



Auditory comprehension of single words and sentences on the WAB-R in persons with aphasia

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Introduction

Various factors affect auditory comprehension of single words and sentences by persons with aphasia (PWAs). Some of the factors that affect single-word comprehension include frequency of occurrence of the word in the language, grammatical class, abstractness, and the semantic category to which the word belongs (Chapey, 2008). Similarly, several factors have been found to have an effect on sentence-level comprehension in PWAs. Some of these factors include sentence length, situational context, speech rate, emotional content, and topic familiarity (Chapey, 2008). Kearns and Hubbard (1977) examined the performance of 10 males with aphasia and created a hierarchy of 13 sentence types from least to most difficult to understand; four of the sentence types were significantly different from one another in their difficulty to comprehend, with 'follow three sequential verb instructions' being the most difficult.

Despite the robust literature pertaining to factors affecting single-word and sentence comprehension in PWAs, there is very little direct comparison of auditory comprehension of single words compared to sentences. Upon review of several databases (PsycINFO, PubMed, ASHA Wire) and other sources (Clinical Aphasiology Conference Proceedings), we found only one study that directly compared auditory comprehension of single words vs. sentences in PWAs (Simos et al., 2014). This study included 22 males with aphasia and found that subjects who were comprehension-impaired had significantly higher single-word comprehension scores compared to sentence-level comprehension scores.

Research Questions

- 1) Do people with aphasia perform better on single-word or sentence-level auditory comprehension tasks?
- 2) Does type of aphasia affect performance on single-word compared to sentence-level auditory comprehension tasks?

Hypotheses

- 1) People with aphasia will perform better on sentence-level auditory comprehension tasks due to the context sentences can provide.
- 2) People with Anomic aphasia will perform significantly better on the most complex WAB-R auditory comprehension subtest, Sequential Commands, compared to all other types of aphasia.

Disclosure

Financial Relationships: Susan Jackson was an employee at the University of Kansas when we analyzed the test results and demographics of persons with aphasia from the AphasiaBank database. She has been an employee of the University of Kansas for the past 24 years.
Non-financial Relationships: Susan Jackson is an AphasiaBank consortium member. The test results of persons with aphasia from the AphasiaBank database were analyzed as part of a research practicum experience for Abby Foutch and Madalyn Roberts while they were graduate students in speech-language pathology at the University of Kansas under the supervision of Susan Jackson.

Subjects

PWAs who participate in the AphasiaBank project were administered the WAB-R Auditory Verbal Comprehension subtests. AphasiaBank contained test results from 321 unique PWAs when the database was accessed on October, 2015 (www.talkbank.org).

Participation Inclusion/Exclusion Criteria:

- Diagnosis of aphasia
- Adequate vision and hearing
- English-speaking monolingual
- Left hemisphere damage post-stroke
- Aphasia duration \geq 6 months
- No history of other neurological conditions

| | Anomic | Broca's | Conduction | Wernicke's | TOTAL |
|----------|--------|---------|------------|------------|-------|
| N | 45 | 40 | 25 | 12 | 124 |
| WAB-R AQ | 83.40 | 49.34 | 69.61 | 59.59 | 67.07 |
| SD | 12.98 | 16.67 | 9.22 | 12.02 | 19.77 |

Time Post-Onset M = 5.61 years (SD = 5.26)*

Years of Education M = 15.16 years (SD = 2.55)*

Age M = 61.87 years (SD = 11.33)*

Aphasia Severity M = 67.07 (SD = 19.77) –WAB-R AQ

Gender 53 Female, 69 Male

Ethnicity 108 Caucasian

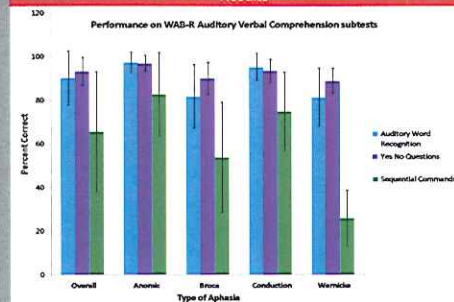
Handedness 112 Right, 10 Left

* No significant difference among groups

Procedure

Individuals who participated in the AphasiaBank project were administered a variety of standardized tests including the WAB-R Auditory Verbal Comprehension subtests (Yes/No Questions, Auditory Word Recognition, and Sequential Commands). The Auditory Word Recognition subtest assesses auditory comprehension at the single-word level. The Yes/No Questions and Sequential Commands subtests assess auditory comprehension at the sentence level. Since the maximum number of points possible for one of the subtests is 80 points and the maximum number of possible points for two of the subtests is 60 points, the percent correct scores were used in the data analyses.

Results



Analyses Using All 122 Subjects with Aphasia

The results of a repeated measures ANOVA using the Greenhouse-Geisser correction showed that the subjects differed significantly in their performance across the three WAB-R auditory comprehension subtests ($F = 142.81$, $df = 1.28$, $p < .0005$), with an effect size (partial Eta squared) of .54.

Pairwise comparisons for unequal variances (Dunnett T3) revealed that subjects scored significantly worse on Sequential Commands than Yes/No Questions or Auditory Word Recognition ($p < .0005$ in both cases), and subjects scored significantly higher on Yes/No Questions than Auditory Word Recognition ($p = .007$).

Performance on WAB-R Auditory Comprehension Subtests Within Each Type of Aphasia

Four separate repeated measures ANOVAs for each type of aphasia using the Greenhouse-Geisser correction (for 3 of the 4 repeated measures ANOVAs) showed that for each type of aphasia, subjects differed significantly in their performance across the three WAB-R auditory comprehension subtests ($p < .0005$ in all 4 analyses), with effect sizes (partial Eta squared) ranging from .39 (Anomic) to .91 (Wernicke's).

For all four types of aphasia (Anomic, Broca's, Conduction, and Wernicke), pairwise comparisons for unequal variances (Dunnett T3) revealed that subjects scored significantly worse on Sequential Commands than Yes/No Questions or Auditory Word Recognition ($p < .0005$ in all cases).

For three of the four types of aphasia (Anomic, Conduction, and Wernicke's), pairwise comparisons for unequal variances (Dunnett T3) revealed that subjects did **NOT** score differently on Yes/No Questions compared to Auditory Word Recognition. Only within the Broca's group was there a difference, with performance on Yes/No Questions ($M = 89.88$, $SD = 7.38$) significantly **BETTER THAN** performance on Auditory Word Recognition ($M = 81.88$, $SD = 14.61$) ($p < .0005$).

Comparison of Aphasia Types on Each of the Three WAB-R Auditory Verbal Comprehension Subtests Using One-Way ANOVAs

Auditory Word Recognition

Subjects with Broca's aphasia and Wernicke's aphasia did not perform differently from one another ($p = 1.00$), but both groups performed significantly worse than Anomic and Conduction aphasia ($p \leq .023$) who did not differ significantly from one another ($p = .57$).

Yes/No Questions
Subjects with Anomic aphasia performed significantly better compared to all other aphasia types ($p \leq .043$). There were no significant differences among the other three types of aphasia.

Sequential Commands

Subjects with Wernicke's aphasia performed significantly worse than all other types of aphasia ($p < .0005$). Subjects with Broca's aphasia performed more poorly than those with Anomic or Conduction aphasia ($p < .0005$). Subjects with Anomic and Conduction aphasia did not perform differently from one another ($p = .43$).

Discussion

- Auditory comprehension of single words can be better or worse than comprehension of sentences – the type of sentence and the type of aphasia make a difference.
- Comprehension of sequential commands was more difficult than comprehension of yes/no questions for each type of aphasia (Anomic, Conduction, Broca's, and Wernicke's)
- This finding is not surprising, since sequential commands are longer and more syntactically complex – factors that have been shown to have a negative effect on auditory comprehension. The response requirements also were different for the two sentence-level tasks: yes/no questions require the participants to indicate "yes" or "no," resulting in a 50% chance of achieving a correct response, whereas sequential commands require the participant to perform an action with different levels of complexity to be credited with a correct response.
- Comprehension of sequential commands was more difficult than comprehension of single words for each type of aphasia
- This finding was not surprising for the Broca's group, since those with Broca's aphasia are known to have difficulty with syntactically complex stimuli. It was the most surprising for the group with Anomic aphasia, since their primary deficit is described as difficulty with word retrieval.
- Comprehension of yes/no questions did not differ from comprehension of single words for three types of aphasia (Anomic, Conduction, and Wernicke's), but comprehension of yes/no questions was **BETTER** than comprehension of single words for subjects with Broca's aphasia
- Perhaps the context provided in the yes/no questions resulted in the subjects with Broca's aphasia performing better on this task compared to the single-word task
- Within each auditory comprehension subtest, there were differences in performance across the aphasia types. It was surprising that Broca's and Wernicke's did not differ on the single-word task (Broca's was expected to be better). Aphasia severity cannot account for why Wernicke's aphasia performed more poorly than Broca's on sequential commands.
- There was variability within each type of aphasia on each auditory comprehension subtest, with the most variability on the Sequential Commands subtest.
- The WAB-R classification system allows for a large amount of variability in auditory verbal comprehension in those with Broca's (4-10) and Wernicke's aphasia (0-6.9), but less variability is allowed in Anomic and Conduction aphasia (7-10).

References

- Boller, F., & Green, E. (1972). Comprehension in severe aphasia. *Cortex*, 8, 382-394.
- Bandur, D.L., & Shewan, C.M. (2008). Language-oriented treatment: A psycholinguistic approach to aphasia. In R. Chapey (Ed.), *Language intervention strategies in aphasia and related neurogenic communication disorders* (5th ed.) pp. 756-799. Philadelphia, PA: Wolters Kluwer Health/ Lippincott Williams & Wilkins.
- Kearns, K. P., & Hubbard, D. J. (1977). A comparison of auditory comprehension tasks in aphasia. *Clinical Aphasiology Conference Proceedings*, pages 32-45.
- MacWhinney, B., Fromm, D., Forbes, M., & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology*, 25, 1286-1307.
- Shewan, C. M., & Canter, G. J. (1971). Effects of vocabulary, syntax, and sentence length in auditory comprehension in aphasic patients. *Cortex*, 7, 209-226.
- Simos, P. G., Kasselimis, D., Potagas, C., & Evdokimidis, I. (2014). Verbal comprehension ability in aphasia: Demographic and lexical knowledge effects. *Behavioral Neurology*, 2014, 1-8.