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	rel	ste	per	o	un	vp
12.	11. Thermometer	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
13.	12. Typewriter	3	2	1	0	G	N	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
	Column Totals																			
	Naming Score (Transfer to page 16, Scoring Worksheet.)	/36						(Transfer to page 14, Error Profile.)												

AUDITORY LANGUAGE COMPREHENSION

This subtest contains three sections. Each item receives a score of 1 or 0. After giving all three sections, use the formula on the bottom of page 11 to sum the scores and find the Auditory Language Comprehension Score.

1 = Correct Response
0 = Incorrect Response
R = Repeated Stimulus
N = No Response

Following Commands

"Okay, now I want you to do some things without talking." If the patient asks, the command may be repeated one time without penalty, but it should be noted by marking the "R" in the response grid.

Item/Response	Score			
1. *Sit up straight.*	1	0	R	N
2. *Now, take a deep breath and relax.*	1	0	R	N
3. *Close your eyes. [Now open them.]*	1	0	R	N
4. *Look all around the room because I'm going to ask you to find something. Check it out. Now...*	1	0	R	N
5. *Where is the exit?*	1	0	R	N
6. *Let's do something different. Please make a fist.*	1	0	R	N
7. *Where is your heart?*	1	0	R	N
8. *Where is your elbow?*	1	0	R	N
Commands Subtotal				

Comprehension of Single Words

Use Cards 14–18 for this section. Begin by placing Card 14 in front of the patient and saying, *"Now for something new. Look carefully at these pictures and show me the [clock.] Now show me the [keys]."* Again, one immediate repetition upon request is permitted without penalty but should be noted in the "R" column.

ph Phonemically Related ("lock" for "clock")
sm Semantically Related ("lock" for "keys")
per Perseveration (incorrectly points to "lock" a second time)
o Other ("watch" for keys)

Card	Item/Response	Score				Errors			
14.	1. *Clock*	1	0	R	N	ph	sm	per	o
	2. *Keys*	1	0	R	N	ph	sm	per	o
15.	3. *Shower*	1	0	R	N	ph	sm	per	o
	4. *Tree*	1	0	R	N	ph	sm	per	o
16.	5. *Banjo*	1	0	R	N	ph	sm	per	o
	6. *Stool*	1	0	R	N	ph	sm	per	o
17.	7. *Candle*	1	0	R	N	ph	sm	per	o
	8. *Ladder*	1	0	R	N	ph	sm	per	o
18.	9. *Headphone*	1	0	R	N	ph	sm	per	o
	10. *Flashlight*	1	0	R	N	ph	sm	per	o
	Single Words Subtotal (Transfer error information to page 14, Error Profile.)								

Understanding Stories

These stories may be read only once, but the questions may be repeated one time without penalty if the patient asks you to repeat them. If the patient fails to answer clearly, instruct him or her to respond with either yes or no. Present all questions after each story. In order to receive credit, the patient must choose the correct answer (marked *) to both questions in each matched pair; that is, both question #1 and question #3 must be answered correctly to receive a score of 1. Present the questions for each story by reading down the left column and then down the right column; that is, read question #1, then #2, then #3, and finally #4.

A. *"Now let's do something different. This time I'm going to read you some stories and then ask you some questions about them. Listen carefully, because some of the questions are kind of tricky, and I'm only allowed to read the story once. Are you ready?"*

"My cousin's doctor recommended that she get some exercise and lose 25 pounds, so she decided to buy a stationary bike. She rode two miles a day, but she never reached her goal."

Question	Resp.		Question	Resp.		Items	Score		
1. *Did my cousin's doctor recommend that she put on a little weight?*	Y	N*	3. *Did my cousin's doctor recommend that she lose 25 pounds?*	Y*	N	1 & 3	1	0	N
2. *Did my cousin reach her goal?*	Y	N*	4. *Did my cousin lose 25 pounds?*	Y	N*	2 & 4	1	0	N
						Story A Subtotal			

B. *"Good. Here's another one. Listen carefully."*

"My friend Bobby is a professional singer. Last week her manager, Robin, was very concerned when Bobby had a sudden attack of laryngitis the day before a performance. Robin thought he would have to cancel the concert, but fortunately Bobby recovered."

Question	Resp.		Question	Resp.		Items	Score		
5. *Is my friend Bobby a woman?*	Y*	N	9. *Is my friend Bobby a man?*	Y	N*	5 & 9	1	0	N
6. *Did Bobby's manager think Bobby would be able to perform?*	Y	N*	10. *Did Bobby's manager think he would have to cancel her concert?*	Y*	N	6 & 10	1	0	N
7. *Did the concert go on as planned?*	Y*	N	11. *Was the concert cancelled?*	Y	N*	7 & 11	1	0	N
8. *Was Robin concerned last week because Bobby had appendicitis?*	Y	N*	12. *Was Robin concerned last week because Bobby had laryngitis?*	Y*	N	8 & 12	1	0	N
						Story B Subtotal			

C. *"Good. Here's the last one. Listen carefully, because it's kind of long."*

"My aunt Alberta, a professor who lives in Boston, has trouble getting to places on time, so her lectures often have to be rescheduled. Last week, she had to catch an 8:45 a.m. plane to Albuquerque for an afternoon lecture. Not surprisingly, to those of us who know her, her lecture was rescheduled for the following morning."

Question	Resp.		Question	Resp.		Items	Score		
13. *Is my aunt frequently late?*	Y*	N	17. *Is my aunt good about getting to places on time?*	Y	N*	13 & 17	1	0	N
14. *Was my aunt going to Alberta?*	Y	N*	18. *Was she going to Albuquerque?*	Y*	N	14 & 18	1	0	N
15. *Did she miss her scheduled plane?*	Y*	N	19. *Did she arrive at the airport on time?*	Y	N*	15 & 19	1	0	N
16. *Was she supposed to leave in the morning?*	Y*	N	20. *Was she scheduled to leave in the afternoon?*	Y	N*	16 & 20	1	0	N
						Story C Subtotal			

Commands Subtotal		Single Words Subtotal		Story A Subtotal		Story B Subtotal		Story C Subtotal		Auditory Lang. Comp. Total Score
/8	+	/10	+	/2	+	/4	+	/4	=	/28

(Transfer to page 16, Scoring Worksheet.)

REPETITION

Say to the patient, *"Now, I want you to try to repeat some things after me. Do the best you can. Some of them are long. Can you say ... ?"* One immediate repetition upon request is permitted without penalty, but should be noted with an "R" on the response grid. Classify all errors.

3 = Immediately, Fully Correct
2 = Mostly Correct Immediately, Fully Correct with Prolonged Delay, or Self-Corrected
1 = Some Correct
0 = Fully Incorrect
R = Repeated Stimulus
N = No Response

ph Phonemic Paraphasia ("noney" for money)
sm Semantic Paraphasia ("children" for babies)
aug Augmentation ("hundreds" for hundred)
pw Part Word ("lidoscope" for kaleidoscope)
pa Paraphrase ("here she is" for Is she here?)
pp Partial Phrase ("three hundred dollars" for three hundred and twenty-one dollars)
ps Phonemic Error on Semantic Paraphasia ("drelden" for babies)
neo Neologistic Paraphasia ("foriga" for tornado)
urw Unrelated Real Words ("dreams of fire" for Babies cry)
ste Stereotypy ("bukky, bukky" for pizza)
per Perseveration (after saying money, "mizza" for pizza)
o Other ("You've got to be kidding" for Chuck challenged Chick ...)
un Unintelligible, nontranscribable

Item/Response	Score						Error Type												
1. *Money*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
2. *Pizza*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
3. *I love you.*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
4. *Kaleidoscope*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
5. *Babies cry.*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
6. *Is she here?*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
7. *Three hundred and twenty-one dollars*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
8. *If they come, he will go.*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
9. *After you push the button, turn the knob.*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
10. *Happy hippopotamus*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
11. *A terrible tornado*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
12. *Chuck challenged Chick to a game of quoits.*	3	2	1	0	R	N	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
Column Totals																			
Repetition Score (Transfer to page 16, Scoring Worksheet.)	/36						(Transfer to page 14, Error Profile.)												

ELICITED GESTURES

Before beginning, tell the patient that you are going to ask him or her to pretend to do some things without talking. Then say, *"Show me how you would...."* Note that, when testing oral movements (Items 1 and 2), it is important to suppress any hand movements the patient might use as a form of self-cuing.

3 = Immediately, Fully Correct
2 = Mostly Correct Immediately, Fully Correct with Prolonged Delay, or Self-Corrected
1 = Some Correct
0 = Fully Incorrect
N = No Response

"Okay, now we're going to try some things without talking. Without talking, show me how you would ...:"

Item/Response	Score				
1. *Lick someone's ice cream cone.*	3	2	1	0	N
2. *Blow out a candle.*	3	2	1	0	N

"Now I want you to use your hand to show me some things. Remember, no talking. Show me how you ...:"

Item/Response	Score				
3. *Wave goodbye.*	3	2	1	0	N
4. *Saw a board in half.*	3	2	1	0	N

Use cards 19–21. Say, *"This is the last batch. This time I'm going to show you some pictures of Again, without talking, show me a gesture that would represent this object."* Do not name the object for the patient.

Card	Item/Response	Score				
19.	5. Bugle.	3	2	1	0	N
20.	6. Can of paint and a stir stick.	3	2	1	0	N
21.	7. Piano.	3	2	1	0	N
	Column Totals					
	Elicited Gestures Score (Transfer to page 16, Scoring Worksheet.)	/21				

SINGING

This section assesses three aspects of singing: whether a patient can (1) initiate the song, (2) carry the tune, and (3) produce at least some of the words of the song. Score 3 points if the patient meets all three criteria, 2 points for two criteria, 1 point for one criterion, and 0 points for no criteria met. If the patient cannot initiate an appropriate song spontaneously, introduce the song(s) and ask him or her to continue. In this case, no score of 3 can be earned. Show the patient cards 22–25 and say, *"Look at this picture. Can you think of a song you might sing when someone is presented with this?"*

Card	Item/Response	Score				
22	1. Birthday cake. ("Happy Birthday to You.")	3	2	1	0	N
23.	2. Cradle. ("Rock-a-Bye-Baby" or other "baby" song.)	3	2	1	0	N
24./ 25.	3. National flag. ("Star-Spangled Banner," "O Canada," or other patriotic song.)	3	2	1	0	N
	Column Totals					
	Singing Score (Transfer to page 16, Scoring Worksheet.)	/9				

BEHAVIORAL PROFILE

Following the completion of the examination, complete the Behavioral Profile by marking the appropriate descriptive observations of the patient's behavior during the **ADP** exam. There will be **no basis for judgment** of some behaviors, and that should be so indicated. In order to prorate scores, at least 8 features must be rated.

Lethargic	1	Somewhat Lethargic	2	Alert	3	No Basis	
Confused	1	Somewhat Confused	2	Lucid	3	No Basis	
Disinhibited	1	Somewhat Disinhibited	2	Appropriate	3	No Basis	
Unconcerned	1	Somewhat Unconcerned	2	Concerned	3	No Basis	
Uncooperative	1	Somewhat Cooperative	2	Cooperative	3	No Basis	
Impulsive	1	Somewhat Impulsive	2	Deliberate	3	No Basis	
Emotionally Labile	1	Somewhat Labile	2	Emotionally Stable	3	No Basis	
Disagreeable	1	Somewhat Disagreeable	2	Pleasant	3	No Basis	
Self-Deprecating	1	Somewhat Self-Deprecating	2	Self-Confident	3	No Basis	
Discouraged	1	Somewhat Discouraged	2	Optimistic	3	No Basis	
Anxious	1	Somewhat Anxious	2	Relaxed	3	No Basis	
Unrealistic	1	Somewhat Unrealistic	2	Realistic	3	No Basis	
Suspicious	1	Somewhat Suspicious	2	Trusting	3	No Basis	
Verbose	1	Somewhat Verbose	2	Verbally Interactive	3	No Basis	

☐ (a) Total Points (Sum of col. 1 + Sum of col. 2 + Sum of col. 3)

☐ (b) Number of Features Rated (14 − Number of "No Basis" checked)

☐ Behavioral Profile Raw Score [(a) or Prorated Behavioral Profile Score (a) ÷ (b) × 14; see **ADP** *Manual*, Table 4.2]

ERROR PROFILES

For each error in each profile, record the total in the "Error Count" space at the top of the appropriate column. Find the row that displays the range containing each total and record the number of that row in the "Standardized Error Score" (SES) space at the bottom of the column.

Comprehension of Single Words

	Error Count			
	ph	sm	per	o
SES 1		1		
SES 2	1	2		
SES 3	2–4	3–6		
	Standardized Error Score			

Naming

	Communicative Error Count					Noncommunicative Error Count							Nonaphasic Error Count
	ph	sm	aug	pw	cir	ps	neo	urw	ste	per	o	un	vp
SES 1	1	1			1		1			1-2	1		
SES 2	2–4	2	1	1	2–3		2–3	1–2		3–6	2–4	1–2	1
SES 3	5–6	3–4	2	2–6	4–8	1	4–8	3–11	1–12	7–11	5–11	3–12	2–4
	Standardized Error Score					Standardized Error Score							SES

Repetition

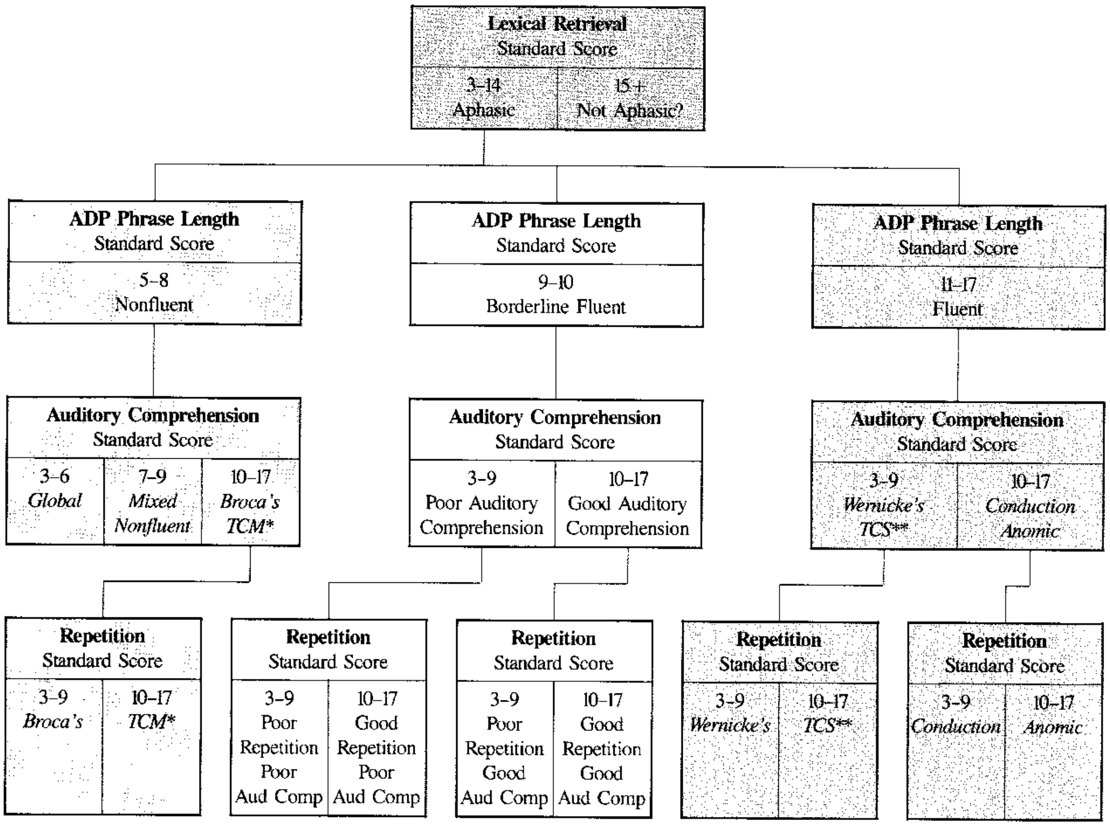
	Communicative Error Count						Noncommunicative Error Count						
	ph	sm	aug	pw	pa	pp	ps	neo	urw	ste	per	o	un
SES 1	1			1	1	1					1		
SES 2	2–3	1	1		2	2–3		1–2	1–2		2–3	1–3	1–3
SES 3	4–9	2	2	2–3	3–4	4–5	1–2	3–7	3–5	1–12	4–12	4–12	4–12
	Standardized Error Score						Standardized Error Score						

CLASSIFICATION PROFILE

Following the completion of the examination, complete the Classification Profile by marking the appropriate STANDARD SCORES, from the Scoring Worksheet on page 16. *Note:* DO NOT use raw scores.

- Nonfluent types
- Borderline fluent types
- Fluent types

**TCM = Transcortical Motor*
***TCS = Transcortical Sensory*



15

SCORING WORKSHEET

	Subtest/Score (Norms Table 1)			Lexical Retrieval (Norms Table 2)			Aphasia Severity (Norms Table 3)			Alternative Communication (Norms Table 3)		
	Raw Score	SS	PR	Subtest Std. Score	Lex. Retriev. SS	Lex. Retriev. PR	Subtest Std. Score	Aphasia Sev. SS	Aphasia Sev. PR	Subtest Std. Score	Alt. Comm. SS	Alt. Comm. PR
Personal Information, p.3												
Writing, p.4												
Reading, p.4												
Information Units, p.7												
ADP Phrase Length, p.8												
Naming, p.9												
Auditory Comprehension, p.11							×2=					
Repetition, p.12							×1=					
Elicited Gestures, p.13												
Singing, p.13												
Behavioral Profile, p.14 (Norms Table 3)		SS	PR									
Lexical Retrieval				Sum	SS	PR	×2=					
Aphasia Severity							Sum	SS	PR			
Alternative Communication										Sum	SS	PR

SCORE SUMMARY

Plot subtest and composite STANDARD SCORES from the worksheet. To reflect confidence ranges, plot an interval of +1 SEM (upper limit) to −1 SEM (lower limit) for each standard score. Consider any two scores different if their confidence ranges do not overlap.

	Lexical Retrieval			Aphasia Severity Profile			Alternative Communication Profile				Summary		
	Standard Scores			Standard Scores			Standard Scores				Standard Scores		
	Personal Info.	Info. Units	Naming	Auditory Compre.	Repetition	Lexical Retrieval	Writing	Reading	Elicited Gestures	Singing	Aphasia Severity	Altern. Commun.	Behavioral Profile
SEM	.9	.9	.7	1.0	.6	.3	.7	.7	.9	1.2	1.0	.8	6.7
Upper Limit + points													
Lower Limit − points													

	Subtest scale	Summary scale
+2SD	17	
	16	130
	15	125
	14	120
+1SD	13	115
	12	110
	11	105
Mean	10	100
	9	95
	8	90
−1SD	7	85
	6	80
	5	75
−2SD	4	70
	3	
	2	

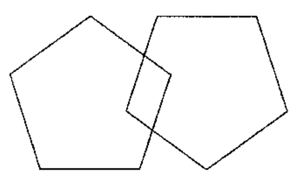
APPENDIX E

THE MINI-MENTAL STATE EXAMINATION

The Mini-Mental State Exam

Patient____________________ Examiner ____________________ Date__________

Maximum	Score	
		Orientation
5	( )	What is the (year) (season) (date) (day) (month)?
5	( )	Where are we (state) (country) (town) (hospital) (floor)?
		Registration
3	( )	Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials ________
		Attention and Calculation
5	( )	Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively spell "world" backward.
		Recall
3	( )	Ask for the 3 objects repeated above. Give 1 point for each correct answer.
		Language
2	( )	Name a pencil and watch.
1	( )	Repeat the following "No ifs, ands, or buts"
3	( )	Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."
1	( )	Read and obey the following: CLOSE YOUR EYES
1	( )	Write a sentence.
1	( )	Copy the design shown.



______ Total Score

ASSESS level of consciousness along a continuum __________

Alert Drowsy Stupor Coma

"MINI-MENTAL STATE." A PRACTICAL METHOD FOR GRADING THE COGNITIVE STATE OF PATIENTS FOR THE CLINICIAN. *Journal of Psychiatric Research*, 12(3): 189-198, 1975. Used by permission.

APPENDIX F

MIAMI VETERAN'S ADMINISTRATION MEDICAL CENTER COMMUNICATION SCREENER

VISION SCREENING:

B F M E P W Did not Respond: ___________ Refused: ____________
Visual Field Deficit: ______________ Other: _______________

PASS/FAIL

COMMUNICATION SCREENING:
DISCOURSE:
Mr. (Mrs., Ms.) __________, I'm here today to find out if you have any problems using or understanding words, but first, I'd like to get to know you a little bit.

1. Where were you born?
2. What kinds of things do you do here?
3. Did you have a big family?
   a. How many brothers and sisters do you have?
   b. Tell me about your wife.
   c. How many children do you have?

Failure = Any evidence of anomia, paraphasia, confabulation, circumlocution, rejection, and/or any error on personal biographic information. PASS/FAIL

PICTURE DESCRIPTION:

Look at this picture and tell me what's going on:

Need for repetition:	Yes ________	No ________
Need for prompting:	Yes ________	No ________
Need for cueing:	Yes ________	No ________

Vocabulary/Word finding:	Passed _____	Failed _____	Note ______
Grammar:	Passed _____	Failed _____	Note ______
Syntax:	Passed _____	Failed _____	Note ______
Articulation:	Passed _____	Failed _____	Note ______
Voice:	Passed _____	Failed _____	Note ______
Relevance:	Passed _____	Failed _____	Note ______

Example of Sentence: ____
____

Evidence of appropriate self correction:	Yes ______	No ______
Patient refused to complete verbal task:	Yes ______	No ______
Patient did not respond:	Yes ______	No ______

Failure = Any apparent disorder of phonatory, resonatory, articulation/oral-motor process and/or evidence of anomia, paraphasia, confabulation, circumlocution, or rejection. PASS/FAIL

GRAPHIC OUTPUT:

Now, I want you to write down what you just told me.
Alternate: If patient is unable to remember what he/she saw in the picture ask him/her to write down a sentence to dictation. "I'll tell you a sentence and you write it down. The family is having a picnic at the lake."

Hand Used:	Right _____	Left _____	
Legibility:	Passed ____	Failed____	Note ____

COMMUNICATION SCREENING
MIAMI VETERANS ADMINISTRATION MEDICAL CENTER

Name: ____________________ S.S.# ____________________ Date: _________

Admission Date: _________ Ward: _______ Date of Birth: __________ Age: _____

Examiner: ______________________ Audiology/Speech Language Pathology

SIGNIFICANT MEDICAL HISTORY:

Stroke:	Yes: ____ No: ____		Head Injury:	Yes: _____ No: _____
Heart Attack	Yes: ____ No: ____		Dementia:	Yes: _____ No: _____

Other: ____

Medications: ____

COMMUNICATION HISTORY:

	Patient Identified	Staff Identified
Hearing Problem:	Yes __ No __	Yes __ No __
Speech Problem:	Yes __ No __	Yes __ No __
Voice Problem:	Yes __ No __	Yes __ No __
Language Problem:	Yes __ No __	Yes __ No __
Memory Problem:	Yes __ No __	Yes __ No __
Swallowing Problem:	Yes __ No __	Yes __ No __
Drooling:	Yes __ No __	Yes __ No __

History of Speech-Language and/or Hearing Intervention: _______________

Hearing Aid: ________ Dentures: ________ Glasses: _______________

OBSERVATION:

Socialization:	Appropriate: ___________	Withdrawn: ___________
Appearance:	Appropriate: ___________	Disheveled: ___________

Other: ____

HEARING SCREENING:

Otoscopic Exam: ____

Pure Tone Screening:

	500 Hz 35 dB	1000 Hz 30 dB	2000 Hz 30 dB	3000 Hz 50 dB
Right:	_____	_____	_____	_____
Left:	_____	_____	_____	_____

PASS/FAIL

Spelling:	Passed ___	Failed___	Note ___
Vocabulary:	Passed ___	Failed___	Note ___
Grammar:	Passed ___	Failed___	Note ___
Syntax:	Passed ___	Failed___	Note ___
Evidence of self correction:		Yes _____	No _____
Refused to complete task:		Yes _____	No _____
Patient did not respond:		Yes _____	No _____

Failure = Any evidence of anomia, paraphasia, confabulation, circumlocution, rejection, visual perceptual errors, spelling errors, syntax errors, memory/recall errors. PASS/FAIL

ORAL READING:

Now, I want you to read this short story aloud.

* THE SUNFLOWER, A NATIVE OF NORTH AMERICA, IS A STRONG COARSE PLANT WITH ROUGH TOOTHED LEAVES AND FLOWERS. IT IS A QUICK GROWER IN LIGHT, DRY SOIL, AND MAY GROW FROM 3 TO 15 FEET IN HEIGHT. IT WAS GROWN BY THE INDIANS FOR FOOD.

Intelligibility:	Passed ______	Failed ______	Note ______
Word Pronunciation errors:	Passed ______	Failed ______	Note ______
Rate:	Passed ______	Failed ______	Note ______
Omissions:	Passed ______	Failed ______	Note ______
Additions:	Passed ______	Failed ______	Note ______
Patient refused to complete the reading task:		Yes ________	No _______
Patient did not respond:		Yes ________	No _______

Failure = 5/45 words PASS/FAIL

AUDITORY COMPREHENSION:

I'm going to read you a short story then ask you some questions. Ready?
*DOCTORS DO NOT KNOW WHAT CAUSES THE COMMON DISEASE KNOW AS THE COLD. COLDS ARE PROBABLY CAUSED BY A GERM, BUT IT HAS NEVER BEEN FOUND. THE WORST SEASON FOR COLDS IS FALL. TO AVOID GETTING A COLD YOU SHOULD EAT WELL, DRESS FOR THE WEATHER, AND KEEP OUT OF CROWDS WHEN YOU CAN.

1.	Do doctors know what causes a cold?	Yes	No
2.	Is Spring the worst time for colds?	Yes	No
3.	Are colds probably caused by germs?	Yes	No
4.	Is it wise to stay out of crowds to avoid a cold?	Yes	No
5.	Is it also best to dress for the weather to avoid a cold?	Yes	No

Patient refused to complete auditory comprehension task: Yes _____ No_____
Patient did not respond: Yes _____ No _____
Failure = Errors on 2/5 questions PASS/FAIL

COMMENTS: ____
____
____

REFERRALS RECOMMENDED:

Audiology	Speech Pathology	Dysphagia
Dental	Eye Clinic	Psychology
EMS	ENT	RT

Other: ______________________________

APPENDIX G

FIGURES G1-G6

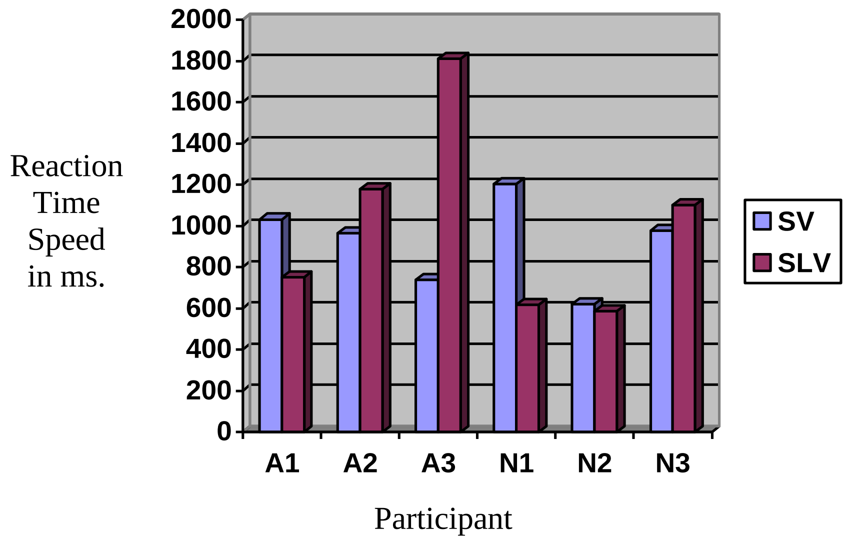


Figure G1:
Individual Performance on SV versus SLV

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

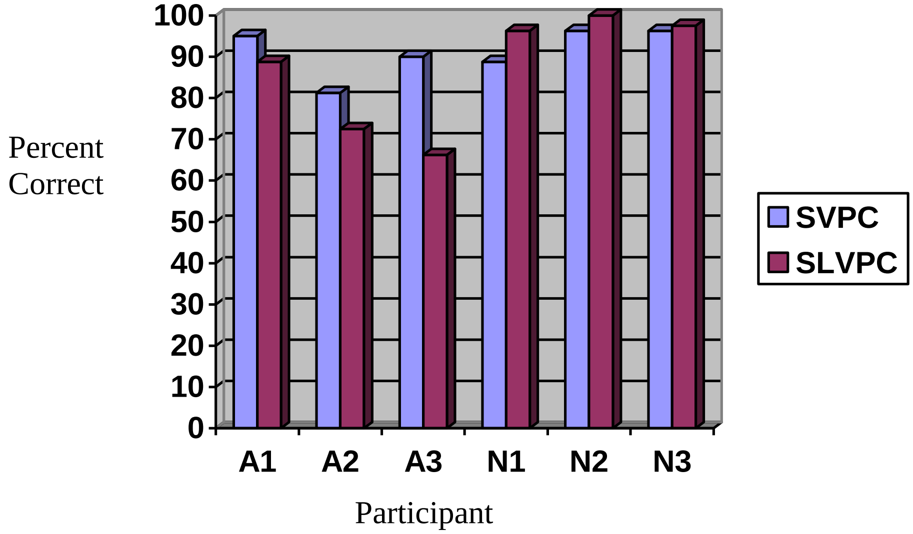


Figure G2:
Individual Performance on SVPC versus SLVPC

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

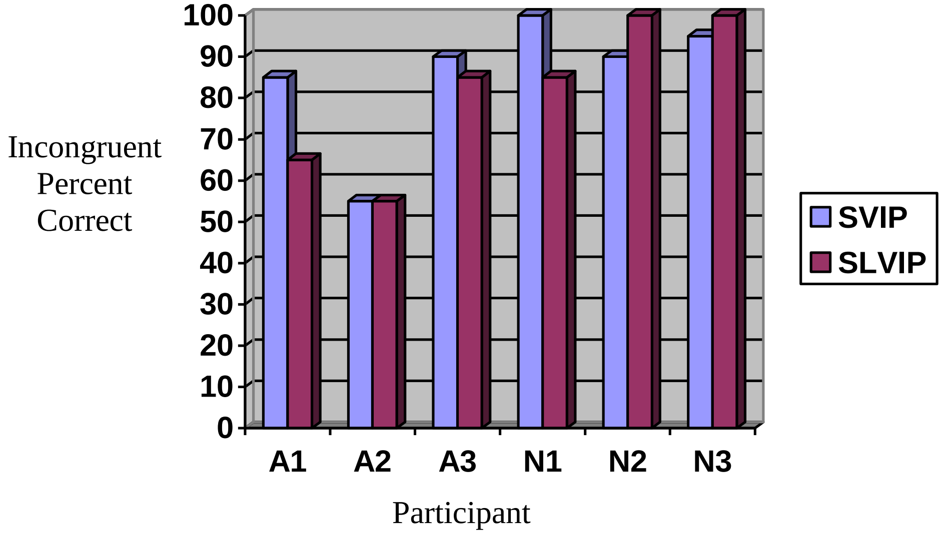


Figure G3:
Individual Performance on SVIP versus SLVIP

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

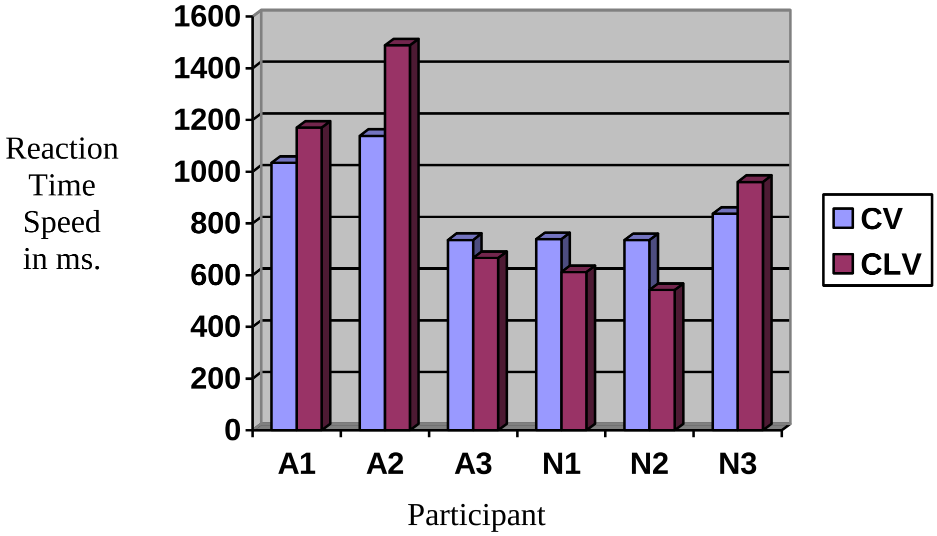


Figure G4:
Individual Performance on CV versus CLV

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

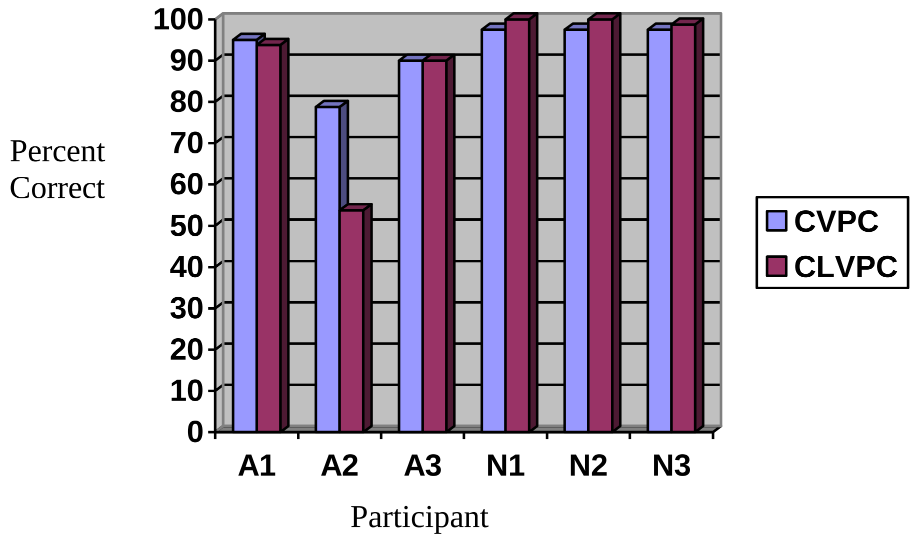
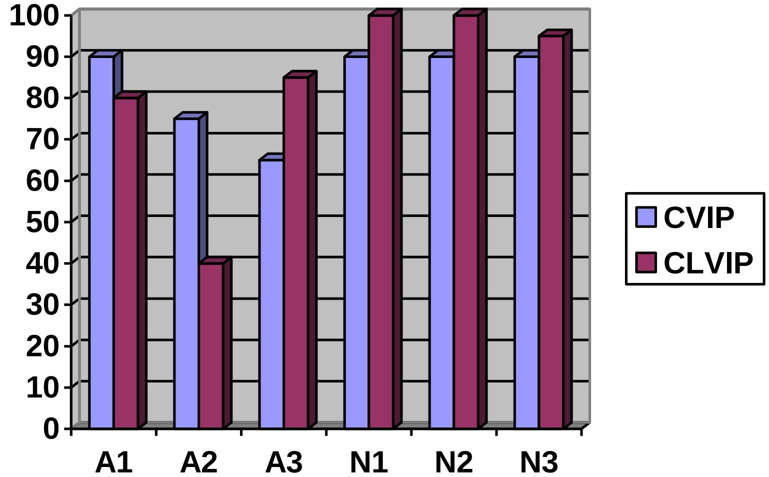


Figure G5:
Individual Performance on CVPC versus CLVPC

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

Incongruent Percent Correct



Participant

Figure G6:
Individual Performance on CVIP versus CLVIP

A1-Individual with Aphasia 1
A2-Individual with Aphasia 2
A3- Individual with Aphasia 3
N1-Non-Neurologically Damaged Individual 1
N2-Non-Neurologically Damaged Individual 2
N3--Non-Neurologically Damaged Individual 3

VITA

Amanda L. Stead received her Bachelor of Arts degree in communication Disorders from University of Wisconsin in 2005. Following graduation, she continued her education at Louisiana State University in the department of Communication Sciences and Disorders in pursuit of the degree of Master of Arts in speech-language pathology. She began her doctoral studies while completing this thesis, with a focus on adult rehabilitation following a stroke. Future plans include continuing to research nonverbal language in persons with aphasia and becoming a professor.