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AN ABSTRACT OF THE THESIS OF Ute Kongsbak for the Master of Science in Speech Communication: Emphasis in Speech and Hearing Science presented October 31, 1990.

Title: Reading Comprehension of Literal, Translational, and High Inference Level Questions in Aphasic and Right Hemisphere Damaged Adults

APPROVED BY MEMBERS OF THE THESIS COMMITTEE:

Marie T. Rau, Co-Chair

Joan McMahon, Acting Co-Chair

Robert C. Casteel

Leonard Cain

The purpose of this study was to examine and compare inferential abilities on a reading comprehension task in two groups of adults who had suffered cerebrovascular accidents

(CVA). Sixteen subjects with a CVA to the right hemisphere of the brain were compared to an equal number of left hemisphere damaged subjects. Subjects were selected after they had demonstrated an adequate level of functioning on the Short Porch Index of Communicative Ability (SPICA), a test which measures communicative efficiency, to perform the tasks required in this study. All subjects were administered the revised version of the Nelson Reading Skills Test (NRST). On the NRST, test questions can be grouped into three categories representing literal, translational and high levels of inference. Subjects were presented five reading paragraphs. They were asked to answer thirty-three questions pertaining to the reading material by pointing to the correct answer out of four choices. Subjects were allowed to refer back to the paragraphs when trying to answer the questions.

Results revealed total NRST performance to be significantly better for RBD subjects. RBD subjects also performed significantly better than LBD subjects on translational inference items. The research data did not reflect the expected error pattern with most errors on questions requiring high inferential abilities followed by translational items and fewest errors on literal inferences for either group of subjects.

READING COMPREHENSION OF LITERAL, TRANSLATIONAL, AND
HIGH INFERENCE LEVEL QUESTIONS IN APHASIC AND
RIGHT HEMISPHERE DAMAGED ADULTS

by

UTE KONGSBAK

A thesis submitted in partial fulfillment of the
requirements for the degree of

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in
SPEECH COMMUNICATION
with an emphasis in
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1990

TO THE OFFICE OF GRADUATE STUDIES:

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CHAPTER I

INTRODUCTION AND STATEMENT OF PURPOSE

INTRODUCTION

While assessing reading skills is an integral part of most test batteries for aphasic patients, few studies have investigated the effect of damage to the right hemisphere on reading comprehension. One possible explanation for this is that the left hemisphere has long been considered the "verbal" hemisphere, and researchers have focused on the more obvious cognitive disturbances in right-brain damaged (RBD) individuals. In common speaking situations, RBD individuals perform verbally better than aphasic individuals. They get their meanings across and pass for functional communicators. In addition, this population has not typically been part of the case load of speech pathologists, which may explain why so few linguistic aspects of right hemisphere impairment have been studied. Although adults with lesions to the right hemisphere are primarily characterized by cognitive impairments including visual-perceptual disabilities, impulsivity, neglect, and reasoning deficits, evidence is increasing that suggests that the right hemisphere does contribute to language processing (Hier & Kaplan, 1980; Myers, 1990). Individuals

with lesions to the right hemisphere demonstrate some degree of communication disorder, although these are usually not identical to the communication difficulties seen in aphasic adults. Communicative disorders after right brain damage typically evolve around the pragmatic aspects of language and such extralinguistic modalities as comprehension and production of affect and prosody (Myers, 1986). The study of communicative competence after damage to the right hemisphere of the brain has become an area of investigation in the field of communication disorders only over the last decade or two.

A question that has not been explored yet is whether right hemisphere injured adults have reading impairments with regard to their comprehension of the content of the material in addition to visual-perceptual problems which may be present or whether comprehension skills improve when visual-perceptual problems are managed. In other words, the question remains to be answered whether the initial reading problem in right hemisphere patients is a purely visual-perceptual deficit or whether other cognitive and language processes are involved. A large number of studies have examined language processing components on reading tasks in left brain injured individuals. The focus of these studies has generally been on reading comprehension, on factors influencing text comprehension, and on treating reading impairments in aphasic adults. Reading impairment in

aphasic adults may be related to the syntactic complexity of a text, the lack of context, difficulty in recognizing letters, or inability to associate words with their proper meaning.

A factor that seems to affect the comprehension of reading material is the level of inference that is required of the reader in order to understand a text. It has been hypothesized that the inability to draw inferences is the central deficit in right hemisphere communication impairment (Myers, 1990). If this is the case, it would be interesting to examine whether the level of inference involved in a reading task affects the performance of right hemisphere damaged adults in a similar fashion to that observed in aphasic adults.

STATEMENT OF PURPOSE

The purpose of this study was to compare the comprehension skills of aphasic and right brain damaged adults on a multiple sentence reading task. The following hypotheses, stated in the null form, were investigated:

1. The performance of aphasic and right hemisphere damaged adults will not differ significantly on test items of the Nelson Reading Skills Test.
2. Right hemisphere damaged subjects will perform equally well on reading comprehension tasks requiring a high degree of inference and tasks

requiring moderate (translational) and minimal (literal) ability to infer information.

DEFINITION OF TERMS

Before reviewing the literature relating to reading comprehension after brain damage, it seems appropriate to provide the reader with operational definitions of the terms used in this study.

aphasia - A deficit in encoding and decoding of linguistic information caused by damage to the areas of the brain responsible for language. These areas are usually located in the left hemisphere of the brain.

brain damage - In the context of this study brain damage is understood as the neuropathological changes that result from a cerebrovascular accident (stroke) to either hemisphere of the brain.

cerebrovascular accident - Impaired bloodflow in an artery of the central nervous system due to vascular occlusion resulting in dysfunction of the area(s) of the brain served by that artery.

higher inference level - Items involving this type of inference according to Nicholas & Brookshire (1987, p. 358), require the reader to "identify cause and effect relationships, make judgements about events and attitudes of characters, and form bridging assumptions between information in the passage and correct answers".

inference level - Degree of difficulty of cognitive and language processing required for extracting meaning from verbal material.

literal inference level items - Those which require the reader to give answers that are explicitly stated in the reading passage to which the test question refers (Nicholas & Brookshire, 1987).

passage dependency - "The extent to which readers must rely upon information in the reading passages to answer test items" (Nicholas & Brookshire 1987, p. 358).

right hemisphere communication impairment - Any communicative deficit resulting from damage to right hemisphere of the brain.

reading comprehension - The ability to perceive, process, and comprehend the meaning of written language.

translational inference level items- those which require the reader to "draw simple inferences, choose a synonym, or determine the correct referent for a pronoun" (Nicholas & Brookshire, 1987, p. 358).

CHAPTER II

REVIEW OF THE LITERATURE

RIGHT HEMISPHERE COMMUNICATION IMPAIRMENT

Little is known about the disturbances in reading comprehension associated with damage to the right hemisphere. It was less than two decades ago that researchers began to discuss the language disorders seen in individuals with damage to the right hemisphere. The disorders reported in the literature include both expressive and receptive language deficits. Hier and Kaplan (1980), for example, reported articulation, prosody, semantics and syntax to be impaired in persons with right hemisphere brain damage. In the area of receptive language skills, verbal problem solving skills as needed in solving linear syllogisms (Caramazza, Gordon, Zurif, & DeLuca, 1976), the ability to extract implicit meaning from pictures (Myers & Linebaugh, 1985), the ability to interpret proverbs or idiomatic language (Hier & Kaplan, 1980), and the ability to utilize context (Tompkins & Mateer, 1984) have been found to be impaired after right brain damage.

While some authors believe that these findings reflect disturbances in communication which are primarily due to visuospatial or attentional deficits (Burns, 1985), other

researchers suggest these reduced linguistic abilities can be attributed to the breakdown of the linguistic functions of the right hemisphere (Myers, 1986).

Deal, Deal, Wertz, Kitselman, and Dwyer (1979) administered the Porch Index of Communicative Ability (PICA), a widely used instrument to assess language and communicative abilities in aphasics, to a group of right hemisphere damaged subjects. They found that 62% of the subjects with right brain damage displayed impaired language abilities. They did not, however, describe how these deficits differed from those of aphasic subjects who were administered the same test. Myers and Linebaugh's (1985) study revealed that the ability to comprehend implicit meaning is more impaired in subjects with right hemisphere involvement than in aphasic subjects. In fact, a recent study involving drawing inferences from visual material led Myers to hypothesize that the communication impairments seen in RBD adults reflect a central disorder of inference (Myers, 1990).

In summary, patients with right hemisphere dysfunction have been found to display difficulties with linguistic functions such as naming, word discrimination, reading, writing, and comprehension of complex sentences. Compared to aphasic patients, however, right brain damaged individuals display milder communication disorders and appear to manage daily communicative demands with much less

difficulty. Current research findings suggest that the communication impairment seen after right hemisphere damage results from deficits in both visual and linguistic processing (Myers, 1986). Both of these are skills required for reading comprehension.

READING COMPREHENSION AFTER BRAIN DAMAGE

Reading comprehension involves the functions of perceiving, processing and comprehending written material (Myers, 1986). While perceiving can be differentiated from the latter two functions, processing and comprehending are much more difficult to separate. To more clearly differentiate between processing and comprehending, this author suggests viewing comprehension as the final product of processing. Processing is the act of arriving at comprehension. Although processing and comprehending can be thought of as two distinct functions, no formal attempts have been made to differentially diagnose between disorders of these two processes in brain damaged adults. Instead, reading comprehension has been the subject of assessment.

Graville (1989) describes the understanding of factual or literal and of inferred information as an ability necessary for comprehension. Myers (1985) distinguishes between explicit and implicit meanings of words or symbols. According to Myers, explicit meaning refers to information which is directly stated in a text. Implicit meaning, in

contrast, is information which is not directly presented. Myers pictorially defines it as " meaning that is one or more steps removed from actual sensory presentation" (Myers, 1985, p. 72).

Reading comprehension of inferential material has been examined in a group of non-brain damaged adults and patients with Alzheimer's Dementia (Graville & Rau, 1990). The design of the study followed that of Nicholas & Brookshire (1986) who used a classroom reading test with stimuli identified as representing three different levels of inference. This test is described in more detail in the next section of this chapter. Although the normal control population performed significantly better across all levels of inference than the demented subjects in the Graville & Rau study, neither of their groups displayed the expected error pattern of most difficulty on high inference level items, less on translational and fewest errors on literal items.

Reading Comprehension after Left Hemisphere Damage

Studies investigating reading comprehension in aphasic adults have shown their skills in understanding reading material to be markedly impaired when compared to non-brain damaged subjects. The majority of studies examining the reading comprehension in aphasia have been confined to the word, phrase or sentence level. The typical design of studies examining the reading abilities of aphasic

individuals involved matching words or phrases with pictures representing the linguistic stimulus. Gardner, Zurif & Denes (1975) used a metalinguistic judgement task to assess reading skills in aphasics. Subjects were presented with pairs of sentences each of which contained one correct sentence and one sentence with either a semantic or a syntactic error and were asked to find the error in each sentence. While these researchers did not find a difference between different types of aphasia, subjects appeared to have least difficulty with detecting erroneous proper nouns and most difficulty with deviant syntactically complex passive sentences. A subsequent study by Gardner and Zurif (1976) examined a range of reading tasks including matching single words to pictures, matching pictures to sentences of increasing syntactic complexity and varying syntactic form, demonstrating knowledge of semantic class by eliminating one word which "did not belong" from a list of four words, and matching words of the same semantic category. As was expected, aphasic subjects had difficulty on all of the above-mentioned tasks. Matching single words to pictures was relatively easy compared to some of the other tasks which required metalinguistic judgement skills. It remains a debatable question whether these tasks assess reading comprehension or whether they use the modality of written language to examine some other aspects of language such as knowledge of semantic classes and syntactic violations.

A study addressing a variety of reading skills including word recognition tests and reading comprehension tests was conducted by Love and Webb (1983). Their findings agreed with Gardner and Zurif's findings in that subjects produced the smallest number of errors on word recognition tasks and most errors on sentence comprehension tasks. As in the Gardner and Zurif study, Love and Webb's subjects made fewer errors on erroneous proper noun detection while syntactic errors including incorrect verbform, incorrect article and incorrect number proved to be most difficult to detect. Another factor affecting reading performance in aphasic subjects is picturability of nouns. Several authors have reported that picturable nouns are less difficult for aphasic individuals to process than nonpicturable nouns (Gardner & Zurif, 1975; Love & Webb, 1983).

Nicholas and Brookshire (1987) examined comprehension skills of aphasic adults on a reading paragraph and found that their performance varied depending on the level of inference required for the test items. Aphasic subjects demonstrated most errors on high inference questions, but performed equally well on literal and on translational questions. Another study involving reading comprehension skills at the paragraph level indicated that paragraph comprehension in aphasic subjects improves if the message to be comprehended is given in a context, even if adding contextual information results in increased linguistic

complexity (Stachowiak, Huber, Poeck, and Kerschensteiner, 1977). Pictures presented prior to, or simultaneously with, the text have also been found to have a facilitating effect on text comprehension (Pierce and Beekman, 1983). Thus, external factors or factors that are not inherent in the reading material itself, such as nonlinguistic context or mode of presentation, have been found to impact on reading comprehension skills in aphasic adults.

Reading Comprehension after Right Hemisphere Damage

A cerebrovascular accident to the right hemisphere of the brain frequently leads to a left visual field cut. This may explain why studies addressing reading skills in individuals with damage to the right hemisphere have focused on visual-perceptual problems including left visual field neglect as did a study by Stanton, Yorkston, Kenyon & Beukelman (1981).

Tompkins and Mateer (1984) conducted a study to investigate paragraph comprehension in left and right hemisphere damaged subjects. Their findings confirmed the observation mentioned previously that damage to the right hemisphere reduces the ability to make contextual inferences. Subjects were able to make literal associations, but were unable to understand indirectly-stated inferences after right hemisphere damage. LBD and RBD subjects exhibited the same error patterns for factual

and inferential questions with higher scores on factual items.

Although the study by Tompkins and Mateer (1984), required the subjects to read the test sentences, and thus involved reading comprehension, the paragraphs consisted of only two sentences each and involved only two levels of inference. The present study of reading comprehension examines the performance of left and right brain damaged individuals on paragraph-length reading tasks requiring three levels of inference.

ASSESSMENT OF READING SKILLS IN INDIVIDUALS WITH BRAIN DAMAGE

Comprehensive assessment of an individual's speech and language abilities after a stroke is imperative both for making an accurate differential diagnosis and for planning treatment. An important factor in arriving at an adequate diagnosis is the accuracy and validity of the instrument selected to measure a patient's abilities. Most aphasia test batteries include a subtest to assess reading comprehension. Typically, one part of each subtest assesses reading comprehension on a multiple-sentence level and therefore consists of a short paragraph which is followed by several, usually multiple-choice type, questions. In order to give a representative picture of a person's reading comprehension capacity, i.e., an individual's accuracy of comprehension without time constraints, instruments for

assessing reading comprehension should be a pure measure with minimum loading on recall, reasoning, and problem solving. In the literature, these features are referred to as indicative of a high "passage dependency index" or "PDI". More specifically, the term passage dependency refers to the degree to which the reader has to rely on information given in the test passage to answer the test questions. Nicholas, MacLennan, and Brookshire (1986) determined the passage dependency index of five different reading tests that are commonly used with aphasics, namely the reading subtests of the Boston Diagnostic Aphasia Exam (Goodglass & Kaplan, 1983), the Minnesota Test for Differential Diagnosis of Aphasia (Schuell 1965), the Reading Comprehension Battery for Aphasia (LaPointe & Horner, 1979), the Western Aphasia Battery (Kertesz, 1982) and Examining for Aphasia (Eisenson, 1954). All of the non-brain damaged and 83% of the aphasic adults in their study scored at a significantly higher than chance level correct on more than half of the test items without reading the passages to which the test questions related. The tests were found to have very low passage dependency indices. This, they concluded, suggests that the five tests examined are not valid measures of aphasic and non-brain damaged subjects' reading comprehension skills. Rather, the tests appear to assess world knowledge since subjects may rely more on their knowledge of the world than

on information given in the reading passages in answering test questions.

Much less is known about reading comprehension capacity in RBD adults. The two assessment instruments most commonly used with right hemisphere damaged individuals are the RIC Evaluation of Communication Problems in Right Hemisphere Dysfunction (RICE) (Burns, Halper, & Mogil, 1986) and the Mini Inventory of Right Brain Injury (MIRBI) (Pimental and Kingsbury, 1985). Although the MIRBI encompasses a broad spectrum of brain functions in addition to the linguistic functions in a rather short protocol, it contains only a short paragraph which tests reading comprehension. None of the test questions can be answered without reading the test passage and the test format is open-ended which reduces the chance of correct guessing even more. The RICE, in contrast, does not assess reading comprehension, although it provides subtests for other aspects of communication, such as writing, pragmatics, and comprehension of metaphorical language. These findings allow two conclusions. First, the existing evaluation batteries for right brain damage induced disorders do not satisfactorily assess reading comprehension. Second, they provide only a very rough quantitative measure of the individual's reading comprehension, if any, and they do not give any qualitative information.

The foregoing discussion gives rise to two questions:

(1) If right hemisphere dysfunction results in communication deficits, how does it compare to the performance of aphasic adults?

(2) If right hemisphere dysfunction is a disorder of inference, does performance on a reading task requiring inferencing yield the expected pattern with more errors as higher inferencing skills are required as was the case with Nicholas & Brookshire's non-brain damaged and aphasic subjects?

The design of this study, therefore, employed the tools which Nicholas & Brookshire (1986) as well as Graville & Rau (1990) used to investigate comprehension of inferential reading material in two groups of brain damaged adults. The next chapter provides more information as to the ways in which the present study is similar to and differs from the above-mentioned studies in terms of study design and experimental methodology.

CHAPTER III

METHODS AND PROCEDURES

SUBJECTS

Two groups of subjects participated in this study: 16 aphasic individuals with only left brain damage (LBD) and 16 individuals with only right brain damage (RBD). Evidence for site of lesion was obtained from the medical charts of subjects, side of hemiplegia, and brain scans. Subjects with damage to both hemispheres were excluded from participation. Subjects were drawn from the Portland Veterans Administration Medical Center and its associated care units. In order to establish the greatest degree of homogeneity possible within and between the two groups, subjects were carefully screened for inclusion in the study. Following are the criteria that were required of subjects for participation in this study.

1. Single thromboembolic or hemorrhagic cerebrovascular accident (CVA);
2. At least one month post-onset of injury at the time of the experimental testing;
3. Right handedness as reported by the subject or significant other in order to corroborate

left hemisphere dominance for speech-language functions;

4. Adequate vision to read large print as determined by the subject reading aloud every word of three sentences on a card sampling the size of the print of the test items;
5. Premorbid reading skills at the seventh grade level or higher as determined by educational and occupational level reported by the subject or significant other;
6. A score of 10 or higher on each item of subtest VII of the PICA (measuring reading comprehension on the sentence level);
7. Overall mean on the short form of the Porch Index of Communicative Ability (SPICA) at or above the 65th percentile in order to screen out moderately and severely language impaired individuals from participation in the study;
8. English as the first and primary language as reported by the subject or significant other;
9. A signed consent form.

Subjects ranged from 50 to 80 years of age. Except for one female RHD subject, all subjects were male. All subjects demonstrated a high level of communicative efficiency as determined by performance on the SPICA (DiSimoni, Keith & Darley, 1980). Based on Nicholas and

Brookshire's study (1987) in which no significant differences in the performance on reading tasks between types of aphasia (fluent, nonfluent, and mixed aphasia) were found, aphasic subjects were not divided into subgroups.

HUMAN SUBJECT CONCERNS

Approval for the use of human subjects in this study was obtained from the Human Subjects Research Review Committee of Portland State University and from the Subcommittee on Human Studies of the Portland Veterans Administration Medical Center (Appendix A). The purpose and nature of the study were explained to the subjects and/or their significant others. Each subject signed an informed consent form indicating that he/she had understood the role of his/her participation in the study (Appendix B). Subjects were told that they could withdraw from the study at any time without penalty. One subject felt that she was unable to complete the final portion of the test and withdrew from the study. Consequently, her scores were not included in subsequent analyses.

Left brain damaged group

The sixteen subjects in the left brain damaged (LBD) group had a mean age of 63.5 years with a standard deviation of 6.65 and a mean educational level of 12.25 years (SD, 2.5). Time post onset of CVA averaged 58.6

months (SD, 70.59). The SPICA mean score was 13.11 (SD, 0.81) out of a possible score of 15.0. On the Metaphorical Language Test this group had a mean of 66.9% correct answers (SD, 2.65). Descriptive characteristics of the LBD group are summarized in Table I.

Right brain damaged group

The mean age for the sixteen right brain damaged (RBD) subjects was 65.56 years (SD, 8.69). RBD subjects had a mean educational level of 11.68 years (SD, 2.7). Subjects were a mean of 58.87 months post onset of a right hemisphere CVA (SD, 57.4). The SPICA mean was 14.45 (SD, 0.54). This group scored an average of 88.7% correct on the Metaphorical Language Test (SD, 1.63). These subjects are described in Table II. A summary of the descriptive statistics for both groups is displayed in Table III.

Group homogeneity

A series of t-tests were performed to determine whether the groups differed significantly on the variables of age, time post onset, educational level, overall language deficit (SPICA score) and metaphorical language comprehension (MLT). There were no significant differences between groups for age, time post CVA or educational level. Subjects did, however, exhibit a significant difference in overall language deficit as determined by performance on the SPICA and in metaphorical language comprehension. The RBD group

performed significantly better on both of these measures. The results are displayed in Table IV.

The Bartlett Test for Homogeneity of Group Variances yielded overall mean standard deviations that were comparable to the pooled within groups standard deviations for all but one demographic feature. This indicates that the groups were homogeneous on all descriptive characteristics except for time post-CVA. Results are displayed in Table V.

TESTING INSTRUMENTS

The Porch Index of Communicative Ability (PICA) (Porch, 1967) consists of 18 subtests and was designed to assess the general communicative ability or communicative efficiency of individuals with aphasia. Modalities evaluated in the PICA include writing, copying, reading, gesturing, speaking, auditory comprehension, and visual perceptual ability. The PICA provides percentile scores for each subtest and an overall percentile score allowing for a severity rating of the testee. DiSimoni, Keith and Darley (1980) developed a shortened version of the PICA, the SPICA, which was found to predict overall PICA scores accurately at the $R = 0.98$ level while using only four subtests (DiSimoni, Keith & Holt, 1975). The modalities through which the SPICA establishes an overall communicative efficiency rating are verbal, auditory, reading, and writing. Although the SPICA does not

yield the same depth of information as the complete administration of the PICA would, it has been found to be useful for screening purposes (Holtzapple, Pohlman, LaPointe & Graham, 1989). Thus, the SPICA was used as a screening tool in this study to determine the extent of overall communicative ability in both groups of subjects. Appendix C displays a sample SPICA score sheet.

The Metaphorical Language Test (MLT) is a subtest of the RICE and consists of a series of ten proverbs the meaning of which the testee is to explain. The RICE manual states that RBD individuals will frequently offer literal or personal interpretations of a proverb or idiom, which is another example for inference failure in this population. A sample score sheet is presented in Appendix D.

The Nelson Reading Skills Test (NRST) was used to assess reading comprehension in this study. As mentioned earlier, the validity of a reading test is determined largely by its passage dependency. Nicholas and Brookshire (1987) determined the passage dependency index (PDI) for the NRST and found it to be higher than the PDI for any of the reading subtests from five aphasia tests frequently used to assess reading skills in aphasic individuals.

The NRST is a classroom reading test that measures a person's silent reading skills. It was standardized on a sample of 3,000 students per grade from 57 school districts, 5 geographical regions, and 4 socioeconomic classes. The

test manual reports the reliability coefficient for internal consistency to be .93.

Form 4 of level B of the NRST was used to assess the subjects' reading comprehension skills. This level assesses grades 4-6 and consists of five paragraphs, each of which is followed by five to eight multiple choice questions. Questions numbered 1, 14, 15, 23, and 31 were excluded due to their ambiguousness in terms of level of inference as found by Nicholas and Brookshire (1987). A total of 33 questions were to be answered by each subject.

In answering the reading comprehension questions, the NRST requires the reader to make inferences on three levels (literal, translational, and higher level). Literal questions refer to answers which are explicitly stated in the text (see questions 4 and 5, Appendix E). Translational items require selecting answers which are paraphrased from the text. An example for translational inference level is question 7 (Appendix E). Higher level questions require answers that must be inferred from the text (see question 6, Appendix E).

Graville and Rau (1989) enlarged the reading material for their study of reading comprehension skills in non-brain damaged and demented subjects. The same stimuli, showing one passage per page in large print, double spaced on 8 1/2" x 11" paper were used in this study. A sample

paragraph and three questions representing the different levels of inference are shown in Appendix E.

PROCEDURES

Testing took place in a well-lit clinic room at the Portland V.A. Medical Center or the subject's home or work place.

Screening Procedures

The Behavioral Observation Profile of the RICE was used to engage subjects in an informal conversation to probe behavioral functions. All subjects were oriented to time, place, and person.

Subjects were asked to explain the ten proverbs from the Metaphorical Language Test upon oral presentation of the stimulus by the examiner. Responses were marked as literal interpretation of the stimulus, partially correct or normal abstract interpretations. Subjects did not have to obtain a certain score on the MLT to be included in this study. Rather, this subtest was used as an additional task on which RBD subjects were expected to demonstrate literal behavior. The protocol for this subtest with the test items is reproduced in Appendix D.

Subjects were given the SPICA and their overall percentile scores were determined. If a PICA had been administered to a subject within a month of participation in this study, those PICA subtest scores were used to establish

the subject's SPICA mean score and to determine eligibility for this study.

For the right CVA group, visual-perceptual skills were evaluated to screen out subjects with visual-perceptual deficits severe enough to interfere with reading. Right CVA subjects had to pass the following screening procedure:

Subjects were required to read aloud three practice sentences. For right hemisphere subjects who demonstrated visual neglect, a left margin anchoring technique was used. In such cases, the subject was told to "look all the way to the left" for each line until he or she could see the red line in a practice paragraph. Two of the sixteen RHD subjects continued to demonstrate left neglect after having been instructed to use the red margin cueing technique. Consequently, they were excluded from this study.

Experimental Procedures

Each subject was given the NRST, one passage at a time, and asked to read each passage aloud. This procedure was the same as that adopted by Graville (1989) whereas Nicholas & Brookshire (1987) did not have the subjects read the passages aloud. Aphasic subjects who were unable to read aloud were asked to follow along while the examiner read the paragraph to them. Subjects read the questions to each passage immediately after reading the passage, and were asked to point to the correct answer from four choices. Subjects were informed that they could reread the passage

and the questions silently to themselves if they wished to do so to answer the questions. A red margin as described previously was provided on each sheet with test paragraphs and questions for right CVA subjects who needed this cue to attend to the left side of the reading material during the screening procedure.

Responses were recorded on-line by the examiner marking each response as correct or incorrect. On the score sheet, the letters L (literal), H (high inference), and T (translational) indicated the inference level required for each of the items so that the subjects' total scores could be analyzed according to inference levels. A sample score sheet is displayed in Appendix F.

Administration time for the NRST was about 25-35 minutes per subject, but subjects were allowed as much time as needed to complete the test. The total time for screening and testing procedures ranged from 35 - 90 minutes.

MEASUREMENT AND DATA ANALYSIS

SYSTAT (Wilkinson, 1986), a software program for statistical analyses, was used to perform the statistical computations for the present study.

Descriptive statistics were used to calculate raw mean scores and percentage correct scores for each subject, mean percentage correct scores for each group for the three

levels of inference, and standard deviations for each type of score. Mean scores of the two groups were compared and analyzed through a series of t-tests for independent means to determine differences between groups on each of the measures taken. In performing multiple t-tests, the chances of making a type I error, i.e. finding a significant difference when there is none, increase. Therefore, the Tukey HSD correction factor was employed which minimizes the chances of making this type of error. A series of one-way analyses of variance were performed to determine if significant within-group differences existed across levels of inference difficulty. The level of significance chosen for this study was $p < .05$.

Pearson Correlations were computed between all demographic and test score variables to determine significant relationships between measures.

TABLE I
DESCRIPTIVE CHARACTERISTICS OF LEFT BRAIN DAMAGED
(LBD) SUBJECTS

Subject	Age (yrs)	Education (yrs)	Time post-CVA (months)	SPICA (mean)	Metaphorical Language Test (mean)
1	52	8	37	12.13	7
2	57	12	288	12.23	9
3	57	14	29	13.05	4
4	60	14	27	13.78	7
5	61	14	31	12.90	10
6	61	17	18	13.60	6
7	61	10	134	14.05	5
8	62	14	10	14.00	3
9	63	12	24	12.45	8
10	63	11	4	12.60	6
11	68	9	31	12.45	1
12	68	13	119	14.13	7
13	68	12	50	14.55	10
14	74	14	41	12.40	9
15	79	14	54	13.30	5
16	62	8	40	12.16	10
Mean	63.50	12.25	58.56	13.11	6.68
SD*	6.65	2.52	70.60	0.81	2.65

* SD = Standard Deviation

TABLE II
DESCRIPTIVE CHARACTERISTICS OF RIGHT BRAIN DAMAGED
(RBD) SUBJECTS

Subject	Age (yrs)	Education (yrs)	Time post-CVA (months)	SPICA (mean)	Metaphorical Language Test (mean)
17	50	12	6	14.00	7
18	51	14	143	14.93	8
19	55	8	12	14.95	10
20	58	8	32	14.30	9
21	62	10	132	15.05	9
22	63	14	24	14.85	10
23	65	14	16	14.53	10
24	66	14	15	14.50	9
25	66	12	45	14.78	10
26	69	9	120	13.53	4
27	71	11	168	13.10	8
28	72	10	31	14.88	10
29	73	18	13	14.83	10
30	75	12	35	14.13	10
31	80	12	18	14.58	8
32	73	9	132	14.25	10
<hr/>					
Mean	65.56	11.68	58.87	14.45	8.87
SD*	8.69	2.70	57.40	0.55	1.63

* SD = Standard Deviation

TABLE III

COMPARISON OF DESCRIPTIVE CHARACTERISTICS FOR BOTH GROUPS

Group	Measure	Age	Time Post	Education	SPICA
LBD N=16	$\bar{X}$	63.5	58.56	12.25	13.11
	SD	6.65	70.59	2.51	0.81
	range	52-79	4-288	8-17	13.1-14.5
RBD N=16	$\bar{X}$	65.56	58.87	11.68	14.49
	SD	8.69	57.40	2.7	0.54
	range	50-80	6-168	8-18	13.1-15.0
$\bar{X}$ = Mean SD = standard deviation					

TABLE IV

SUMMARY OF t-TESTS FOR INDEPENDENT MEANS FOR AGE, EDUCATION,
TIME POST CVA, SPICA AND MLT SCORES

	overall mean	SD*	pooled within groups SD	t**	probability
AGE	64.53	7.68	7.742	-0.754	0.457
EDUCATION	11.96	2.58	2.61	-0.609	0.547
TIME POST CVA	58.72	63.29	64.34	-0.014	0.989
SPICA	13.78	0.96	0.691	-5.475	0.001***
METAPHORICAL LANGUAGE TEST	7.78	2.43	2.2	-2.812	0.009***

* SD = Standard Deviation

** t = t-Statistic

*** significant ($p < .05$)

TABLE V

SUMMARY OF BARTLETT TEST FOR HOMOGENEITY OF GROUP VARIANCES

	overall mean	SD*	pooled within groups SD
Age	64.53	7.68	7.74
Time post CVA	58.71	63.29	64.34
Education	11.69	2.58	2.61
SPICA	13.78	0.96	0.69
Subtest VII of SPICA	14.39	1.14	1.00

* SD = Standard Deviation

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

In analyzing the results of this study, descriptive statistics, t-tests, Pearson Correlations, and a series of one-way repeated measures analyses of variance (ANOVA) were employed.

Review of the Research Questions

(1) If right hemisphere dysfunction results in communication deficits, how does it compare to the performance of aphasic adults?

(2) If right hemisphere dysfunction is a disorder of inference, does performance on a reading task requiring inferencing yield the expected pattern with more errors as higher inferencing skills are required as was the case with Nicholas & Brookshire's non-brain damaged and aphasic subjects?

Descriptive Results

Table VI displays the means, standard deviations and ranges of NRST scores , as well as total scores per question type for both groups of subjects.

t-Test Results

Total NRST Score. Application of t-tests revealed the two experimental groups to differ significantly ($p = .028$) for total NRST scores ($t = -2.310$; $df = 1, 30$). The RBD group obtained significantly higher scores on the reading test than did the LBD subjects.

Performance by Level of Inference. RBD subjects performed significantly better than their LBD counterparts on translational items ($df = 1, 30$; $p = .028$), but groups did not display significant differences on literal and high inference level items (Table VII). However, a comparison of performance on high inference level items between the two groups approached significance ($df, 1, 30$; $p = 0.052$). Figure 1 illustrates the differences in performance between the two groups on literal, translational, and higher inference level test items. Again, the RBD subjects received higher scores than the LBD subjects on questions requiring higher inference skills.

ANOVA Results

In examining the question of whether or not RBD and LBD subjects had more difficulty with questions requiring a higher level of inference, a repeated measures ANOVA design (Wilkinson, 1986) was used. Because the total number of questions requiring literal, translational, and high levels of inference were not the same, raw scores for each type of question were converted to percent correct scores before the

ANOVA was performed. No significant main effect was observed within either group of subjects across question types, i.e the null hypothesis was supported for there was no difference across levels of inference (see Figure 2). It seems important to point out that within RBD subjects there was no significant difference between literal and high inference level items. This was rather a surprising finding since it was expected that the RBD group would perform significantly better on literal than on high inference level items. Table VIII shows the results of the ANOVA by question type within and between groups.

Analyses of other measures

A series of t-tests yielded that the left and right brain damaged groups differed significantly on the SPICA ($p = 0.00$; $df = 1, 30$; $t = -5.475$) and on subtest VII of the PICA ($p = 0.004$; $df = 1, 30$; $t = -3.135$). Both times the RBD subjects obtained higher scores than did the LBD subjects.

The RBD group also performed significantly better on the Metaphorical Language Test, including scores for literal interpretation, partially correct and totally correct explanations of idioms. These results are displayed in Table IX. A word of caution seems necessary, however, to avoid drawing erroneous conclusions from these scores. As the response mode for the MLT was verbal, LBD subjects were at a disadvantage in answering these questions due to their

expressive language deficits. Results would allow more valid interpretations if a multiple choice answer format had been used which would compensate for some of the difficulties aphasics will have in completing this test.

Pearson Correlations

Pearson Correlations with Bonferroni Corrections (Wilkinson, 1986) were computed to identify relationships between the variables involved in this study. Correlations of 0.7 or above were found between several variables. The most significant correlations were found between SPICA mean and hemisphere ($r = 0.70$; $p < 0.001$), normal correct score on interpretation of idioms and hemisphere ($r = 0.72$; $p < 0.001$), between the scores on high inference and translational questions of the NRST ($r = 0.75$; $p < 0.001$), and between score on translational questions and overall SPICA score ($r = 0.71$; $p < 0.001$). The correlation values are displayed in Table X.

DISCUSSION

The literature reveals conflicting results as to how levels of inference impact upon reading comprehension in brain damaged adults. While Nicholas & Brookshire (1987) found comprehension to deteriorate in both LBD and non-brain damaged (NBD) subjects as level of inference required to answer a question increased, Graville & Rau's study (1990) did not confirm this pattern for either demented or NBD

subjects. The present study attempted to resolve some of these conflicting findings. In addition to including the LBD subjects, as was done in the Nicholas & Brookshire (1987) study, another group, a right brain damaged sample, was used in the present study. Subjects with RBD had not been included in either of the afore-mentioned studies.

It was expected that both LBD and RBD subjects would show a pattern which reflects more difficulty as level of inference required increases. The total score was expected to be better among RBD subjects than among LBD subjects. Perhaps the most certain expectation was that RBD subjects would show most difficulties on higher inference level items as opposed to lower inference level questions.

As was predicted, aphasic and right hemisphere damaged subjects performed significantly differently on the reading tasks of the NRST. The RBD group obtained higher total scores on the NRST than did the LBD subjects. RBD subjects also scored significantly higher on the translational level of inference than the aphasic subjects.

A comparison of this data with the results of Nicholas and Brookshire's study (1987), suggests that both groups also performed significantly lower than a group of non-brain damaged subjects would have. The aphasic subjects in this study presented the same mean total score on the NRST as did the aphasic group in Nicholas and Brookshire's study. A very interesting finding was that the total NRST score for

the aphasic subjects of the present study was the same as the total NRST score of the mildly demented subjects in the Graville & Rau (1989) study while the total NRST score for RBD subjects approached the scores of Graville & Rau's non-brain damaged subjects.

This study also attempted to reveal a difference as to type of difficulties in reading comprehension between the two groups. A review of the literature and basic clinical knowledge about the nature of aphasia and right hemisphere dysfunction led to the prediction of an error pattern which reflected that high inference level items require more complex inferencing than do translational items and that these latter items require higher inferencing than literal items. Based upon the hypothesis of inference failure being the underlying deficit in right hemisphere dysfunction, this study attempted to reveal a difference in performance by item type between the LBD and RBD subjects. Based upon Nicholas & Brookshire's findings and based upon Myer's hypothesis of inference failure being the central deficit in right hemisphere communication impairment, it was expected that inference level would affect performance of both groups and that RBD subjects would have more difficulty with higher inference questions than LBD subjects. Therefore, performance of the two groups was compared on the basis of inferential skills required to master the reading task. The data did not lend support for this predicted pattern. Test

results did not reflect the expected hierarchy of difficulty among the three levels of inference as described by Nicholas and Brookshire (1987). Instead, LBD subjects did not exhibit any significant effects by level of inference. A pattern reflecting a difference in performance across question type did not emerge for either group of subjects.

One reason the expected error patterns did not occur could be that the NRST does not successfully differentiate between different inference levels, as Graville (1989) has speculated. The criteria which were used to select subjects for this study allowed only rather high functioning individuals to participate. It would be interesting to examine whether a population with a slightly greater overall impairment would exhibit an error pattern as was described by Nicholas and Brookshire. This would mean that the NRST is not sensitive to subtle inference disorders in high level stroke subjects, and it remains to be shown that it is sensitive to these errors in a neurologically more involved population.

Qualitative Observations

It seems appropriate to relate an observation the examiner made during the experimental testing of subjects for this study. Right brain damaged participants frequently commented on the task required of them by stating that one could answer the test questions very easily if one watched certain programs on television. Two subjects independently

referred to a program on penguins they had watched on television. They maintained that their having seen this program on television put them at an advantage in answering the questions about the third test paragraph which was about Adelie penguins. When answering the questions to this particular paragraph, these two subjects and two other right brain damaged subjects commented that the correct answer was not among the four choices given. This in and of itself can be viewed as literal behavior as it disregards the fact that in order to comprehend a written text, it is necessary to draw conclusions from the material read. In using knowledge that was acquired prior to reading the test material in answering the questions, these subjects approached the task in a rather literal way as they did not use the contextual cues given in the reading paragraph to answer the test questions.

This study revealed a few interesting correlations between several variables. The correlation which was observed between site of lesion (hemisphere damaged) and overall SPICA score deserves some attention. As a screening version of the PICA, the purpose of the SPICA is to bring to light whether an individual presents any aphasic characteristics. The overall SPICA mean for the LBD subjects in this study was 13.11 which, according to PICA norms, would place the recipient of this particular score at the 78th percentile rank (Porch, 1981). The overall SPICA

mean for the right hemisphere damaged group, however, was 14.49 which is commensurate with the 95th percentile ranking by PICA norms. Thus, this correlation corroborates once again that LBD individuals are more impaired in the linguistic aspects of language whereas in RBD individuals, different aspects of communicative functioning appear to be impaired.

In summary, the results of this study support the hypothesis that reading comprehension skills are better preserved in individuals with right hemisphere damage than in individuals with left hemisphere damage. The data do not reveal an error pattern which would illustrate a more pronounced difficulty in making translational or higher inferences for right brain damaged individuals. Likewise, aphasic subjects displayed no significant differences between scores across levels of inference. This suggests that the NRST does not assess increasing levels of inference in brain damaged adults.

TABLE VI
SUMMARY OF DESCRIPTIVE STATISTICS FOR NRST SCORES

Group	Measure	Literal Score	Translational Score	High Inference Score	Total Score
LBD	$\bar{X}$	6.25	6.94	6.31	19.5
N = 16	SD	1.69	2.29	2.09	5.44
	range	3-6	2-11	2-11	9-28
RBD	$\bar{X}$	7.12	9.25	7.81	24.18
N = 16	SD	2.27	2.43	2.11	6.03
	range	2-10	5-12	4-11	11-32
$\bar{X}$ = Mean SD = Standard Deviation					

TABLE VII

SUMMARY OF t-TESTS FOR PERFORMANCE ON NRST BY QUESTION TYPES

	pooled variances t-statistic	DF*	probability
LITERAL	-1.234	30	.227
TRANSLATIONAL	-2.764	30	.010**
HIGH INFERENCE	-2.024	30	.052
TOTAL SCORE	-2.310	30	.028**

* DF = Degrees of Freedom

** significant ($p < .05$)

TABLE VIII
SUMMARY OF THE ANALYSIS OF VARIANCE BY QUESTION TYPE
WITHIN AND BETWEEN GROUPS

	SS	DF	MS	F	Probability
<hr/>					
LBD					
TOTAL SCORE					
between	258.380	2	129.19	1.286	0.291
within	3014.233	30	100.474		
<hr/>					
RBD					
TOTAL SCORE					
between	382.853	2	191.426	1.3	0.287
within	4417.954	30	147.265		
<hr/>					
SS = Sum of Squares		DF = Degrees of Freedom			
MS = Mean Squares		(p < .05)			

TABLE IX
SUMMARY OF t-TESTS ON SPICA, SUBTEST VII,
AND METAPHORICAL LANGUAGE TEST SCORES

TEST	overall mean	within group SD*	t-statistic	probability
SPICA	13.78	0.691	-5.475	0.001**
Subtest VII	14.39	1.00	-3.135	0.004**
Literal Interpre- tation	0.375	0.671	-2.108	0.043**
Partially Correct	1.594	1.881	-3.664	0.001**
Totally Correct	6.188	2.249	-5.816	0.001**
* SD = Standard Deviation ** significant ($p < .05$)				

TABLE X

PEARSON CORRELATIONS WITH BONFERRONI CORRECTIONS
FOR ALL VARIABLES

	Hemisphere	Age	Time Post	Education	SPICA	Subtest VII	Literal Correct	Partial Correct	Normal Correct	Meta Total	Literal Inference	Translational Inference	High Inference	MRST Total
Hemisphere	1.000													
Age	0.136	1.000												
Time Post	0.003	-0.054	1.000											
Education	-0.111	0.145	-0.192	1.000										
SPICA mean	0.707	0.103	-0.115	0.167	1.000									
Subtest VII	0.497	0.105	-0.231	0.260	0.746	1.000								
Literal Score	0.359	-0.103	0.044	0.007	-0.162	0.012	1.000							
Partial Score	0.556	0.071	-0.089	-0.187	-0.560	-0.585	0.243	1.000						
Normal correct	0.728	0.011	0.080	0.144	0.663	0.539	0.428	-0.658	1.000					
Meta Total	0.457	0.081	0.025	0.019	0.367	0.179	-0.345	0.043	0.724*	1.000				
Literal Infer.	0.220	-0.273	0.046	0.375	0.446	0.411	-0.231	-0.401	0.330	0.071	1.000			
Translational	0.451	-0.128	-0.076	0.513	0.710	0.684	-0.160	-0.604	0.638	0.293	0.685	1.000		
High Inference	0.347	-0.250	-0.118	0.358	0.555	0.530	-0.348	-0.522	0.644	0.377	0.672	0.753	1.000	
MRST Total Score	0.389	-0.234	-0.060	0.470	0.649	0.617	-0.269	-0.577	0.612	0.283	0.922	0.922	0.901	1.000

TABLE X

PEARSON CORRELATIONS WITH BONFERRONI CORRECTIONS
 FOR ALL VARIABLES - MATRIX OF
 BONFERRONI CORRECTIONS
 (continued)

	Hemisphere	Age	Time Post	Education	SPICA	Subtest VII	Literal Score	Partial Correct	Normal Correct	Meta Total	Literal Inference	Translational Inference	High Inference	WRSY Total
Hemisphere	0.000													
Age	1.000	0.000												
Status post	1.000	1.000	0.000											
Education	1.000	1.000	1.000	0.000										
SPICA	0.001*	1.000	1.000	1.000	0.000									
Subtest VII	0.348	1.000	1.000	1.000	0.000	0.000*								
Literal Score	1.000	1.000	1.000	1.000	1.000	1.000	0.000							
Partial Score	0.087	1.000	1.000	1.000	1.000	0.077	0.039	1.000	0.000					
Normal Correct	0.000*	1.000	1.000	1.000	1.000	0.003	0.134	1.000	0.004	0.000				
Meta Total	0.781	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000*	0.000				
Literal Inference	1.000	1.000	1.000	1.000	1.000	0.948	1.000	1.000	1.000	1.000	0.000			
Translational	0.879	1.000	1.000	0.245	0.000*	0.001*	1.000	0.023	0.008	1.000	0.001	0.000		
High Inference	1.000	1.000	1.000	1.000	0.089	0.165	1.000	0.200	0.006	1.000	0.002	0.000*	0.000	
WRSY Total	1.000	1.000	1.000	0.601	0.005	0.015	1.000	0.050	0.018	1.000	0.000*	0.000*	0.000*	0.000

Figure 1. Mean percentage correct scores for left brain damaged and right brain damaged subjects on test items of the Nelson Reading Skills Test (NRST) by levels of inference.

Figure 2. Mean percentage correct scores on literal, translational and higher inference level test items of the Nelson Reading Skills Test by subject groups.

CHAPTER V

SUMMARY AND IMPLICATIONS

SUMMARY

The purpose of this study was to examine and compare inferential abilities on a reading comprehension task in two groups of adults who had suffered cerebrovascular accidents (CVA). Sixteen subjects with a CVA to the right hemisphere of the brain were compared to an equal number of aphasic subjects. Subjects were selected after they had demonstrated an adequate level of functioning on the SPICA (a test measuring communicative efficiency) to perform the tasks required in this study. All subjects were administered the revised version of the Nelson Reading Skills Test (NRST). On the NRST, test questions are grouped into three categories representing literal, translational and high levels of inference. Subjects were presented five reading paragraphs. They were asked to answer thirty-three questions pertaining to the reading material by pointing to the correct answer out of four choices. Subjects were allowed to refer back to the paragraphs when trying to answer the questions.

Results revealed total NRST performance to be significantly better for RBD subjects. RBD subjects also

performed significantly better than LBD subjects on translational inference items. The research data did not reflect the expected error pattern with most errors on questions requiring high inferential abilities followed by translational items and fewest errors on literal questions for either group of subjects.

CLINICAL IMPLICATIONS

Because of its high passage dependency the NRST may be better suited to test reading comprehension than a number of tests for aphasia or right hemisphere impairment. The results of this study do not, however, support previous research indicating that the NRST is a sensitive measure of different levels of inferential reading comprehension (Nicholas & Brookshire, 1987). In fact, the results of this study confirmed the findings of Graville & Rau (1990) indicating that the NRST is not suited to detect differences in performance across levels of inference. Moreover, performance on the NRST does not illustrate the inference disorder underlying right hemisphere impairment. Thus, while the NRST may be a helpful tool for establishing general reading comprehension abilities in stroke patients or any adult brain damaged patient population, it does not appear that it will aid in differentially diagnosing subtle disorders of inference. Other procedures and materials may have to be used to determine inferential abilities when

examining reading comprehension until a reliable and valid instrument has been developed. Furthermore, the present findings indicate the need for research comparing a range of language functions, including inferencing, in left and right CVA patients.

IMPLICATIONS FOR FURTHER RESEARCH

This study suggests that the NRST is not a useful instrument to assess some aspects of reading comprehension in brain damaged adults. As the NRST did not differentiate between question types in RBD and LBD subjects, it is indicated that a different reading instrument be used to investigate inferential comprehension in brain damaged populations. It would be erroneous to conclude that inference failure is not a central deficit of right hemisphere dysfunction. The literature reviewed for this study points to the fact that inference may very well be a core problem in right brain damaged individuals. Since speech pathologists are becoming more involved in the diagnosis and treatment of this population, a reading test which accurately assesses inferential abilities would be helpful for clinical practice.

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APPENDIX A

HUMAN SUBJECTS COMMITTEE APPROVAL

HUMAN SUBJECTS RESEARCH REVIEW COMMITTEE

MEMORANDUM

OFFICE OF GRANTS AND CONTRACTS

DATE: November 21, 1989

TO: "Uta Kongsbak, SP

FROM: Dean Frost, Chairperson
Human Subjects Research Review Committee (HSRRC) 1989-90

RE: HSRRC Approval

In accordance with your request, the Human Subjects Research Review Committee has reviewed your proposal entitled Reading Comprehension of Literal, Translational, and High Inference Level Items in Aphasic and Right Hemisphere Damaged Adults for compliance with DHHS policies and regulations on the protection of human subjects.

The committee is satisfied that your provisions for protecting the rights and welfare of all subjects participating in the research are adequate and therefore the project is approved. Any conditions relative to this approval are noted below:

c: Office of Grants and Contracts

DF:jmp

REPORT OF SUBCOMMITTEE ON HUMAN STUDIES		PROJECT OR PROGRAM TITLE READING COMPREHENSION OF LITERAL, TRANSLATIONAL AND HIGH INFERENCE LEVEL ITEMS IN APHASIC AND RIGHT HEMISPHERE DAMAGED SUBJECTS.	
PRINCIPAL INVESTIGATOR'S NAME Marie T. Rau, Ph.D.		DATE OF REVIEW February 13, 1990	
INSTITUTION OF SUBCOMMITTEE (or its equivalent body) Department of Veterans Affairs Medical Center, Portland, Oregon			
This subcommittee has reviewed the above described project with respect to the rights and safety of the human subjects. The following are our findings:			
1. RISKS (Check one) ☐ The planned research involves little foreseeable risk and the subjects safety is adequately protected unless the plan is modified. ☐ The foreseeable risk is justified by the potential benefit to the subjects or by the anticipated benefit to society and the plans include adequate and appropriate measures to reduce the risk insofar as feasible. ☐ The risk is justified but further measures seem advisable to protect the subject, including _____ _____ _____ DO NOT START YOUR RESEARCH PROJECT UNTIL — CORRECTED CONSENT FORM IS RETURNED TO RESEARCH (151). PLEASE RETURN THIS FORM AND CORRECTED CONSENT FORM WITHIN 30 DAYS ☐ The risk seems greater than can be justified by the research. A NEW APPROVAL FORM WILL BE ISSUED TO YOU ¹			
2. INFORMATION FOR THE SUBJECT (Check one) ☐ The information to be given the subjects (or their legal representatives) is complete and accurate enough for them to reach a valid decision concerning participation in the research. ☐ The information for the subjects is incomplete or defective in that _____ _____ _____			
3. CONSENT METHOD (Check one) ☐ The format and manner of obtaining informed consent from the subjects (or their legal representatives) is satisfactory. ☐ The method of obtaining informed consent is defective in that _____ _____ _____			
4. FURTHER COMMENTS Approved on condition that a corrected consent form is returned to Research Service with the following changes: 1. Delete all references to spouse/ward and guardians since this protocol and consent form may only refer to competent subjects. If incompetent subjects will be used, submit a separate protocol and consent form. 2. Add the standard VA liability statement. 3. Change hemisphere to <u>side</u> .			
5. RECOMMENDATION (Check one) ☐ The project or program be approved as submitted.		☐ The plan or protocol be revised in keeping with our comments and resubmitted.	
☐ The proposal as described be rejected.		SIGNATURE OF CHAIRMAN 	

APPENDIX B

CONSENT FORMS

Ute Kongsbak, B.A.
 Marie T. Rau, Ph.D., CCC-SLP
 Speech Language Pathology
 Portland VA Medical Center
 Portland, OR 97207
 (503) 220-8262 x5717

Reading Comprehension of Literal, Translational, and High
 Inference Level Items in Aphasic and
 Right Hemisphere Damaged Adults

Consent Form (stroke subjects)

1. The purpose of this study is to gather information on the reading comprehension of subjects who have suffered a stroke to the left or right side of the brain. I understand that I was selected for this study because I have been diagnosed with a stroke.

Ute Kongsbak has explained the details of the study. The procedure involves reading aloud, five passages, and answering the questions following each passage by pointing to the correct answer.

I understand that I will be informed of any changes in the nature of the study or in the procedures, as described above, as they may occur. Ute Kongsbak will answer any and all questions that I have.

2. I understand that there is no physical risk or discomfort involved.

I understand that there is no benefit of this procedure to me, but that the study may help to better understand how reading comprehension is affected in subjects who have suffered a stroke.

3. I consent to the use of the results of this study for publication for scientific purposes, excluding my identity.

4. I understand I may withdraw from the study at any time without prejudice or without prejudice to any VA benefits.

Every reasonable effort to prevent any injury that could result from this study will be taken. In the event of physical injuries resulting from the study, medical care and treatment will be available at this institution. For eligible veterans, compensation damages may be payable under 38 USC 251 or, in some circumstances, under the Federal Tort Claims Act. For non-eligible veterans and non-veterans, compensation would be limited to situations where negligence occurred and would be controlled by the provisions of the Federal Tort Claims Act. For clarification of these laws, contact District Counsel (503) 221-3429.

5. You have not waived any legal rights or released the hospital or its agents from liability for negligence by signing this form.

6. Therefore having given consideration to the above information, I voluntarily consent to participate in this study as described.

Volunteer's Signature

Date

Witness's Signature

Date

Ute Kongsbak, B.A.
Marie T. Rau, Ph.D., CCC-SLP
Speech Language Pathology
Portland VA Medical Center
Portland, OR 97207
(503) 220-8262 x5717

Reading Comprehension of Literal, Translational, and High
Inference Level Items in Aphasic and
Right Hemisphere Damaged Adults

Consent Form (spouse/guardian)

1. The purpose of this study is to gather information on the reading comprehension of subjects who have suffered a stroke to the left or right side of the brain. I understand that my spouse/ward was selected for this study because he/she has been diagnosed with a stroke.

Ute Kongsbak has explained the details of the study. The procedure involves reading aloud, five passages, and answering the questions following each passage by pointing to the correct answer.

I understand that I will be informed of any changes in the nature of the study or in the procedures, as described above, as they may occur. Ute Kongsbak will answer any and all questions that I have.

2. I understand that there is no physical risk or discomfort involved.

I understand that there is no benefit of this procedure to my spouse/ward, but that the study may help to better understand how reading comprehension is affected in subjects who have suffered a stroke.

3. I consent to the use of the results of this study for publication for scientific purposes, excluding my spouse/ward's identity.

4. I understand my spouse/ward may withdraw from the study at any time without prejudice or without prejudice to any VA benefits.

Every reasonable effort to prevent any injury that could result from this study will be taken. In the event of physical injuries resulting from the study, medical care and treatment will be available at this institution. For eligible veterans, compensation damages may be payable under 38 USC 251 or, in some circumstances, under the Federal Tort Claims Act. For non-eligible veterans and non-veterans, compensation would be limited to situations where negligence occurred and would be controlled by the provisions of the

Federal Tort Claims Act. For clarification of these laws, contact District Counsel (503) 221-3429.

5. You have not waived any legal rights or released the hospital or its agents from liability for negligence by signing this form.

6. Therefore having given consideration to the above information, I voluntarily consent for my spouse/ward to participate in this study as described.

Spouse/Guardian's Signature

Date

Witness's Signature

Date

APPENDIX C

SHORT PORCH INDEX OF COMMUNICATIVE ABILITY TEST PROTOCOL

SPICA

Name _____ Case No. _____

Date _____ By _____ Time _____ to _____ Total Time _____

Test Conditions _____

Patient Conditions _____

TIME				
ITEM	I	VI	VII	D
1. Tb				
2. Cg				
3. Ph				
4. Kf				
5. Fk				
6. Qr				
7. Pl				
8. Ml				
9. Ky				
10. Cb				
MODALITY	VRB	GST	GST	GPH
MINUTES				
MEAN SCORE				

Response Levels:

Overall _____

%ile _____

Note: _____

APPENDIX D

REVISED METAPHORICAL LANGUAGE TEST PROTOCOL

RICE

Metaphorical Language Test

Have the patient explain the following proverbs and idioms from an auditory stimulus.
 Check response category applicable to each item.

- Nothing ventured, nothing gained.
- Look before you leap.
- A stitch in time saves nine.
- He's a chip off the old block.
- A penny saved is a penny earned.
- It's raining cats and dogs.
- Beat around the bush.
- Save it for a rainy day.
- Your name will be mud.
- It takes two to tango.

	Literal Interpretation	Partially Correct	Normal Abstract Interpretation

Total correct _____

APPENDIX E

EXAMPLE OF NRST PARAGRAPHS AND TEST QUESTIONS

Long ago, people believed in monsters. The manticore was thought to have the head of a man, the body of a lion, and three rows of sharp teeth. It ate people if it caught them. The centaur, which lived in the forest, was believed to have the body of a horse but the shoulders, arms, and head of a man. Its voice sounded like the whinny of a horse. It hunted with a bow and arrows. A mermaid was said to have a fish's tail and a woman's body. It lived in the ocean. People believed a ship would sink if it got too close to a mermaid. And almost everyone believed in dragons. Drawings of dragons showed some with wings, most with feet, and a few breathing fire. All of these monsters were considered dangerous.

4. Which monster didn't have the head of a person?

- A. Centaur B. Dragon C. Manticore D. Mermaid

5. Which monster had the body of a lion?

- A. Centaur B. Manticore C. Dragon D. It doesn't say.

6. Sailors were probably most scared of

- A. centaurs. B. dragons. C. manticores. D. mermaids.

7. Which monster hunted with a weapon?

- A. Centaur B. Dragon C. Manticore D. It doesn't say.

APPENDIX F

REVISED NELSON SCORE SHEET

REVISED NELSON SCORE SHEET

#	ANSWER	CA*	TYPE	+/-
1		A	H	
2		B	H	
3		D	H	
4		B	L	
5		B	L	
6		D	H	
7		A	T	
8		C	T	
9		D	T	
10		A	L	
11		A	L	
12		B	H	
13		C	L	
14		B	T	
15		B	T	
16		A	T	
17		D	H	
18		C	T	
19		B	H	
20		C	L	

REVISED NELSON SCORE SHEET
(continued)

#	ANSWER	CA	TYPE	+/-
21		D	H	
22		A	H	
23		A	T	
24		D	H	
25		C	T	
26		C	T	
27		A	L	
28		B	L	
29		D	T	
30		D	L	
31		D	T	
32		A	L	
33		C	H	

Total L (literal) correct:
 Total T (translational) correct:
 Total H (high inference) correct:
 NRST Total correct:

*CA = correct answer