# Facilitation of Verb Retrieval Skills in Aphasia: A Comparison of Two Approaches

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Word retrieval impairment is common in aphasia. Although this difficulty encompasses both nouns and verbs, until recently the research focused on noun retrieval. Studies of verb retrieval have, as a starting point, used picture naming tasks to assess verb naming (Miceli, Silveri, Villa, & Caramazza, 1984; Zingeser & Berndt, 1988). It has been argued, however, that picture naming has a limited ability to capture the nature of verb retrieval (Kohn, Lorch, & Pearson, 1989), and more recent studies emphasized the importance of assessing verb retrieval in the context of a sentence (Kohn et al., 1989; Zingeser & Berndt, 1990). In addition to the manner and context of elicitation, the aphasic patient's word retrieval skills are affected by lexical/semantic factors such as word frequency and form class. The ungrammatical Broca's aphasic patient, for example, typically shows a disproportionate use of content to functor words (Goodglass, 1976) and even within the class of content words, noun retrieval is superior to verb retrieval in both single word production (Miceli et al., 1984) and spontaneous speech (Zingeser & Berndt, 1990). This is in contrast to the anomic aphasic patient who is reported to show the opposite pattern in some tasks and does not typically demonstrate a difficulty with verbs relative to nouns (Miceli et al., 1984; Zingeser & Berndt, 1990). These studies, along with theories of language processing (Bock, 1987) and language rehabilitation (Loverso, Prescott, & Selinger, 1988) that consider the verb to be central to syntactic constructions, suggest a relationship between sentence formulation and access to verbs, though the nature of this relationship is not simple and appears to vary among patients (Zingeser & Berndt, 1990).

In spite of the significant difficulty that some aphasic patients have with

verbs, and the possible influence of this deficit on sentence construction, few intervention studies target the verb retrieval deficit specifically for remediation (see, however, Mitchum & Berndt, 1990). The present study focused on improving verb retrieval in the context of sentence production and was designed to evaluate the effectiveness of two training procedures developed in our laboratory.

# METHOD

## Subject

Our subject (G. R.), a 64-year-old former engineer, suffered a left hemisphere cerebral vascular accident (CVA) in July 1982. (He was not receiving therapy, however, during the course of this study.) A CT scan five days later revealed a large infarction in the distribution of the left middle cerebral artery that extended deep into the basal ganglia. Initially mute, with severe comprehension problems, G. R. has been in therapy almost continuously since 1982. When seen almost eight years post CVA, he demonstrated a severe agrammatic Broca's aphasia, characterized mainly by single word utterances with some two-word combinations produced under more structured conditions (picture descriptions). This was complicated by an apraxic component that further impaired articulation and prosody. Comprehension, as measured by standardized tests, was very good. On the Boston Diagnostic Aphasia Examination (BDAE, Goodglass and Kaplan, 1983) his average auditory score was 86%. However, under specialized testing, his comprehension reflected a pattern consistent with agrammatic comprehension (Schwartz, Saffron, Fink, Myers, & Martin, 1991). Following a period of Mapping Therapy* to improve his agrammatic comprehension and production, G. R. demonstrated significant improvement in his sentence production during a picture description task but was still largely unable to access main verbs (Schwartz et al., 1991). Thus, he would describe a picture using a full sentence, marking the verb with a tongue click or a gesture (not necessarily a meaningful gesture). The fact that he could order nouns appropriately around missing verbs, and that his verb retrieval was quite responsive to phonemic cueing, suggested that G. R.'s verb retrieval problem was due to reduced accessibility to the phonology of this class of lexical items. We thus developed two training procedures to

*Mapping therapy is a sentence level training program which focuses on the noun-verb relationship by training the patient to "map" grammatically defined constituents (e.g. subject, object) onto thematic roles (e.g. agent theme, goal [Schwartz et al., 1991]).

facilitate lexical phonological access to verbs in the context of a sentence. We call these procedures Direct Verb Training and Verb Priming.

## Procedures

In Direct Verb Training, the subject is trained to name the verb that describes the depicted action, to report which is the agent and the theme (object) of the action, and then to compose a sentence incorporating this information when describing the picture. Verb access is elicited through modeling and phonemic cueing. In this direct approach, the subject is repeatedly made aware of the target verb and the noun phrases that fill thematic roles. The second training procedure, Verb Priming, aims to improve access to lexical phonology through repetition priming. This paradigm alternates sentence repetition (priming) trials with picture description trials. In a priming trial, the verb target is embedded in a sentence that the subject is asked to repeat. Immediately following this, the subject is asked to describe a picture that is designed to elicit the same primed verb. The subject is not told directly of the verb targets in either trial. Repetition priming has been used successfully to facilitate use of certain syntactic constructions (e.g., passive) in both normals (Bock, 1986) and agrammatic aphasic patients (Saffron & Martin, 1990). The assumption behind Verb Priming is that comprehending or producing a verb in the context of sentence repetition will boost the activation of the lexical phonological representation of the verb, making it more accessible for production in a subsequent picture description task. In the Verb Priming procedure each of five verbs is elicited under three conditions: without a prime (0 prime), following a single priming sentence (1 prime), and following three priming sentences with the same verb (3 prime). This enables us to evaluate the extent to which the prime facilitates the use of the targeted verb in the picture description immediately following each prime, and whether there is carryover to unprimed picture descriptions within and across sessions.

Prior to initiating treatment, a Verb Assessment Test was administered to identify the verbs to be used in training. This test uses picture description to evaluate access to 28 different verbs, each with five different picture tokens. Based on this assessment, we selected 10 verbs that G. R. was consistently unable to retrieve (name). These were divided into two sets of five verbs, each set approximately balanced for frequency and for argument structure complexity. The five verbs of Set I were the targets of Direct Verb Training and those of Set II were the targets of Verb Priming. Set II verbs also served as controls for Direct Verb Training.

Each of the two training procedures was organized in two steps. Step 1 used a single stimulus picture (token), for training each verb in order to determine whether repeated training on one picture facilitated retrieval to

other, untrained pictures that called for the same verb. Step 2 paralleled Step 1 but used five different pictures for training each verb to determine whether use of a range of picture tokens enhanced the training effects.

The two groups of verbs (Set I and Set II) were reassessed after each step and each procedure. In addition, the Verb Assessment Test was re-administered at the completion of all procedures. Appendix A outlines the entire sequence of this study. The study began with Direct Verb Training on Set 1 verbs (give, throw, blow, put, and lock).

## RESULTS

Figure 1 shows the effects of the Direct Training procedure on the five verbs trained. There was improved access to all verbs trained and absolutely no carryover to the untrained (Set II) verbs. Following Direct Training Step 1, where only one picture token was used to train each verb, G. R. demonstrated significant improvement (McNemar, $X^2$ (1) = 12, $p < .001$) in retrieving the trained verbs when asked to describe untrained picture tokens. That is, he could now retrieve 58% of the untrained picture tokens presented in contrast to 0% at the pretreatment baseline level. Following Step 2 training, where multiple pictures were used to train each verb, he showed some additional improvement, retrieving 65% of untrained tokens of the trained verbs. These gains were still in evidence (55%) six months later, during which time these verbs received no further treatment.

Following this training we began the Priming procedure on the untrained (Set II) verbs: take, buy, pull, carry, lick. As in Direct Verb Training, we began with Step 1, which uses only one stimulus picture to train each verb. Figure 2 shows the results for the Priming procedure across all conditions for each verb. Although the Priming procedure showed a significant effect following Step 1 training, (Binomial test, $p < .05$), the effects were less impressive than those noted on the Direct procedure. Following Step 1 training, improvement was noted on only three of five verbs (carry, lick, and pull). Following Step 2 training, however, there was consistent improvement on only one verb (lick) and performance on this verb continued to improve after a seven-week delay during which time no training took place.

Priming did, however, serve as a short term facilitator, significantly enhancing access to the target verbs in the picture description task following both the one and three prime condition. Table 1 shows the percentage of times each verb was successfully used in the picture description task following each priming condition over the 10 sessions of Priming Step 1 and the 10 sessions of Step 2. The changes in G. R.'s verb retrieval immediately following the one and three prime conditions are significant (Page Test for

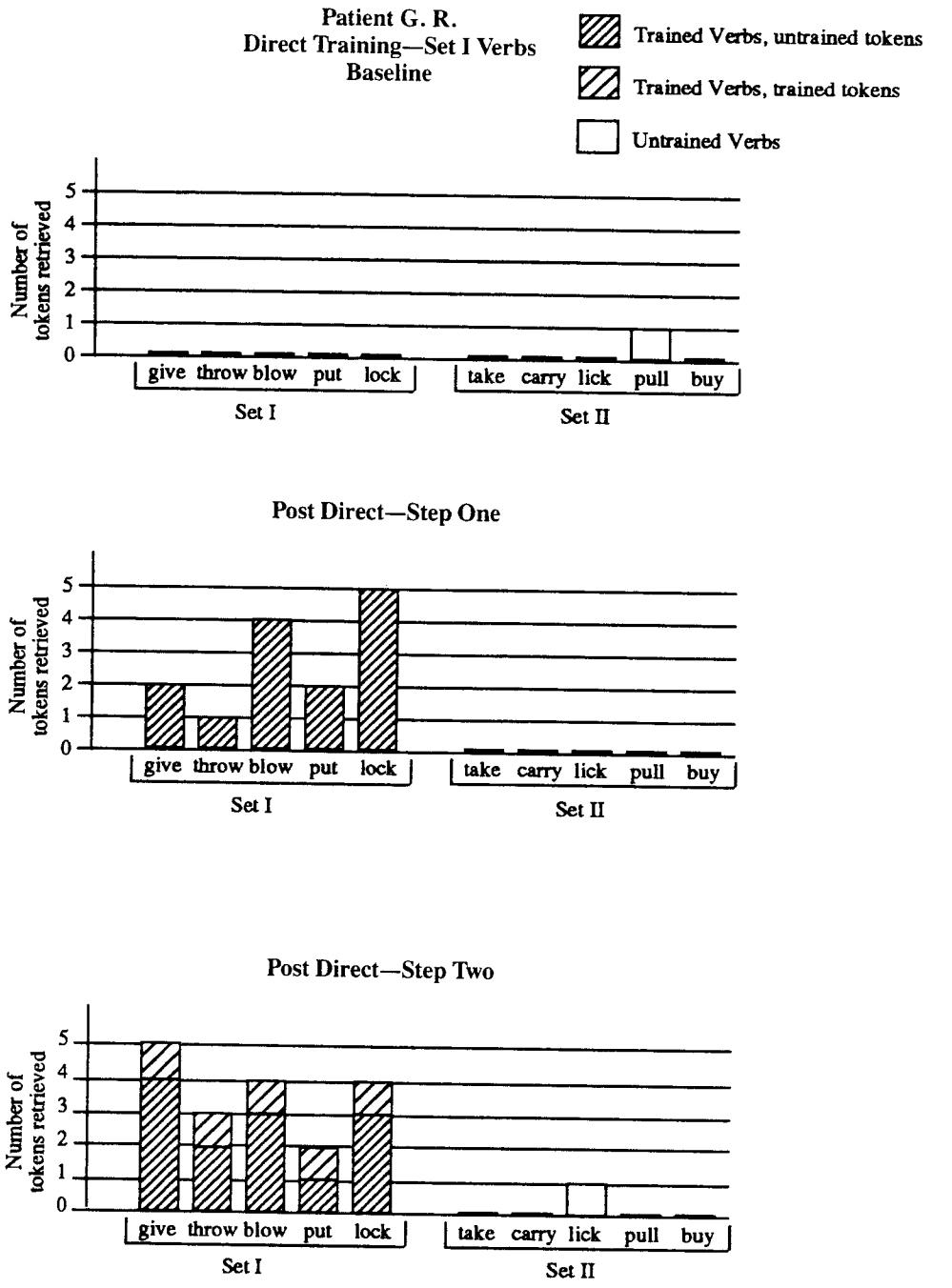


**Figure 1.** Effects of the Direct Training procedure on the number of novel picture tokens retrieved for trained (Set I) and untrained (Set II) verbs, comparing G. R.'s performance at baseline, following Direct Training Step 1, and following Direct Training Step 2. Note that one token of each verb in the bottom panel (post Direct Step 2) represents the actual token used in Step 1 training.

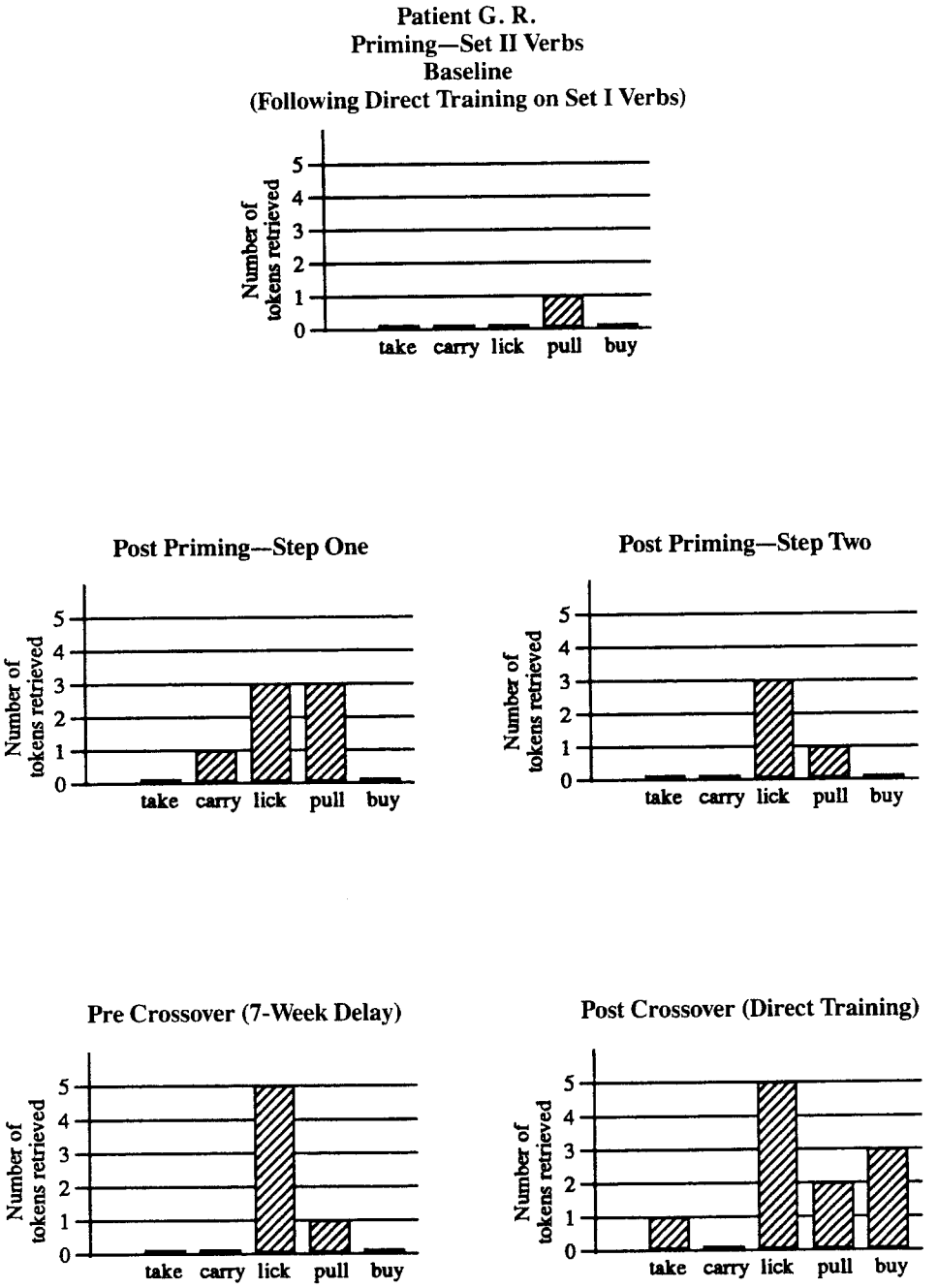


**Figure 2.** Effects of verb training on the number of novel picture tokens retrieved for trained (Set II) verbs, showing G. R.'s performance at baseline (top), following Priming Training, Steps 1 and 2 (middle) and following Direct Training (crossover) on the same verbs (bottom).

**TABLE 1. PRIMING EFFECTS: PERCENTAGE OF TIMES G. R. USED EACH VERB SUCCESSFULLY IN THE PICTURE DESCRIPTION TASK FOLLOWING EACH PRIMING CONDITION (0, 1, OR 3 REPETITION PRIME)**

| | Priming Step 1 | | | Priming Step 2 | | |
|---|---|---|---|---|---|---|
| | % correct after each condition | | | % correct after each condition | | |
| *Verb* | *0 Prime* (N = 30) | *1 Prime* (N = 20) | *3 Prime* (N = 20) | *0 Prime* (N = 30) | *1 Prime* (N = 20) | *3 Prime* (N = 20) |
| Take | 1 | 25 | 50 | 10 | 10 | 50 |
| Carry | 10 | 65 | 70 | 27 | 70 | 70 |
| Lick | 100 | 100 | 95 | 80 | 95 | 95 |
| Pull | 20 | 60 | 70 | 63 | 75 | 70 |
| Buy | 10 | 35 | 36 | 17 | 70 | 36 |
| Mean (%) | 28 | 57 | 64 | 39 | 64 | 74 |

Ordered Alternatives [Siegal and Castellan, 1988] $p < .05$ for Step 1 and $p < .01$ for Step 2).

To determine whether the differential effects of training were related to the procedure (Direct vs. Priming) or to the verbs selected for each procedure, we extended the study, using a crossover manipulation. That is, we used the Direct Training Step 2 procedure to train the verbs previously trained via Priming (Set II verbs). Results are shown on the bottom panel of Figure 2. Using G. R.'s performance 7 weeks post-Priming as baseline, G. R. correctly retrieved 6 of 25 tokens (24%) pre-crossover and 11 of 25 (44%) post-crossover, a significant change (Binomial test, $p < .05$). Although the direct training procedure was more successful in facilitating verb access to three of the five verbs of Set II, two verbs (take and carry) remained essentially unchanged, suggesting that these verbs were especially problematic for G. R.

On the pre- and post-training Verb Assessment Test, the verb targets of Direct Training (Set I) showed significant improvement relative to untrained verbs (Mann-Whitney $U_{(5,18)} = 14.5$, $p < .05$) but Priming Verbs (Set II) did not ($U_{[5,18]} = 23$, $p > .05$).

There was no significant change in G. R.'s access to the verb targets of the 18 untrained verbs on the pre- and post-assessment (Wilcoxin $z = .47$, $p > .10$). However, there was a significant change in the number of acceptable alternatives* G. R. used ($z = 1.88$, $p < .05$) pre- and post-training as well as a significant decrease in the verb omissions ($z = 2.80$, $p < .01$).

*Verbs that are semantically related to the picture or the target verb, though not necessarily a synonym (i.e. holding/carrying or washing feet/soaking feet)

**TABLE 2. PRE- AND POST-THERAPY PRODUCTION MEASURES ON A PICTURE DESCRIPTION TASK FOR SUBJECT G. R.**

| | *Pre Mapping Therapy* | *Post Mapping Therapy* | *Post Verb Studies Therapy* |
|---|---|---|---|
| % of Words in 'Sentences'* | 52% | 88% | 97% |
| Number of 'Sentences'* (max = 20) | 10 | 16 | 19 |
| % of Syntactically Well-formed Sentences* | 30% | 44% | 74% |
| Number of Verbs (non copula) (max = 18) | 10 | 11 | 18 |
| Number of Acceptable Verbs (max = 18) | 9 | 9 | 14 |

*Based on Quantitative Production Analysis, Saffron, Berndt, & Schwartz, 1989.

To further examine generalization of training, we analyzed pre- and post-training performance on a picture description task standardly used in our laboratory, using the procedures for quantifying narrative speech samples described by Saffron, Berndt, & Schwartz (1989). This analysis (Table 2) shows the progression of his dramatic improvement in both sentence production and verb retrieval during and following G. R.'s participation in Mapping Therapy, and following this Verb Therapy Study. These positive effects of training are further illustrated in Appendix B, with samples of G. R.'s picture descriptions before and after each treatment.

## DISCUSSION

The hypothesis that the verb retrieval deficit is rooted in impaired access to lexical phonology leads to the prediction that training on a particular verb should increase access to that verb but not generalize to use of other verbs. The Direct Training procedure yielded both the predicted facilitation of access and the restriction on generalization. However, while G. R. showed no significant increase in access to the untrained verb targets, he did show a significant increase in production of semantically related alternatives to the targets in a picture description task. One explanation for this unexpected but positive finding is that the Direct Training procedure we employed, with its emphasis on retrieving the verb and its arguments in a picture description task, stimulated processing at all stages of verb retrieval (message, semantic, and phonological levels). So although the verb was elicited with a phonological cue, the training task also encour-

aged semantic search and assigning nouns to verb argument slots as well as phonological encoding of the verb.

Although the long-term effects of Verb Priming were less impressive, its short term facilitatory effects are robust enough to warrant further investigation. The fact that the three prime conditions showed stronger immediate effects than the one prime condition indicates that the number of primes does affect accessibility, at least in the short term. The variable's effect should also be considered in comparing the results of the two training procedures, as the phonology of the verb was provided to the patient more frequently in Direct Verb Training than in Verb Priming. A priming procedure that more closely parallels the direct procedure in terms of the number of exposures to the target verb might be the subject of future study. Whether further massing of repetition primes can prolong the facilitating effect remains to be seen.

## SUMMARY AND CONCLUSION

These major findings were achieved:

1. The Direct Training procedure, which focuses on cueing the verb's lexical phonology in the context of a picture description task, resulted in significant improvement in verb retrieval for both trained and novel picture tokens in a subject who was nine years post CVA.
2. Training on only one stimulus picture for each verb was highly effective and the use of multiple exemplars may not be necessary, although a study that directly compares these two variables is indicated.
3. Although this training did not generalize to untrained verb targets, the use of semantically appropriate verbs increased and, significantly, verb omissions for untrained verbs decreased.
4. The effects of the Direct Verb Training are highly enduring, lasting at least 6 months.
5. The Priming procedure appears to act as good short-term facilitator of the target verb but is not as effective as the Direct Procedure.

The results of this study show that access to specific verbs can be enhanced and maintained with a direct procedure that focuses on the verb's lexical phonology in the context of a sentence. Further investigations of the semantic as well as the structural properties of verbs and their

effects on treatment would add to our understanding of the verb retrieval process.

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## REFERENCES

Bock, J. K. (1986). Syntactic persistence in language production. *Cognitive Psychology, 18,* 355–387.

Bock, J. K. (1987). Coordinating words and syntax in speech plans. In A. Ellis (Ed.), *Progress in the Psychology of Language,* London: Erlbaum.

Goodglass, H. (1976). Agrammatism. In H. Whitaker and H. A. Whitaker (Eds.), *Studies in Neurolinguistics,* New York: Academic Press.

Goodglass, H., and Kaplan, E. (1983). *The assessment of aphasia and related disorders.* Philadelphia, PA: Lea and Febiger.

Kohn, S. E., Lorch, M. P., & Pearson, D. M. (1989). Verb findings in aphasia. *Cortex, 25,* 57–69.

Miceli, G., Silveri, C., Villa, G., & Caramazza, A. (1984). On the basis for the agrammatic's difficulty in producing main verbs. *Cortex, 20,* 207–220.

Mitchum, C., & Berndt, R. (1990, October). An intervention strategy to improve sentence production in aphasia. Paper presented at the 28th annual meeting of the Academy of Aphasia, Baltimore, MD.

Saffron, E., Berndt, R., & Schwartz, M. (1989). The quantitative analysis of agrammatic production: Procedure and data. *Brain and Language, 37,* 440–479.

Saffron, E., & Martin, N. (1990, October). Effects of syntactic priming on sentences production in an agrammatic aphasic. Paper presented at the 28th annual meeting of the Academy of Aphasia, Baltimore, MD.

Schwartz, M. F., Saffron, E. M., Fink, R. B., Myers, J. L., & Martin, N. (1991). *Mapping therapy: A treatment program for agrammatism.* Manuscript submitted for publication.

Siegel, S., & Castellan, N. J., Jr., (1988). *Nonparametric statistics for the behavioral sciences* (2nd ed.). New York: McGraw-Hill.

Loverso, F. L., Prescott, T. E., and Selinger, M. (1988). Cueing verbs: A treatment strategy for aphasic adults (CVT). *Journal of Rehabilitation Research and Development, 2,* 47–60.

Zingeser, L., & Berndt, R. (1988). Grammatical class and context effects in a case of pure anomia: Implications for models of language production. *Cognitive Neuropsychology, 5,* (4), 473–576.

Zingeser, L., & Berndt, R. (1990). Retrieval of nouns and verbs in agrammatism and anomia. *Brain and Language, 39,* (1), 14–32.

# APPENDIX A
# VERB STUDY DESIGN

**Pretraining Assessment**

Subject was tested on five pictures for each of 28 verbs.
Ten verbs were chosen that subject never produced.
These 10 were divided into two sets (Set I & Set II), balanced for frequency and argument structure complexity.

**Direct Verb Training**

**Step One**

Subject was trained on one picture for each of five verbs (Verb Set I).

**Test**

Subject was tested on 5 pictures for each of the 10 verbs in Sets I and II.
Questions:
"Does this training generalize to the untrained verbs in Verb Set II?"
"Does this training facilitate access to trained verbs in novel pictures?"

**Step Two**

Subject was trained on five new pictures for each of the five verbs in Set I.

**Test**

Subject was tested on 5 pictures for each of the 10 verbs in Sets I and II.
Questions:
"Does this training generalize to the untrained verbs in Verb Set II?"
"Is access to verbs enhanced by training on more than one picture?"

**Indirect Verb Priming**

**Step One**

Subject was trained on one picture for each of five verbs (Verb Set I).

**Test**

Subject was tested on 5 pictures for each of the 10 verbs in Sets I and II.
Question:
"Does this training facilitate access to trained verbs in novel pictures?"

**Step Two**

Subject was trained on five new pictures for each of the five verbs in Set I.

**Post Training Assessment**

Subject was tested on 5 pictures for each of 28 verbs, 5 direct trained (Verb Set I), 5 primed (Verb Set II), and 18 controls.

Question:

"Does this training generalize to untrained verbs?"

**Test**

Subject was tested on 5 pictures for each of the 10 verbs in Set I and Set II.

Questions:

"Is access to verbs enhanced by training on more than one picture?"

"What is the durability of learning after delay?"

**Crossover**

Subject was given direct training on the verbs (Verb Set II) previously primed.

**Test**

Subject was tested on 5 pictures for each of the 10 verbs in Sets I and II.

Question:

"Does direct training result in improved access to the verbs (Set II) previously primed?"

# APPENDIX B.
# EXAMPLES OF G. R.'S PICTURE DESCRIPTION PERFORMANCE AT THREE POINTS IN TIME: PRE- & POST-MAPPING THERAPY (M), AND POST VERB STUDIES (V).

| | Pre Mapping 1/2/90 | Post Mapping 5/11/90 | Post Verb Studies 12/7/90 |
|---|---|---|---|
| **Target** | **The boy is sleeping in the bed.** | | |
| Pre M | Sleep . . . boy . . . bed . . . | | |
| Post M | The man is sleeping. | | |
| Post V | The boy is sleeping. | | |
| **Target** | **The girl is giving flowers to the teacher.** | | |
| Pre M | Girl and woman . . . flowers . . . | | |
| Post M | The . . . girls is washing . . . daisies. | | |
| Post V | The girl is . . . giving the papsies [poppies] to the teacher. | | |
| **Target** | **The rock is falling on the boy.** | | |
| Pre M | Rock . . . | | |
| Post M | The . . . the rock is small big . . . big . . . | | |
| Post V | The rock is . . . putting on the man. | | |
| **Target** | **The boy is giving a valentine to the girl.** | | |
| Pre M | Boy is . . . valentine . . . and . . . girl . . . | | |
| Post M | The man . . . valentines day . . . | | |
| Post V | 1-The boy is giving the girl to the no . . . | | |
| | 2-The boy is holding the card to the girl . . . valentine. | | |
| | 3-The boy is holding the valentine of the girl. | | |
| **Target** | **The truck is towing the car.** | | |
| Pre M | One grutch [truck] and one car . . . | | |
| Post M | The truck is . . . the car . . . | | |
| Post V | The truck is towing the car. | | |
| **Target** | **The boy is watching television.** | | |
| Pre M | Television and man . . . | | |
| Post M | The man is TV opening the TV. | | |
| Post V | The boy is . . . putting on the TV. | | |
| **Target** | **The ball is hitting the boy in the head.** | | |
| Pre M | Baseball hit . . . | | |
| Post M | The baseball is . . . ah no . . . | | |
| Post V | The . . . ball is striking the . . . boy. | | |