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Comparison of Active Versus Passive Prestimulation in the Treatment of Anomia

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It is generally accepted that one of the mechanisms underlying anomia is decreased access to lexical entries. In this view, word retrieval difficulty arises when the neural representation of a target word is not activated to a level that permits generation of an accurate overt response. Prestimulation and cueing hierarchy treatment approaches are based on the idea that repeated "deblocking" of a given lexical entry will facilitate future retrieval. Presumably, creating a convergence of information regarding a lexical entry, thereby activating various components of the entry's neural representation, will facilitate retrieval of the target entry and of semantically related entries as well. A number of prestimulation- and cueing hierarchy–based treatments for anomia have been shown to be efficacious; however, generalization and maintenance of treatment effects have been inconsistent (Hillis, 1989; Linebaugh & Lehner, 1977; Thompson & Kearns, 1981).

The present study was designed to address one aspect of the theory underlying prestimulation-based interventions. Specifically, we hypothesized that requiring an overt response to a prestimulus would yield greater activation of lexical representations than would passively listening to the prestimulus. We anticipated that a treatment requiring such overt responses would yield more efficient acquisition of trained responses and better generalization and maintenance than one that required no overt response to prestimuli.

METHOD

Treatment Conditions

Two different treatment conditions were employed in this study. The first, referred to as the passive prestimulation (PP) condition, involved a traditional prestimulation format in which the subject was presented with a line drawing of a single object along with a prestimulus consisting of a verbal statement of function. For example, the investigator presented a picture of a knife followed by the statement "You cut food with this. What's it called?"

In the second condition, referred to as the active prestimulation (AP) condition, the subject was presented with a card with four black-and-white line drawings. One picture depicted a target response, another depicted a semantically related item, and the remaining two pictures depicted unrelated items. The examiner then presented a verbal prestimulus such as "Show me what you sleep on," and the subject pointed to one of the four pictures. The subject's response was scored as accurate or inaccurate. Inaccurate responses were succeeded by the following cueing hierarchy until a correct response was elicited:

1. Prestimulus repeated;
2. Function gestured;
3. Clinician identifies target; subject points in imitation.

The examiner then presented a picture of the target item alone and asked "What's this called?"

In both conditions, the subject's naming response was scored using a multidimensional scoring system (Table 1). Responses scored as 5 or higher were accepted as correct. Phonemic paraphasias were accepted as correct because the emphasis of this study was on lexical semantic retrieval and not on the retrieval or execution of phonological representations.

The following hierarchy of naming cues was implemented after responses scored below 5:

1. Sentence completion using the functional prestimulus;
2. Sentence completion + initial phoneme;
3. Clinician states item; subject imitates.

Following an accurate production of the target word in response to cue 2 or 3, each prior naming cue was presented again, in reverse order,

Table 1. Response Scoring for Training and Generalization Probes

8	Immediate and accurate
7	Delayed, accurate
6	Self-corrected
5	Recognizable response with phonemic paraphasia(s)
4	Error, semantically related word
3	Error, circumlocution
2	Error, unrelated word or perseveration
1	Error, neologism
0	No response, or reference to not knowing

until the target was accurately produced in response to the picture only.

Treatment and Probe Stimuli

Appendix A lists the stimuli used in this study. To assess the relative effectiveness of the two treatment formats, we selected stimuli from six different semantic categories: tools, furniture, kitchen utensils, transportation, clothing, and dwellings. Items were generally equated for frequency of occurrence (Battig & Montague, 1969).

Ten training items were used in each treatment format. In the AP approach, items consisted of 5 tools and 5 pieces of furniture. In the PP approach, items were 5 kitchen utensils and 5 means of transportation.

Ten response generalization probe items were selected from the same categories for each format. Ten additional items selected from untrained categories (dwellings and clothing) were used to monitor naming performance changes in untreated categories. The 30 probe items were presented under baseline conditions with no corrective feedback; no items from the untrained categories were presented under treatment conditions.

The Subject

J.L. was a 51-year-old right-handed male, born in Ireland. He was reported to have initially presented with "global aphasia and buccofacial apraxia" and received speech–language treatment in Switzerland. At 4 months postonset, J.L. moved to the United States and underwent further rehabilitation.

The *Western Aphasia Battery* (WAB) (Kertesz, 1979) and the *Boston Naming Test* (BNT) (Goodglass & Kaplan, 1983) were used to assess J.L.'s language functioning prior to participation in this study. Results revealed a moderate anomia with well-preserved auditory comprehension (see Table 2). Performances on the WAB Object Naming and Word Fluency subtests revealed essentially no gains between 4 and 7 months postonset. It should be noted, however, that J.L.'s performance on the BNT did improve substantially between 4 and 7 months postonset. On both occasions, his error responses consisted of a statement indicating his inability to respond correctly.

The Experimental Design

A single-subject alternating treatments design was used (McReynolds & Kearns, 1983). Change in naming performance in the active prestimulation (AP) versus the passive prestimulation (PP) condition was evaluated by assessing acquisition rates of trained exemplars under the treatment conditions, along with stimulus and response generalization. Generalization to items from untrained categories was also assessed. The specific dependent variables that were considered included

1. The number of treatment sessions required to reach criterion for trained exemplars under treatment conditions

Table 2. Language Functioning as Assessed by the *Western Aphasia Battery* and the *Boston Naming Test*

Test	*4 Months Postonset*	*7 Months Postonset*
Western Aphasia Battery		
Information Content	6/10	8/10
Fluency	8/10	8/10
Comprehension Y/N	57/60	NT
Word Recognition	54/60	57/60
Commands	70/80	80/80
Repetition	65/100	87/100
Object Naming	35/60	37/60
Word Fluency	1/20	1/20
Sentence Completion	8/10	8/10
Responsive Speech	6/10	6/10
Reading	73	95
Aphasia Quotient	63	79
Boston Naming Test	7/34 (7/91)	21/60

2. The number of trained exemplars named accurately in a visual confrontation naming task without prestimulation
3. The number of untrained exemplars from trained categories named accurately in a visual confrontation naming task without prestimulation
4. The number of exemplars from untrained categories named accurately in a visual confrontation naming task without prestimulation.

Treatment

This study was initiated when J.L. was 7 months postonset of his aphasia. Following establishment of stable baseline measures, naming treatment was initiated simultaneously in both conditions. Figure 1 depicts the training task sequence.

Training was carried out three times a week in 1-hour sessions. Both the AP and the PP approaches were conducted in each session. The order of presentation was alternated across sessions. Initially, the subject was trained on 6 of the 10 treatment stimuli per condition (TS1). Each training item was presented twice per treatment session. Training with TS1 continued until 5 of the 6 treatment items (83%) were named accurately on two trials for two consecutive sessions. To assess the effects of training additional exemplars on response and stimulus generalization, the subject was then trained on the 4 remaining treatment stimuli (TS2) in addition to the last 2 items failed in TS1. Training on TS2 items was carried out until criterion was met again.

BL	*TS1*	*TS2*	*M*
	Training on 6 exemplars in AP and PP conditions*	Training on 4 new exemplars and last 2 items failed in TS1*	Maintenance of performance on exemplars no longer under treatment

Figure 1. Task sequence for the active prestimulation (AP) and passive prestimulation (PP) approaches. *Criterion: accurate responses on two trials for 5 of 6 exemplars for two consecutive treatment sessions.

Probes

Response generalization probes were conducted once weekly. All subject responses in both treatment conditions and probes were audio recorded for later scoring and reliability assessment. Approximately 10% of the subject's responses from both treatment sessions and probes were scored by a second examiner. Point-to-point interobserver reliability for specific response scores was determined to be .90.

RESULTS

Rate of Acquisition

Comparison of Figures 2a and 2b reveals that criterion was met for TS1 items in the active prestimulation (AP) condition in 10 training sessions as opposed to 9 training sessions in the passive prestimulation (PP) condition. For TS2 items, criterion was met in the AP condition in 3 sessions, whereas criterion had not been met after 6 sessions in the PP condition. At this point, the subject returned to Switzerland and thus was unavailable for further treatment or follow-up testing.

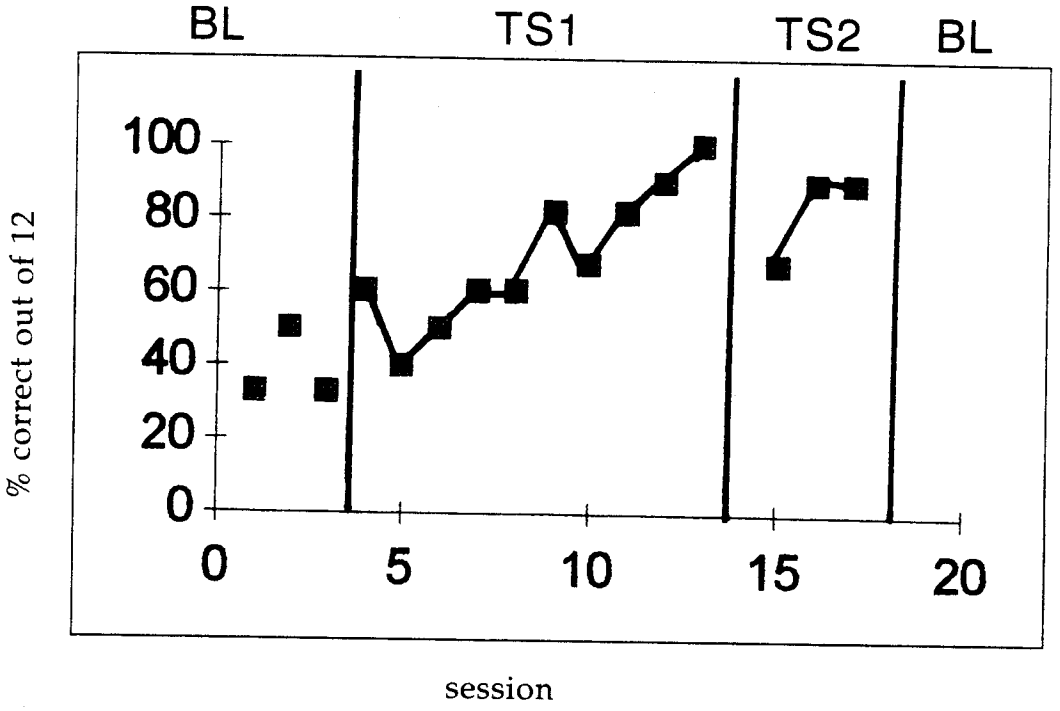
Stimulus Generalization—Visual Confrontation Naming Without Prestimulation for Trained Exemplars

Figures 3a and 3b compare performance in naming trained items in a visual confrontation naming (VCN) format with no prestimulation. Performance on AP training stimuli improved during training on TS1 items (Figure 3a), but performance on PP training stimuli did not (Figure 3b). VCN performance for TS2 items also improved for AP stimuli, whereas improved performance on PP stimuli was unstable.

Maintenance of Treatment Effects

Figure 4a shows that performance of the four AP stimuli on which training was stopped during TS2 was maintained at 100% accuracy during TS2 and when all AP treatment had been discontinued. Meanwhile, performance on the four PP items no longer under direct treatment deteriorated rapidly (Figure 4b).

2a. Active Prestimulation (AP)



2b. Passive Prestimulation (PP)

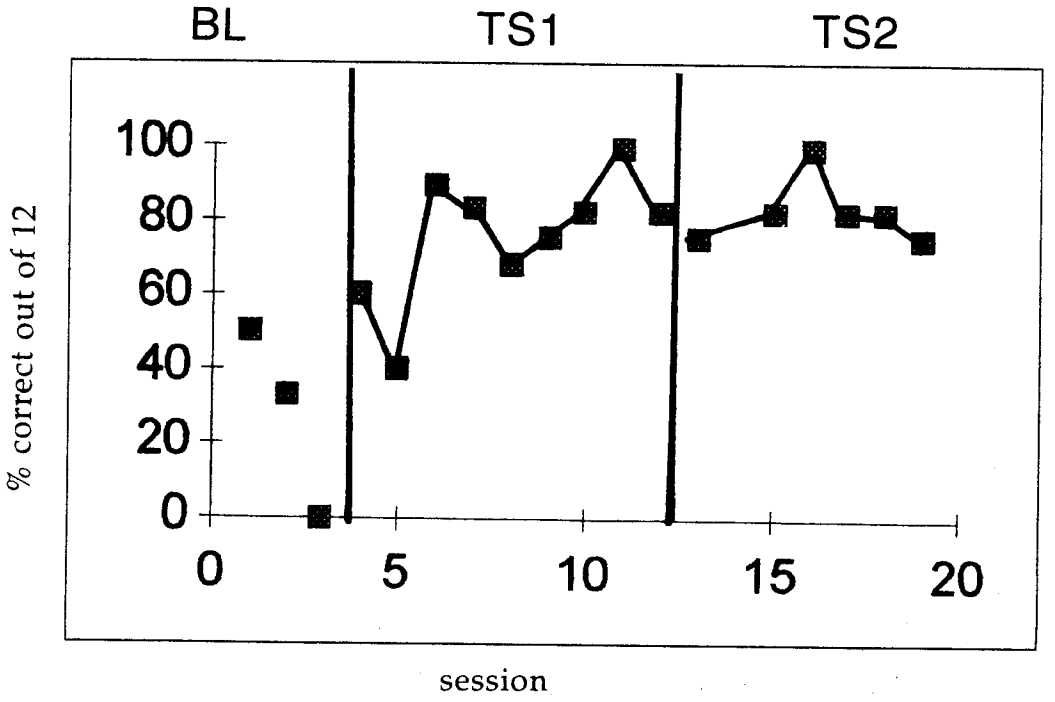
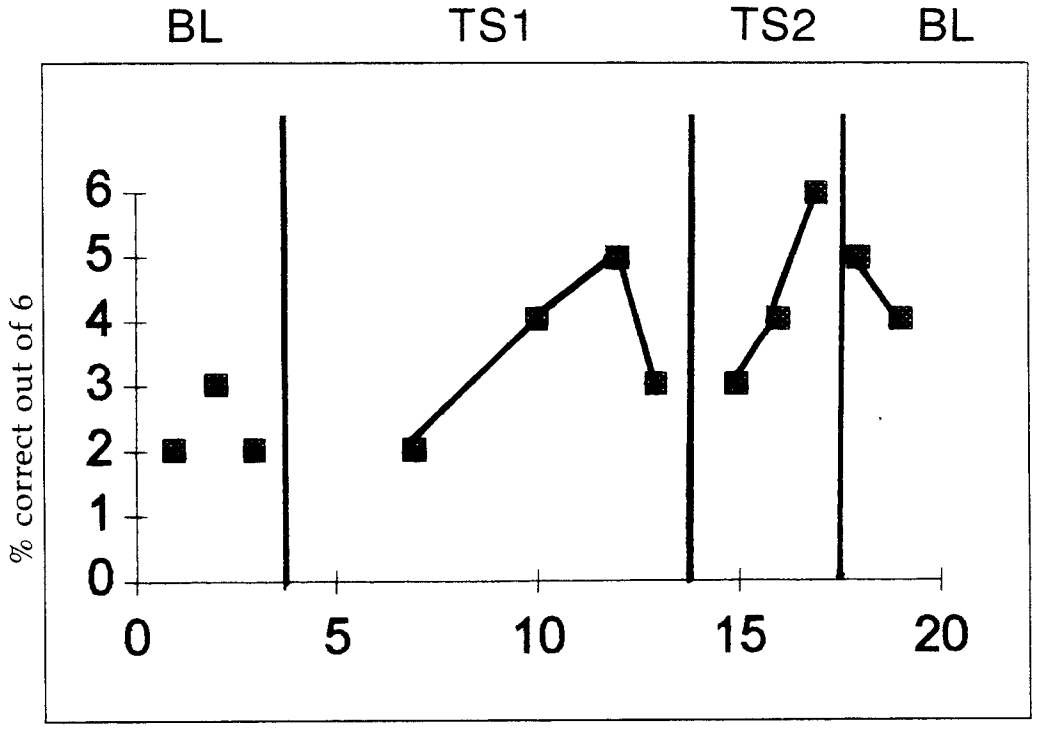


Figure 2. Acquisition rates (number of sessions to criterion) for trained exemplars.

3a. Active Prestimulation (AP)



3b. Passive Prestimulation (PP)

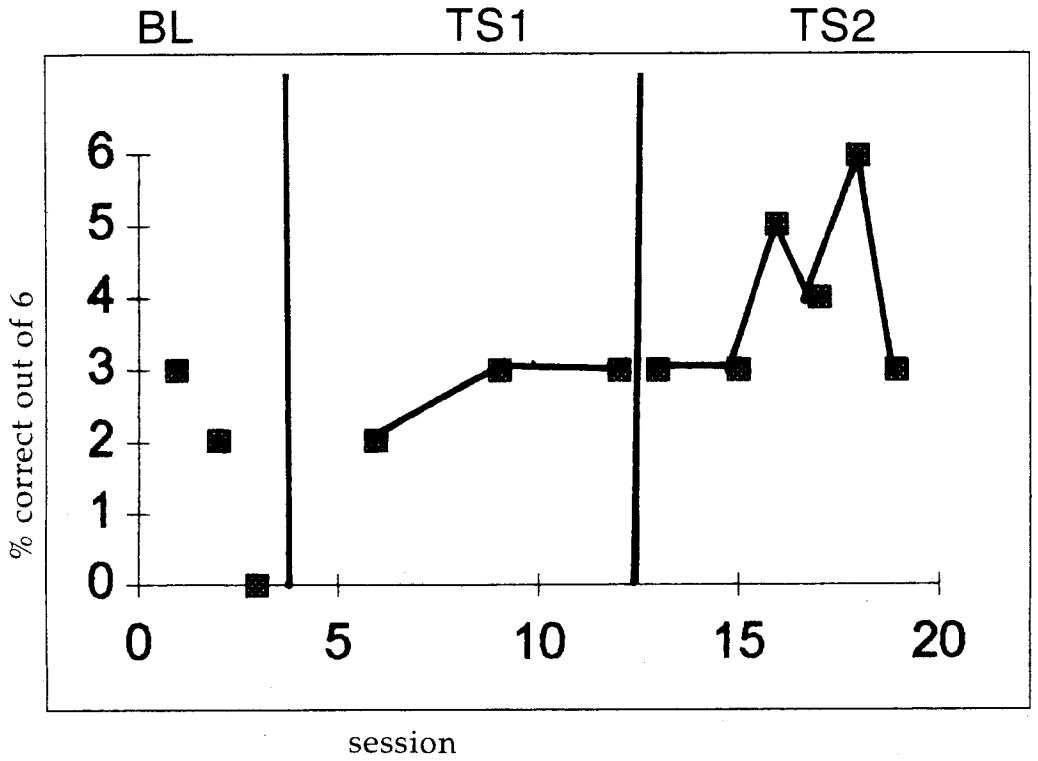
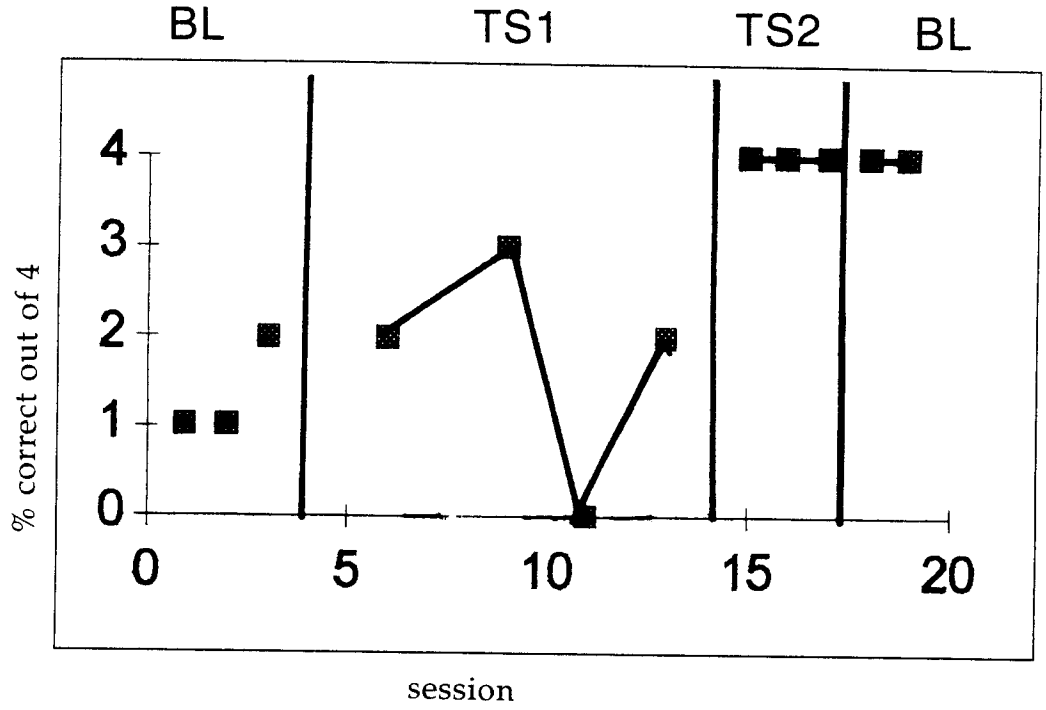


Figure 3. Generalization of trained exemplars to a visual confrontation naming (VCN) task without prestimulation.

4a. Active Prestimulation (AP)



4b. Passive Prestimulation (PP)

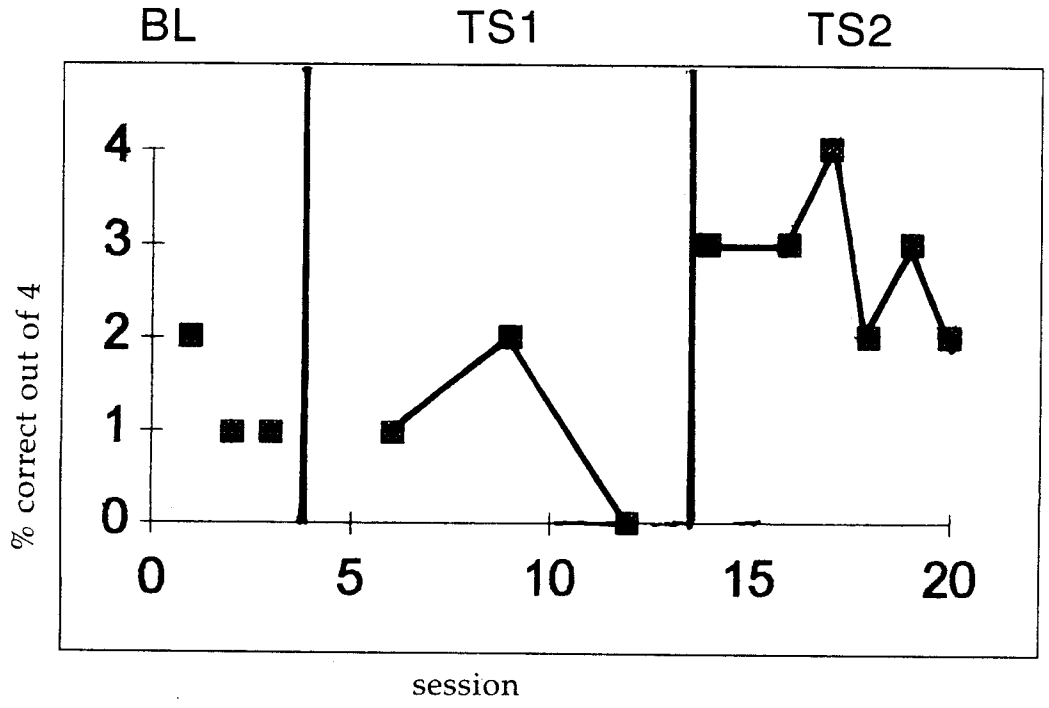


Figure 4. Maintenance of performance on trained items.

Response Generalization

Figure 5a shows that performance on untrained exemplars from categories trained in the AP condition remained within the baseline range. Performance on the untrained exemplars from categories trained in the PP condition improved slightly (Figure 5b).

Figure 6 shows improved performance for exemplars from untrained categories during TS1 and further improvement with training of additional exemplars during TS2.

DISCUSSION

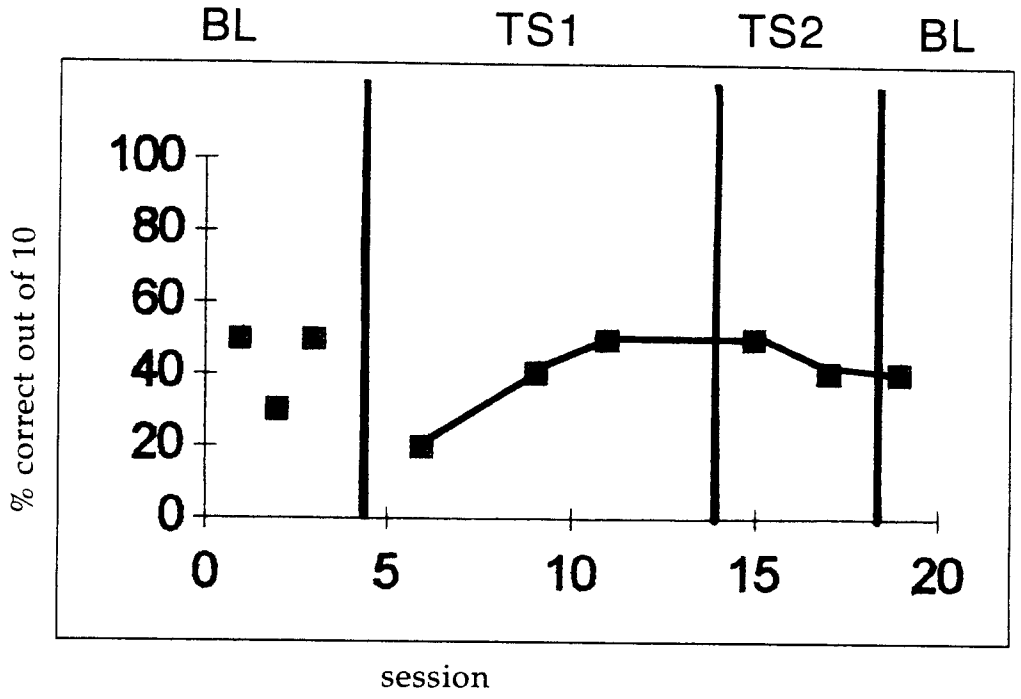
Overall, the results of this study provide modest support for the hypothesis that the active prestimulus (AP) approach better facilitates naming performance than does the passive prestimulus (PP) approach. For the first six items trained, criterion was reached in one less session in the PP than in the AP condition. However, with training of additional exemplars, a substantial advantage in acquisition rate was found for the AP condition. Maintenance of naming performance for previously trained items, in the absence of direct treatment, favored the AP approach. Response generalization to untrained exemplars from trained categories occurred only for the PP approach and was minimal.

The advantages in rate of acquisition and maintenance of naming performance for trained exemplars in the AP condition may be attributed to the active response required for the prestimulus. Differentiating the target item from both semantically related and unrelated foils may have led to greater activation of the neural representation of the target item than resulted from merely listening to the prestimulus. The result might be that these more fully activated semantic representations would then be more readily available when no prestimulation was provided.

The absence of response generalization to exemplars representing the categories trained under the AP condition suggests that requiring an overt response to the prestimulus did not result in any palliative activation of the neural representations of semantically related lexical items. Moreover, the approximately 30% improvement in naming performance for untrained exemplars from categories trained under the PP condition suggests that some significant degree of activation of these neural representations did occur. An explanation for these differences in response generalization is more challenging.

One possible explanation is that the items drawn from the categories used under the PP condition may have been more strongly semanti-

5a. Active Prestimulation (AP)



5b. Passive Prestimulation (PP)

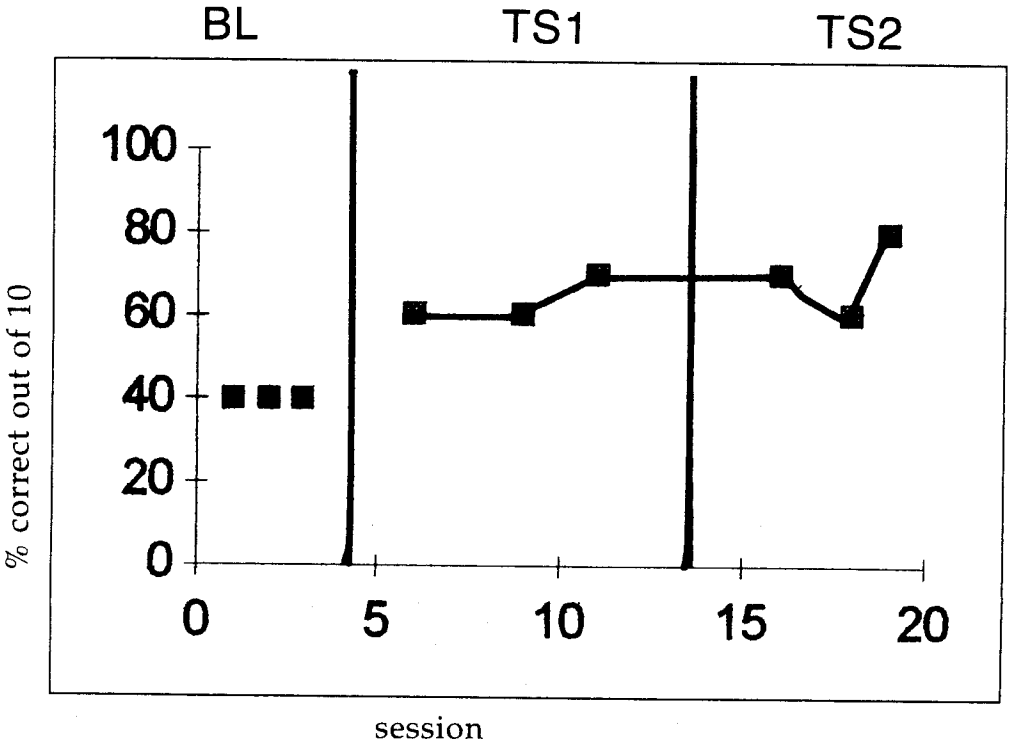


Figure 5. Generalization to untrained exemplars from trained categories.

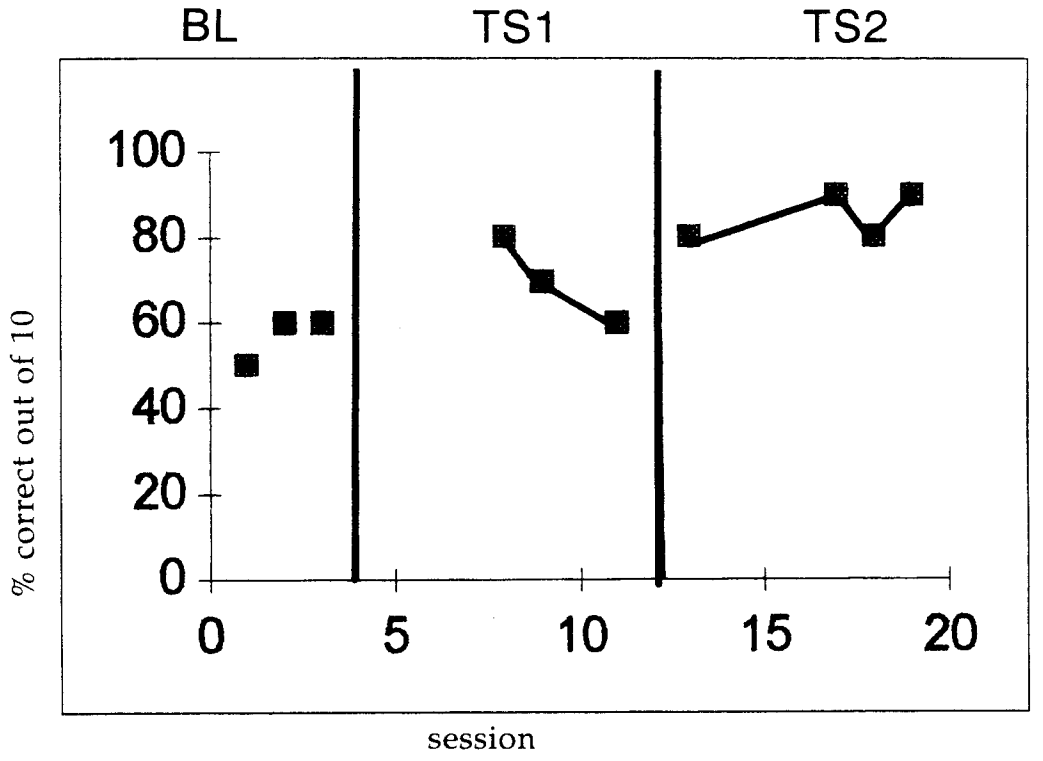


Figure 6. Generalization to exemplars from untrained categories.

cally related, at least within the current subject's lexicon. If, indeed, the neural representations of the trained and untrained exemplars used in the PP condition shared more components than those used in the AP condition, then greater response generalization would occur.

Another possible explanation for the difference in response generalization may be drawn from resource allocation theory. One might speculate that production of the overt response to the prestimulus in the AP condition may have diverted resources that in the PP condition permitted partial activation of the neural representations of semantically related lexical items. Such a diversion of resources may have resulted both from the differentiation of the target from the foil response choices and from the production of the pointing response. Thus, while the overt response required in the AP condition may have yielded more efficient acquisition of trained responses and greater maintenance, it may have contributed to limited generalization to untrained responses.

In spite of, if not because of, the inconsistencies in our results, further study of the relative efficacies of active versus passive prestimulation methods is warranted. The methods used should be applied to additional subjects. To address the issues raised by the semantic-

relatedness of stimulus items, all categories used to select stimuli should be represented in each set of stimulus items. In addition, future studies should consider such variables as the number of presentations of each trained exemplar per treatment session; the number of cues provided by the examiner as a potentially more sensitive indicator of the nature of the treatment process; procedural reliability data; and the use of more stringent task criteria. Furthermore, the studies would advocate generalization measures that are more distant from the treated responses and conditions, including maintenance measures, as well as generalization probes taken concurrently with the initiation of treatment and periodically thereafter.

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REFERENCES

Battig, W. F., & Montague, W. E. (1969). Category norms for verbal items in 56 categories: A replication and extension of the Connecticut category norms. *Journal of Experimental Psychology Monograph, 80*(3, Pt. 4), 1–48.

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

Hillis, A. E. (1989). Efficacy and generalization of treatment for aphasic naming errors. *Archives of Physical Medicine and Rehabilitation, 70,* 632–636.

Kertesz, A. (1979). *Western Aphasia Battery.* New York: Grune & Stratton.

Linebaugh, C., & Lehner, L. (1977). Cuing hierarchies and word retrieval: A treatment program. In R. H. Brookshire (Ed.), *Clinical Aphasiology: Conference proceedings.* Minneapolis: BRK Publishers.

McReynolds, L. V., & Kearns, K. P. (1983). *Single-subject experimental designs in communicative disorders.* Baltimore: University Park Press.

Thompson, C. K., & Kearns, K. P. (1981). An experimental analysis of acquisition, generalization, and maintenance of naming behavior in a patient with anomia. In R. H. Brookshire (Ed.), *Clinical aphasiology: Conference proceedings.* Minneapolis: BRK Publishers.

APPENDIX: TREATMENT AND PROBE STIMULI

Condition	*Training Items*	*Generalization Items*
Active prestimulation	hammer	nail
	chisel	screwdriver
	drill	ruler
	brush	pliers
	crowbar	pencil
	bed	window
	lamp	desk
	rug	stool
	vase	bookcase
	picture	mirror
Passive prestimulation	knife	fork
	spatula	pan/pot
	mixer/blender	stove
	sink	rolling pin
	toaster	jar
	airplane	train
	truck	motorcycle
	tractor	boat
	pram	wagon
	skate	sled

Generalization Items from Untrained Categories

house	necktie
church	glove
tent	belt
igloo	boot
barn	vest