

Introduction

Word retrieval deficit is the most common finding in aphasia secondary to left hemisphere stroke. Often differing brain lesions can lead to difficulty retrieving content words such as nouns and verbs. Generally, lesions in the inferior temporal cortex have been associated with noun retrieval difficulties, while lesions in the inferior frontal cortex leave verbs particularly vulnerable (Damasio & Tranel, 1993; Zingeser & Berndt, 1990). The notion that nouns and verbs have different neural representations generates several interesting questions about the remediation of word retrieval deficits.

Reports have suggested that gesture treatments and semantic-phonologic treatments are effective in improving lexical retrieval in anomia. However, most studies focus on noun production (lexical retrieval and motor representation retrieval), with verb production less commonly reported. Thus, the purpose of this investigation is to study the effect of gesture and semantic-phonologic treatments on verb retrieval within the same participants. While there is evidence that semantic-phonologic treatments are effective in remediating word retrieval deficits (Drew & Thompson, 1999), we hypothesize that the gesture treatment will yield a more positive outcome given the link between verbs and actions (Druks, 2002).

Participants

We report treatment results for four participants, three male and one female, with aphasia and word retrieval impairments subsequent to left hemisphere CVA (Demographics in Table 1). Each of the four participants underwent a speech/language assessment which included the Western Aphasia Battery (WAB) (Kertesz, 1982), Boston Naming Test (BNT) (Kaplan et al., 1983), Action Naming Test (ANT) (Obler & Albert, 1986), and the Noun/Verb Battery (NVB) (Zingeser & Berndt, 1990), a test that measures performance on naming to pictures, sentence completion, and spoken word/picture verification. Results (Table 1) indicate that while the participants had different types of aphasia (P1= transcortical sensory, P2 and P3= conduction, P4= mixed transcortical), all had word retrieval impairments. P1's verb retrieval deficits were primarily phonologic in nature. P2, P3, and P4 showed comprehension deficits, suggesting that their word retrieval difficulty was due to semantic impairment.

The participants were recruited for the study from two sites according to guidelines set forth by the Institutional Review Boards overseeing this investigation. All four participants provided written informed consent prior to any participation in the treatment study.

Treatment Design and Methods

The protocol consisted of a single-participant treatment design across behaviors and participants. During the treatment phases, each participant completed daily probes followed by a training session. The probe task involved naming 60 viewed pictures, which were black and white line drawings of one or two-place verbs. Twenty items were used for gesture treatment, 20 for semantic-phonologic treatment, and 20 as untrained probe items. The control measure was oral reading performance on 20 real words or 20 nonwords. Any verbal production that was identifiable as the target word was accepted. Reliability was assessed with a second examiner who scored responses for 10-25% of sessions and ranged 98.8-100% across participants.

Experimental probes were administered across 8 baseline sessions. Treatment order was randomly assigned across participants. P1, P3, and P4 received the gesture treatment followed by the semantic-phonologic treatment and P2 received the semantic-phonologic treatment followed by the gesture treatment. Treatment took place 2-3 sessions per week. Ten treatment sessions were completed per phase with a one-month break between treatment phases. The gesture treatment protocol required them to first repeat the word, then produce the target gesture, and then practice verbal production with the target gesture. The semantic-phonologic protocol required them to first to repeat the target word, then answer four yes/no questions about semantic (associated noun, associated verb) and phonologic characteristics (initial phoneme, rhyming word) of the item, and then to practice verbal production again. Results were graphed and effect sizes (d) were calculated for each participant on both treatment phases. An effect > 2.0 was considered large.

Results

Baseline performance was stable for all four participants prior to the initiation of treatment. P1 initiated gesture training first and significantly improved retrieval of trained items ($d=3.34$). Semantic-phonologic training was then initiated, which also resulted in a significant improvement on trained items ($d=9.92$). No generalization occurred to untrained items in either training phase and no improvement was noted in the control task. P2 initiated semantic-phonologic training first and showed significant improvement on trained items ($d=3.38$). Gesture training was then initiated but did not yield a significant improvement. No significant improvement was noted on untrained items or the control task. P3 initiated treatment on the gesture training first but did not show a significant improvement during this phase. However, her improvement reached significance during the semantic-phonologic treatment phase that followed ($d=2.27$). No significant improvement was noted on untrained items or the control task. P4 initiated gesture training followed by semantic-phonologic training with no significant improvement on trained items, untrained items, or the control task in either phase.

Discussion

Four participants with aphasia and word retrieval impairments participated in verb training contrasting a gesture treatment and a semantic-phonologic treatment. Three of the four demonstrated significant naming improvements with the semantic-phonologic treatment, while only one showed significant naming improvement with the gesture treatment. Results of control measures and lack of generalization to untrained words suggest that changes were related to the training and not to extraneous factors. These results lead us to two conclusions. First, gesture training may not be superior to semantic-phonologic training for verb retrieval as we hypothesized. In fact, verbs may be amenable to the same types of treatments as nouns despite the different neural representations. Furthermore, significant improvements were only noted on trained items, suggesting that gesture and semantic-phonologic treatments affect individual representations rather than the process that occurs during word retrieval. Thus, we need to be selective in the verbs we train in order to see functional gains in an individual's ability to communicate. Because three of the four participants received gesture treatment first, results of this study need to be replicated in similar individuals with order of

treatment presentation counterbalanced. Future studies should also continue to investigate the differences between gesture and semantic-phonologic treatments and focus on ways to enhance their generalizability.

References:

Damasio, A.R., & Tranel, D. (1993). Nouns and verbs are retrieved with differently distributed neural systems. *Proceedings of the National Academy of Sciences of the United States of America*, 90(11), 4957-60.

Drew, R.L., & Thompson, C.K. (1999). Model-based semantic treatment for naming deficits in aphasia. *Journal of Speech, Language, & Hearing Research*, 42, 972-989.

Druks, J. (2002). Verbs and nouns-a review of the literature. *Journal of Neurolinguistics*, 15, 289-315.

Kaplan, E., Goodglass, H. & Weintraub, S. (1983). *Boston Naming Test*. Philadelphia, PA: Lea and Febiger.

Kertesz, A. (1982). *Western Aphasia Battery*. Test manual. San Antonio, TX: The Psychological Corporation.

Obler, L.K., & Albert, M. (1986). *Action Naming Test*.

Zingeser, L.B., & Berndt, R.S. (1990). Retrieval of nouns and verbs in agrammatism and anomia. *Brain and Language*, 39, 14-32.

Table 1: Participant demographic data.

| | P1 | P2 | P3 | P4 |
|-------------------------------|-----------|-----------|-----------|-----------|
| Age (yrs) | 73 | 63 | 52 | 72 |
| Education (yrs) | 14 | 12 | 12 | 12 |
| Gender | M | M | F | M |
| Time post stroke (mos) | 8 | 96 | 24 | 9 |
| WAB AQ (max. 100) | 78.2 | 54.6 | 43.4 | 37.4 |
| BNT (max. 60) | 41 | 6 | 3 | 3 |
| ANT (max. 52) | 45 | 13 | 9 | 4 |
| <u>NVB (Verbs only)</u> | | | | |
| Picture Naming (%) | 73.3 | 26.7 | 10 | 3.3 |
| Sentence Completion (%) | 70 | 26.7 | 60 | 6.7 |
| Word/Picture Verification (%) | 86.7 | 67.7 | 73.3 | 23.3 |