

## Types of Errors in Multiple-Sentence Reading Comprehension of Aphasic Adults

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In a recent study of multiple-sentence listening comprehension, we (Nicholas and Brookshire, 1986) found that aphasic adults comprehended and remembered stated details from discourse significantly better than they comprehended and remembered implied details. We then began to wonder if the same relationship between how directly information is stated and the ease with which it can be comprehended and remembered exists in reading. The literature on aphasic reading impairments was of little help. Published studies of aphasic reading impairments usually have focused on single word, phrase, or sentence reading, rather than reading of multiple-sentence texts. It did not seem certain that aphasic adults' comprehension of multiple-sentence printed materials would mirror their comprehension of spoken discourse. It seemed that unlimited access to stimulus passages in a reading task, compared with the transitory nature of passages in a listening task, might lead to different patterns of comprehension and retention of information in the two tasks.

Most standardized multiple-sentence reading comprehension tests designed for the general population measure comprehension of both stated and implied information. The Nelson Reading Skills Test (NRST; Hanna, Schell, and Schreiner, 1977) is a standardized measure of silent reading for students in Grades 3 through 9. It assesses reading vocabulary (word meaning) and comprehension of passages at three levels of difficulty (A, B, and C). Level B is for students in Grades 3 through 6. The NRST requires readers to answer three types of test items. (1) Literal items require answers that are stated in the test items as they are in the reading passage to which the test items refer. (2) Translational items require answers that are reworded from the way the information was stated in the passage. Translational items may require readers to draw simple inferences, choose a synonym, or determine the correct referent for a pronoun. (3) Higher Level items require inferences from information in the passage. Higher level items may require readers to identify cause and effect relationships, make judgments about events and attitudes of characters, and form bridging assumptions between information in the passage and correct answers. An example of a passage and test items from the NRST are presented in Appendix A. This study (a) evaluated the validity of the NRST designation of test items as literal, translational, or higher level, and (b) assessed aphasic and non-brain-damaged readers' performance on literal, translational, and higher level test items from the NRST.

### METHOD

#### Evaluation of the Validity of NRST Test Item Classifications

The NRST manual provides no information about the validity of their classification of test items into literal translational, and higher level categories. In order to assess the validity of these three categories, we

asked 10 speech pathologists associated with the Minneapolis Veterans Administration Medical Center to read the passages and questions from the NRST, Level B, Forms 3 and 4, and decide to which of the three categories each test item belonged, based on the definitions for the categories from the NRST manual.

Evaluation of the Effects of Test Item Type on Performance

Subjects. Subjects were 15 non-brain-damaged and 15 aphasic adults. Mean age and education were essentially equivalent for the two groups. All aphasic subjects were at least 2 months post onset of a single thromboembolic brain injury. Aphasic subjects were independently classified by the investigators into groups representing nonfluent (Broca's), fluent (anomic), and mixed aphasia (fluent with literal paraphasias). The severity of each subject's aphasia was estimated with the Aphasia Severity Rating Scale from the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass and Kaplan, 1983). Classification of subjects according to aphasia type and severity was based on analysis of audiotaped conversation and picture description, and aphasia test results. Two of three judges had to agree on a subject's type and severity classification in order for the subject to be included in the study. Six aphasic subjects were judged nonfluent, 3 were judged fluent, and 6 were judged to have mixed aphasia. Descriptive information for these subjects is presented in Table 1.

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 Table 1. Descriptive information and Nelson Reading Skills Test scores for aphasic (APH) and non-brain-damaged (NBD) subjects in the reading errors analysis study (n = 15 per subject group).  
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Nelson Reading Skills Test (Level B, Form 3)

	Age	Education (years)	Word Meaning (n = 31)	Reading Comprehension (n = 33)	Total (n = 97)
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APH					
Mean	61.6	13.1	25.7 (7.2)	19.5 (4.3)	64.7 (5.1)
SD	7.7	2.6	3.6 (1.4)	4.3 (.9)	9.7 (0.8)
Range	46-75	9-20	18-31 (5.6-10.6)	11-25 (2.6-5.8)	46-78 (3.7-6.5)
NBD					
Mean	65.5	13.2	30.6 (10.1)	31.1 (10.1)	92.9 (10.5)
SD	3.6	2.0	.7 (0.8)	1.6 (1.3)	3.8 (1.3)
Range	59-72	10-16	29-31 (8.4-10.6)	28-33 (7.6-11.7)	85-97 (8.0-12.2)

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 Note. Nelson Reading Test scores are presented as number correct with grade equivalents in parentheses. The highest possible grade equivalents are: Word Meaning, 10.6; Reading Comprehension, 11.7; Total, 12.2.  
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Procedure

The NRST, Level B, Form 3, was administered individually to each subject. The word meaning subtest was administered in standard timed fashion. The reading comprehension subtest also was administered in standard timed fashion, but when the allotted time was up, the last item completed by each subject was marked and the subject was instructed to go on and complete the remaining test items. The number of errors made on each of the three types of test items (literal, translational, and higher level) was calculated and a reading grade level was determined for each subject (Table 1). Aphasic subjects were subsequently divided into a high error group (n = 8) and a low error group (n = 7) based on their performance on all reading comprehension items from this form of the NRST. Nonfluent, fluent, and mixed aphasic subjects were distributed nearly equally between the high and low error groups.

RESULTS

Agreement Between the NRST and VA Judges. The percentages of agreements and disagreements between the VA judges and the designation of test items in the NRST manual are summarized in Table 2 for literal, translational, and higher level test items.

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Table 2. Percent of agreements (in brackets) and disagreements between Nelson Reading Skills Test manual and VA judges' designations of test items.

		Form 3			Form 4			
		NRST DESIGNATION						
VA		<u>Lit</u>	<u>Trans</u>	<u>High</u>	<u>Lit</u>	<u>Trans</u>	<u>High</u>	
DESIG- NATION	<u>Lit</u>	[80]	18	00	<u>Lit</u>	[78]	08	00
	<u>Trans</u>	10	[64]	18	<u>Trans</u>	11	[92]	09
	<u>High</u>	10	18	[82]	<u>High</u>	11	00	[91]

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Note. One item in each form did not achieve significant level of agreement from VA raters and was not included in this analysis.

Most categories of test items achieved at least 80% agreement between NRST and VA designations, except for translational items on Form 3, which generated 64% agreement. The effects of this low level of agreement on interpretation of results will be discussed subsequently.

Reliability of VA Judges on Judgments of Item Type. Agreement among VA judges was significantly beyond chance (p. < .05) for all test items except one on each form of the NRST. The correct answer for these two items was "it doesn't say" (see appendix, last test item), which seem to be difficult, both for judges who must categorize them according to type and for subjects who must answer them. These two items were excluded from statistical analyses involving item designations by VA judges.

**Subjects' Performance According to Test Item Type.** The performance of non-brain-damaged, low error aphasic, and high error aphasic subjects according to test item type is summarized in Figure 1.

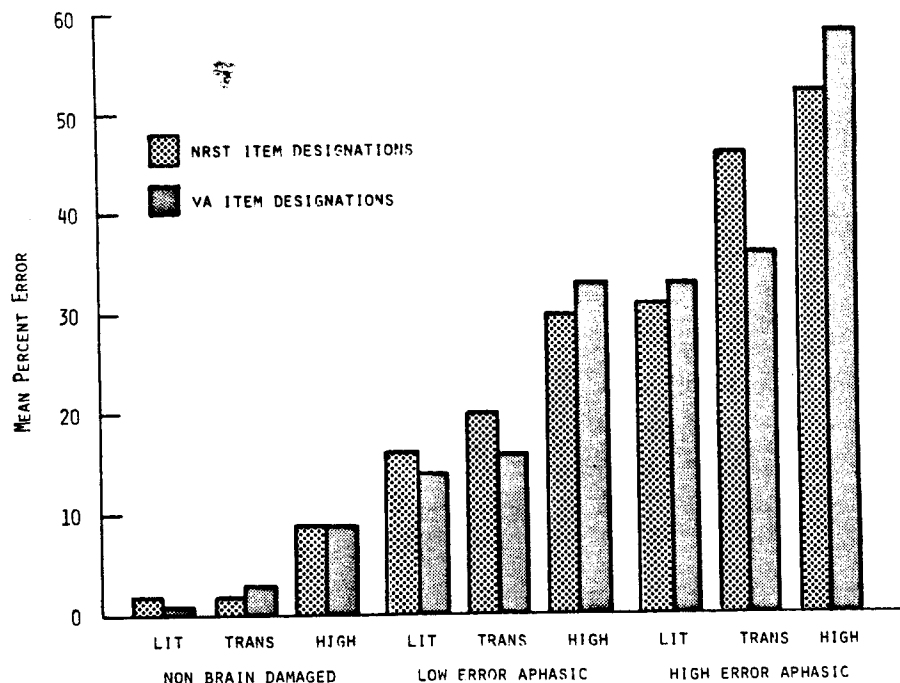


Figure 1. Mean percent error for Non-brain-damaged, Low Error and High Error Aphasic Adults on Literal, Translational and Higher Level Test Items as designated by the Nelson Reading Skills Test manual or VA judges.

All groups made the most errors on higher level items and the fewest errors on literal items, with errors on translational items falling between these two for both NRST and VA designations. In order to determine which of the differences shown in Figure 1 were significant, four repeated-measures analyses of variance were calculated. Two were calculated on the performance of non-brain-damaged subjects -- one using NRST item designations, and the other using VA judges' item designations. (Because of unequal variability between the non-brain-damaged and aphasic groups, we could not include the non-brain-damaged and aphasic groups in the same analyses of variance.) Two analyses of variance were calculated on the performance of aphasic subjects, separated into high and low error groups -- one using NRST item designations, the other using VA judges' item designations.

Item type had a significant effect on both non-brain-damaged and aphasic subjects' performances for both the NRST and VA designations of test items. High error aphasic subjects performed significantly better than low error aphasic subjects for both designations of test items. There was no interaction between aphasia group and item type, suggesting that both groups of aphasic subjects responded to the three types of test items in the same way. Newman-Keuls comparisons were then computed on the significant main effects found in the analyses of variance. The results are summarized in Table 3.

Table 3. Newman-Keuls comparisons on differences among Literal (L), Translational (T), and Higher Level (H) Nelson Reading Skills Test items for non-brain-damaged (NBD) and aphasic (APH) readers.

Groups	Mean Percent Errors		
	L	T	H
NBD - NRST	<u>2.0</u>	<u>2.4</u>	8.5
NBD - VA	<u>1.0</u>	<u>2.7</u>	8.9
APH - NRST	<u>24.0</u>	<u>33.3</u>	41.8
APH - VA	<u>24.0</u>	<u>26.7</u>	46.7

Note. Groups underlined in common did not differ significantly. NRST = Nelson Reading Skills Test manual's designations for test items. VA = VA judges' designations for test items.

The performance of non-brain-damaged and aphasic subjects was similarly affected by the three types of test items. Performance on higher level test items was always significantly worse than on literal test items. Performance on literal and translational test items never differed significantly. Performance on higher level test items was significantly worse than on translational items in four of five comparisons, the exception being aphasic subjects' performance on translational and high-level items as defined by the NRST. This exception probably is because the NRST designations of translational items are not valid based on the judgments of the ten VA judges.

#### DISCUSSION

Reading test items that require readers to draw complex (higher level) inferences are significantly more difficult for both non-brain-damaged and aphasic adults than literal test items or items that require readers to draw simple inferences (translational items). Since non-brain-damaged age-matched adults display this pattern, this seems to be a normal pattern of performance that is exaggerated for aphasic readers. These results are consistent with those reported by Nicholas and Brookshire (in press) for comprehension of spoken discourse. Unlimited access to stimulus passages in reading comprehension did not eliminate differences between performance on literal test items and higher level inferential test items as we had speculated it might.

#### REFERENCES

Goodglass, H. and Kaplan, E. Assessment of Aphasia and Related Disorders. Philadelphia: Lea and Febiger, 1983.  
 Hanna, G., Schell, L.M. and Schreiner, R. The Nelson Reading Skills Test. Chicago: Riverside Publishing Co., 1977.  
 Nicholas, L.E. and Brookshire, R.H. Consistency of the effects of rate of

speech on brain-damaged adults' comprehension of narrative discourse.  
Journal of Speech and Hearing Research, (in press).

Reference note. The Nelson Reading Skills Test is published by Riverside  
Publishing Company, 8420 Bryn Mawr Avenue, Chicago, Illinois 60631.  
(800-323-9540).

APPENDIX

Example of Nelson Reading Skills Test (Level B) passage and test items.

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Kansas, "The Wheat State," grows more wheat than any other state. It grows hard red winter wheat that is used to make flour for bread.

Over 100 years ago, a group of Christians called Mennonites moved from Russia to Kansas because they didn't believe in being soldiers. In Kansas they were free to practice their religion. Most of them were farmers. They brought a hard winter wheat called Turkey Red with them. Turkey Red was so successful that other farmers soon ABANDONED soft wheat and began growing this new hard wheat.

Turkey Red wheat is not grown now but its improved descendants still make Kansas the nation's breadbasket.

ABANDONED means

- A. adopted.
  - B. bought.
  - C. gave up.
  - D. harvested.
- (NRST = W)

Flour from hard red winter wheat is used to make

- A. bread.
  - B. crackers.
  - C. noodles.
  - D. pancakes.
- (NRST, VA = L)

Kansas is called the nation's breadbasket because it

- A. grows so much wheat.
  - B. makes so many baskets.
  - C. makes so much flour.
  - D. produces so much bread.
- (NRST = T, VA = H)

Kansas farmers stopped growing soft wheat because

- A. soldiers didn't like it.
  - B. the Mennonites made them.
  - C. Turkey Red was much better.
  - D. it was against their religion.
- (NRST, VA = T)

Where did the Kansas Mennonites come from?

- A. Mennon.
  - B. Russia.
  - C. Turkey.
  - D. It doesn't say.
- (NRST, VA = L)

Mennonites moved to the United States so they wouldn't have to be

- A. Christians.
  - B. religious.
  - C. soldiers.
  - D. farmers.
- (NRST, VA = T)

Where does the name Turkey Red come from?

- A. The Kansans.
  - B. The Mennonites.
  - C. The Russians.
  - D. It doesn't say.
- (NRST = L, VA = \*)

\* No significant agreement on type.

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Note. NRST = Nelson Reading Skills Test manual designations of test items.  
VA = Veterans Administration judges' designations of test items.  
W = Word Meaning, L = Literal, T = Translational, H = Higher Level