7. Experimental Analysis of Aphasia Treatment Tasks: A Preliminary Report

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Stimulation approaches to aphasia treatment have been promoted by those who consider aphasia a multimodal disorder (Davis, 1983; Schuell, Jenkins, & Jimenez-Pabon, 1964). Stimulation involves the clinical aphasiologist's use of facilitators to elicit responses from the patient that will improve functioning within the modality being treated, as well as enhancing performance in related, but untreated, modalities. An example would be using picture identification to improve a patient's single-word comprehension, which might also improve functioning on an untreated task such as picture labeling.

In stimulation therapy, the choice of specific facilitators is individualized and governed by the severity of the patient's aphasia, the deficit pattern, and other factors. Studies in which the treatment provided has been described as stimulation reflect this trend. Wertz and colleagues (1986), in describing treatment for groups of aphasic patients participating in VA Cooperative Study #110, state:

> Treatment for all patients was individual, usually stimulus-response treatment, and designed to improve language deficits in auditory comprehension, reading, oral expressive language, and writing. Specific techniques were designed to meet each patient's deficits. These ranged from traditional facilitation methods—such as picture identification, verbal repetition, sentence completion, and confrontation naming to specific programs such as Melodic Intonation Therapy and PACE. (p. 655)

Similarly, Basso, Capitani, and Vignolo (1979) stated:

> Language rehabilitation followed the so-called stimulation approach. In this stimulus-response situation the therapist endeavors to elicit and consol-

> idate language responses by giving stimuli and reinforcements. Aphasic patients may be unable to produce a given language response voluntarily but may produce it automatically in response to a facilitator. At times it is possible to first facilitate the response in a more automatic way and then to withdraw the facilitator. This passage from more automatic to more voluntary forms the core of rehabilitation. (p. 192)

In his chapter on Schuell's stimulation approach to aphasia therapy, Duffy (1986) notes that "while stimulation therapy is widely used, it is difficult to make a single empirically based statement about the efficacy of this treatment." This may be interpreted to mean that it is unclear what transpires in stimulation therapy that helps the patient and under what kinds of conditions treatment efforts are optimized. Under such circumstances it has been difficult to construct a model for aphasia treatment.

In 1984, we initiated a project to construct a model of aphasia treatment. We designed a group study in which (a) training tasks and procedures were defined explicitly, (b) task stimuli were identical, (c) the amount and duration of training were equal, and (d) a common dependent variable was employed to determine the degree to which training generalized to an untreated task. Because the individual differences among aphasic subjects precluded carrying out a clinically based group study design, we designed an experiment similar to that reported by Horner and LaPointe (1979) and to earlier studies of Glass, Gazzaniga, and Premack (1973) and Carson, Carson, and Tikofsky (1968). We developed tasks using artificial stimuli that would stimulate treatment processes, but that would not be biased by prior experience and individual subject variability. This report describes the project and presents some preliminary results.

METHODS

Subjects

Twenty-two chronic, stable aphasic adults, 20 men and 2 women (see Table 7.1 for details), participated in the experiment. Twenty were right handed, 7 were nonfluent, and 15 were fluent speakers. Nineteen became aphasic after a left-hemisphere thromboembolic cerebrovascular accident (CVA). Subjects' ages ranged from 29 to 66 years with a mean of 55 years. Time of aphasia ranged from 4 to 144 months with a mean of 34 months; education ranged from 9 to 26 years with a mean of 13.4 years. With few exceptions, subjects presented with moderate-to-mild aphasia deficits. Overall scores on the *Porch Index of Communicative Ability* (Porch, 1981)

TABLE 7.1. SUMMARY OF APHASIC SUBJECTS

Age/Sex	*Months Post-Onset*	*Etiology*	PICA *%ile*	*Token Test (# correct of 62 items)*	*Education (years)*	*Handedness*	*Speech*
59/M	4	L CVA	72	25	11	Right	Nonfluent
38/M	120	Aneurysm	79	56	14	Right	Fluent
29/M	36	Head Injury	65	6	9	Right	Nonfluent
59/M	22	L CVA	60	39	12	Right	Nonfluent
64/M	14	L CVA	62	45	14	Right	Fluent
63/M	9	L CVA	60	35	12	Right	Fluent
65/M	80	L CVA	78	51	16	Right	Fluent
59/M	5	L CVA	83	53	16	Left	Fluent
56/M	15	L CVA	87	46	10	Right	Fluent
46/M	8	L CVA	59	48	14	Right	Fluent
59/M	9	L CVA	79	54	12	Right	Fluent
52/M	28	L CVA	54	28	10	Right	Nonfluent
45/M	10	L CVA	87	43	12	Right	Fluent
50/M	13	L CVA	90	56	14	Right	Fluent
55/M	9	L CVA	66	49	26	Right	Fluent
59/M	59	L CVA	49	8	20	Right	Fluent
64/M	13	L CVA	52	15	12	Right	Nonfluent
41/M	11	L CVA	88	58	12	Left	Fluent
60/F	144	Aneurysm	79	13	13	Right	Nonfluent
64/F	66	L CVA	84	48	13	Right	Fluent
55/M	14	L CVA	59	20	14	Right	Fluent
66/M	57	L CVA	81	54	9	Right	Fluent

Note: CVA = cerebrovascular accident.

Auditory Comprehension (AC). The subject listened to the word spoken by the examiner and pointed to one of four symbols.

Auditory Comprehension Without Verbal Rehearsal (AC – R). This condition was identical to the AC condition except that the subject was prevented from rehearsing the words verbally during the training task through (a) the use of a bite block by the subject to restrict overt articulatory movements, (b) finger tapping by the subject for 6 seconds between stimulus presentation and the subject's response, and (c) instructions to the subject to cease any verbalizations during the training task. Six practice trials using stimuli that were not included in the actual training task were given to ensure that the task was understood by the subject.

Visual Comprehension (VC). The subject was presented with a printed word and asked to point to one of four symbols.

Auditory and Visual Comprehension (AC + V). The subject was presented with a printed word as the examiner simultaneously said the word. The subject pointed to the correct item in the four-symbol array.

Repetition (R). The examiner presented the symbol associated with the word and simultaneously said the word. The subject repeated the word.

Simple Cueing (SC). The examiner presented a symbol and provided a simple sentence-completion cue, for example, "Bake a . . . ," Read a . . . ," and "Sing a . . ." The subject said the word that completed the sentence and was associated with the symbol.

Complex Cueing (CSC). The examiner presented a symbol and provided an open-ended sentence. For example, "Tie the present with a . . . ," and "The country was ruled by the . . ." The subject said the word that completed the sentence and was associated with the symbol.

Self-Prompt (SP). When introducing the subject to the task, the examiner presented the symbol and provided the word associated with the symbol. Then the subject was asked to create a self-prompt in the form of an association, mnemonic, phrase, or some other internal cue that would assist him or her in remembering the pairing. During the training, the subject was first asked to label the symbol; if the subject could not do this, he or she was asked to produce a self-prompt to see if this would trigger the correct label. When the correct label was not evoked, the subject was reminded of both the self-prompt and the correct label.

Figure 7.1. Description of simulated treatment tasks.

spanned the 49th to the 90th percentile with a mean of 71.5; scores on the 62-item version of the *Token Test* (Spreen & Benton, 1969) ranged from 6 to 58 correct with a mean score of 37.

Simulated Treatment Tasks

Eight tasks simulating procedures and techniques used in aphasia stimulation treatment were developed. Experimental tasks are completely described in Figure 7.1. (Each task required the subject to learn to associate a real word with a visual symbol. Four recognition tasks—auditory comprehension (AC), auditory comprehension without rehearsal (AC - R), visual comprehension (VC), and auditory and visual comprehension (AC + V)—demanded a pointing response. Four production tasks—repetition (R), simple-sentence completion (SC), a self-prompt (SP), and complex-sentence completion (CSC)—required a verbal response.

On the recognition tasks, the subject viewed four symbols. Representative examples of stimulus items for these tasks are shown in Figure 7.2 and described in Figure 7.1. On the AC - R task, the examiner said the word to be associated with the symbol and the subject pointed to the appropriate symbol. The subject was prevented from rehearsing verbally by limiting articulatory movements with a bite block and by having the subject perform a finger-tapping task for 6 seconds between stimulus presentations. The AC task was identical to the AC - R task with the exception that no restrictions were made to avoid the patient's rehearsal behavior. On the VC task the subject saw a printed word and pointed to the appropriate picture. For the AC + V task the printed and spoken words were provided simultaneously.

On the production tasks, the subject saw a single symbol as depicted in Figure 7.3 and described in Figure 7.1. For the repetition (R) task the examiner presented the symbol, said the word associated with the symbol, and had the subject repeat it. On the simple-sentence-completion (SC) task the examiner provided a phrase or sentence that was intended to elicit a high probability and convergent associate such as "Bake a . . ." or "Read a . . ." and the subject provided the word to complete the sentence. On the SP task the examiner presented the symbol and supplied the word associate. The examiner then asked the subject to create his or her own self-prompt in the form of an association, mnemonic, descriptive phrase, or some other internal cue that would assist the subject in remembering it. For the complex-sentence completion, the examiner provided a sentence-completion cue so as to elicit an associative response that would not ordinarily occur as an automatic response to the stimulus, such as "Tie the present with a *string*" or "The country was ruled by the *king*."

Procedures

Each task contained 12 word-symbol pairs. Symbols were obtained from the Bliss system (Hehner, 1983) but words assigned to symbols were not those employed in the Bliss system itself so as to avoid pictorial associations on the part of the subjects. Standardized instructions were developed for each task and when necessary, as was the case with the AC - R task, practice items were given. Prior to beginning training for each task,

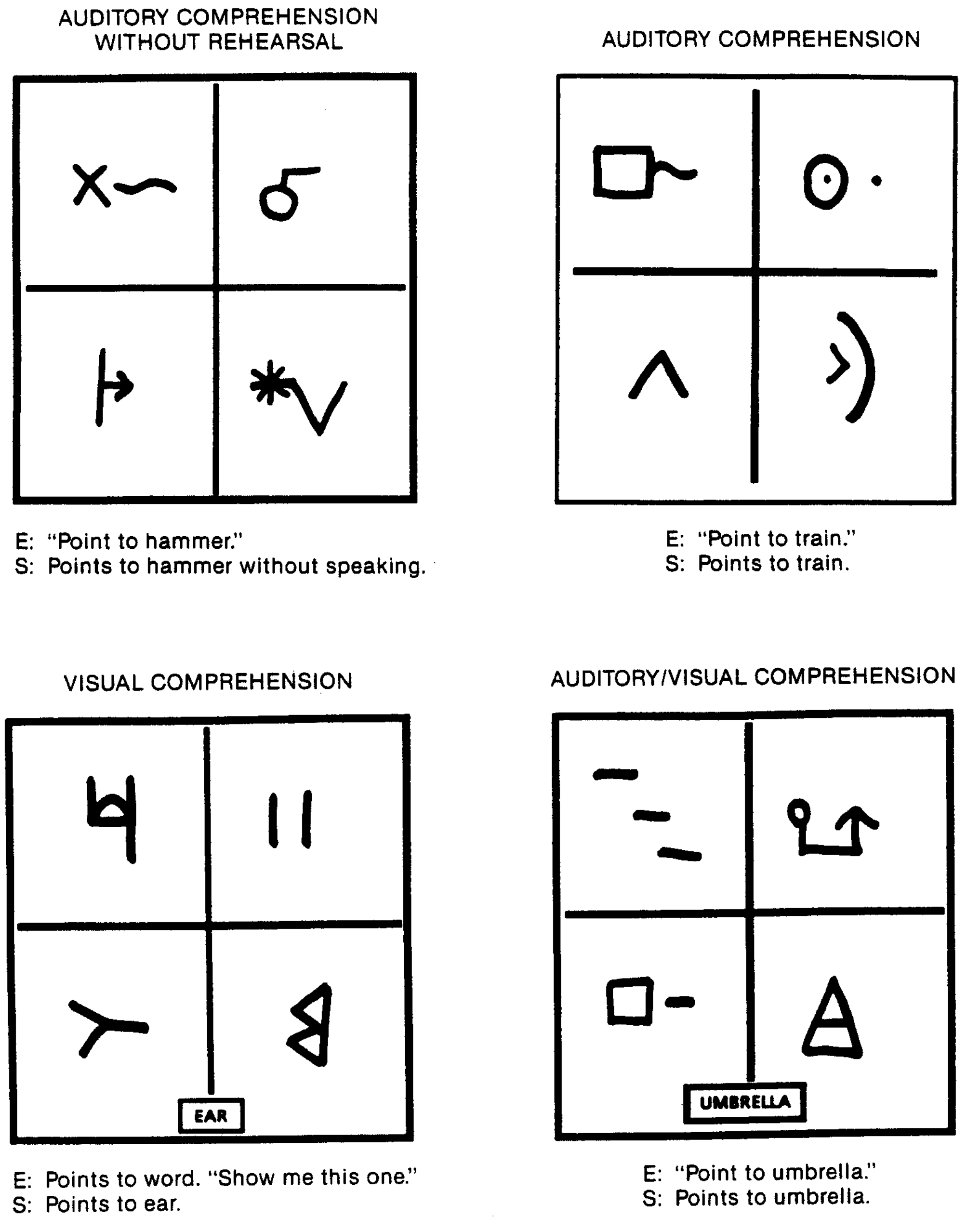

Figure 7.2. Representative stimulus items for recognition tasks.

the subject was shown each symbol singly and provided the word to be associated with the symbol. This was necessary because our pilot work indicated that subjects became upset and anxious when they had no idea of the associative response demanded of them.

Table 7.2 summarizes the task training sequence and probe measures obtained. Training on each task consisted of six blocks of four 12-item

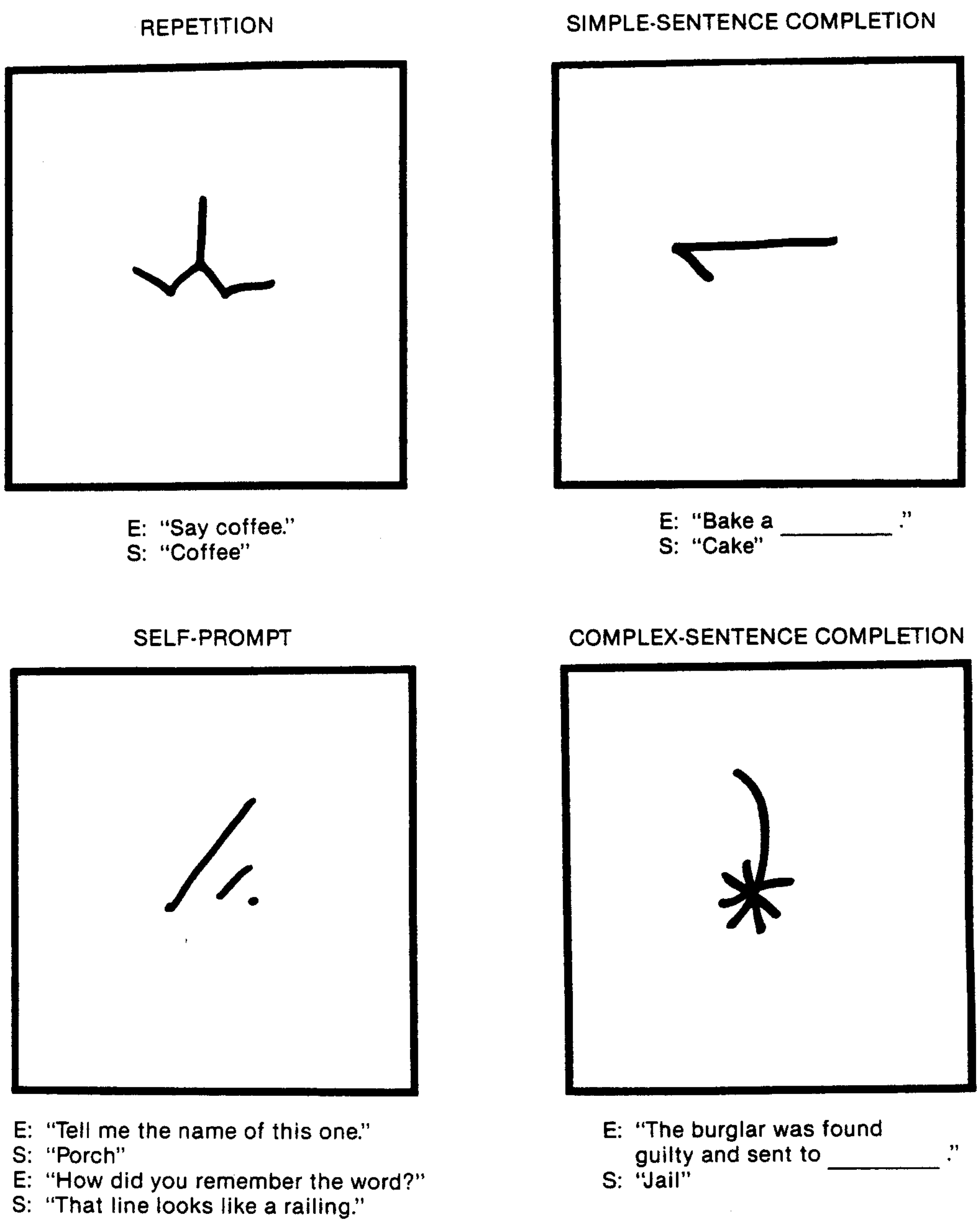

Figure 7.3. Representative stimulus items for production tasks.

trials. On recognition tasks location of the correct stimulus was randomized from trial to trial. The order of presentations was randomized across trials for all tasks. The order of presentation of the eight paired associate tasks was counterbalanced across subjects. As depicted in Table 7.2, subjects received three blocks of training on one day and another three blocks of training three or fewer days later.

TABLE 7.2. SEQUENCE OF TRAINING TASK AND LABELING PROBE ADMINISTRATION

	Day 1	
Block #1	Block #2	Block #3
Trial #1	Trial #5	Trial #9
#2	#6	#10
#3	#7	#11
#4	#8	#12
Probe #1	Probe #2	Probe #3
	Day 2	
Block #4	Block #5	Block #6
Trial #13	Trial #17	Trial #21
#14	#18	#22
#15	#19	#23
#16	#20	#24
Probe #4	Probe #5	Probe #6

Labeling Probe. After each training block (four trials), the subject was presented each of the 12 symbols singly and asked to provide the associated word.

Follow-Up Probe. To determine if subjects retained the ability to label the symbols without training, a follow-up probe was administered 1 week after completion of training. Again, the 12 symbols were presented singly and the subject was asked to provide the associated word.

Scoring of Probe Responses. Probe responses were scored right or wrong. Responses containing minor articulatory errors which clearly indicated that the subject knew the label were scored correct. Feedback regarding accuracy of responses was minimized and the examiner did not repeat the word associated with the symbol during probe administration.

RESULTS

Data analyzed from the experiment to this point include subjects' and group mean scores on verbal labeling probes 1 and 6 and the follow-up probe. One-way analyses of variance (ANOVAs) were performed to determine if there were within-task and between-task differences for the three probe measures. When differences were evident, multiple comparisons were made using the Bonferroni method (Kirk, 1968).

Table 7.3 presents the ANOVA results comparing subjects' performance on Probe 1 and Probe 6, and Probe 6 and the follow-up probe. Subjects improved their performance on the untreated verbal labeling task from Probe 1 to Probe 6 following training on all eight tasks. Improvements were statistically significant ($p < .01$) on all tasks except the self-prompt task, for which improvements in labeling from Probe 1 to Probe 6 were statistically significant ($p < .05$). Figure 7.1 also shows that comparisons of labeling scores from Probe 6 and the follow-up probe decreased statistically significantly ($p < .01$) on all tasks except the self-prompt task, which did not differ significantly from Probe 6.

Between-Task Analysis

Tables 7.4 through 7.6 summarize ANOVA results for between-task comparisons on Probe 1, Probe 6, and the follow-up probe, respectively. Nine between-task differences were statistically significant on Probe 1. Five were accounted for by the fact that scores following self-prompt training were significantly higher than those following training in five tasks: AC, VC, AC + V, AC – R, and SC. Three differences were attributed to the fact that labeling scores following the AC – R condition were statistically significantly lower than those following AC, R, and CC training.

On Probe 6 only three between-task differences were statistically significant. Specifically, scores following the AC – R condition were significantly lower than those following R, SP, and CSC conditions.

On the follow-up probe there were nine statistically significant between-task differences. Seven involved the self-prompt task for which follow-up labeling probe scores were significantly higher than for all other tasks.

DISCUSSION

The authors acknowledge that our experimental tasks only "simulate" aspects of aphasia treatment. They were chosen so that we could conduct a group study that met certain methodological requirements and that would not be affected by prior learning and individual differences. Moreover, we have completed only a preliminary analysis of our results using selected probe data.

Given these caveats, do our results have theoretical implications for aphasia treatment? We believe that they do. We found that training on eight different paired-associate tasks led to improvements on an untreated verbal labeling task for which no training was provided. This is what is supposed to happen in stimulation therapy given the multimodal nature

TABLE 7.3. ANOVA RESULTS COMPARING SUBJECTS' PERFORMANCE ON PROBES 1 AND 6 AND PROBE AND FOLLOW-UP

AC

Probe	1	6	F/U
Mean	6.09	9.23	6.27
1	—	**	
6		—	**
F/U			—

VC

Probe	1	6	F/U
Mean	4.41	8.55	4.23
1	—	**	
6		—	**
F/U			—

A & V

Probe	1	6	F/U
Mean	5.41	9.09	5.36
1	—	**	
6		—	**
F/U			—

AC - R

Probe	1	6	F/U
Mean	3.77	7.45	5.14
1	—	**	
6		—	*
F/U			—

R

Probe	1	6	F/U
Mean	6.77	9.77	6.45
1	—	**	
6		—	**
F/U		—	

SC

Probe	1	6	F/U
Mean	5.09	8.95	5.23
1	—	**	
6		—	**
F/U			—

SP

Probe	1	6	F/U
Mean	8.32	10.64	9.04
1	—	*	
6		—	
F/U			—

CC

Probe	1	6	F/U
Mean	6.45	10.32	6.50
1	—	**	
6		—	**
F/U			—

Note: ANOVA = analysis of variance.
$^{*}p \leq .05$. $^{**}p \leq .01$.

Treatment Tasks

AC = Auditory comprehension.
VC = Visual comprehension.
A + V = Auditory and visual comprehension.
AC - R = Auditory comprehension without rehearsal.
R = Repetition.
SC = Simple cuing.
SP = Self-prompt.
CC = Complex cuing.

TABLE 7.4. SUMMARY OF ANOVA RESULTS FOR PROBE 1

Treatment Task	*AC*	*VC*	*A + V*	*AC – R*	*R*	*SC*	*SP*	*CC*
Mean	*6.09*	*4.41*	*5.41*	*3.77*	*6.77*	*5.09*	*8.32*	*6.56*
AC	—			*			*	
VC		—			*		**	
A + V			—				**	
AC - R				—	**		**	**
R					—			
SC						—	**	
SP							—	
CC								—

Note: ANOVA = analysis of variance.
*$p \leq .05$. **$p \leq .01$.
AC = Auditory comprehension.
VC = Visual comprehension.
A + V = Auditory and visual comprehension.
AC - R = Auditory comprehension without rehearsal.
R = Repetition.
SC = Simple cuing.
SP = Self-prompt.
CC = Complex cuing.

TABLE 7.5. SUMMARY OF ANOVA RESULTS FOR PROBE 6

Treatment Task	*AC*	*VC*	*A + V*	*AC – R*	*R*	*SC*	*SP*	*CC*
Mean	*9.23*	*8.55*	*9.09*	*7.45*	*9.77*	*8.95*	*10.64*	*10.32*
AC	—							
VC		—						
A + V			—					
AC - R				—	*		**	**
R					—			
SC						—		
SP							—	
CC								—

Note: ANOVA = analysis of variance.
*$p \leq .05$. **$p \leq .01$.
AC = Auditory comprehension.
VC = Visual comprehension.
A + V = Auditory and visual comprehension.
AC - R = Auditory comprehension without rehearsal.
R = Repetition.
SC = Simple cuing.
SP = Self-prompt.
CC = Complex cuing.

TABLE 7.6. SUMMARY OF ANOVA RESULTS FOR FOLLOW-UP PROBE

Treatment Task	*AC*	*VC*	*A + V*	*AC – R*	*R*	*SC*	*SP*	*CC*
Mean	*6.27*	*4.23*	*5.36*	*5.14*	*6.45*	*5.23*	*9.04*	*6.50*
AC	—						**	
VC		—			*		**	*
A + V			—				**	
AC – R				—			**	
R					—		**	
SC						—	**	
SP							—	**
CC								—

Note: ANOVA = analysis of variance.
*$p \leq .05$. **$p \leq .01$.
AC = Auditory comprehension.
VC = Visual comprehension.
A + V = Auditory and visual comprehension.
AC – R = Auditory comprehension without rehearsal.
R = Repetition.
SC = Simple cuing.
SP = Self-prompt.
CC = Complex cuing.

of aphasia. However, a follow-up probe one week after cessation of training showed subjects' labeling probe scores dropping to Probe 1 levels on all tasks except one, the self-prompt task. This task distinguished itself clearly from other tasks at follow-up.

What is it about the self-prompt task that seems to assist subjects in remembering the labels associated with the symbols? Possible explanations arise from studies of the processes of normal human memory and provide food for thought. The first involves Schulman's (1970) principle of congruity. This suggests that memory performance is enhanced to the extent that the context, or encoding question, forms an integrated unit with the word presented. A congruous encoding yields superior memory performance because a more elaborate trace is laid down and in such cases the structure of semantic memory can be used more effectively to facilitate retrieval. A second explanation implicates the work of Craik and his colleagues (Craik & Lockhart, 1972; Craik & Tulving, 1975; Craik & Watkins, 1973). The basic notion here is that the persistence of the memory trace is a positive function of the "depth" of stimulus processing. Depth refers to a greater degree of semantic involvement. Normal human memory research has illustrated that when subjects are required to process words to different depths, both recall and recognition memory performance are enhanced under deeper conditions of encoding than under "shallow" or intermediate conditions.

The self-prompt task required subjects to establish a personalized internal cue to help them remember the word to be associated with the Bliss symbol. Significantly better verbal labeling scores at follow-up suggest that subjects were forced to use a deeper level of processing for this training paradigm than the others selected. Craik and colleagues also point out that deeper levels of stimulus processing take more time and this was the case with the self-prompt task.

Results also indicate that subjects' labeling scores following the auditory comprehension task in which rehearsal was prevented fell consistently below those for many other tasks at Probe 1, Probe 6, and follow-up. This may indicate that opportunity for rehearsal is important, a fact implicit in much memory research. We also recognize the atypicality of this task and the fact that the subject may have been frustrated by it.

We cannot generalize our findings to aphasia treatment, but at a time when language and cognition are separated by a hyphen rather than a comma and many (Fodor, 1983; McNeil, 1982; Wepman, 1976) consider aphasia as much a cognitive disorder as a linguistic disturbance, we need to think about what occurs in stimulation therapy to aid the patient as well as the overall outcome. As Horner and LaPointe (1979) suggested some time ago, it is important to know that the aphasic patient can learn and how learning is optimized.

Carrying out such a study has forced us to a "deeper level of processing" with respect to the tasks of aphasia treatment. Appropriately, Rosenbek, LaPointe, and Wertz (1989), in commenting on Fodor's notion of the "cognitive impenetrability" of the language system, point out that if Fodor is correct in his assumption that language activities can occur independently of central, horizontal processes, then simple facilitation and elicitation procedures may simply activate the damaged module without affecting it or contributing to its repair. Successful treatment—that is, treatment that makes a response, once elicited, more likely to reappear—may require activities that enhance cognitive penetration.

We do not know if the self-prompt task signified cognitive penetration, deeper levels of processing, or heightened congruity, but it is apparent that recall, as measured by labeling scores at follow-up, was superior for this task. We must analyze our results further and, as always, additional research is needed to determine what it is in stimulation therapy that helps aphasic patients get better.

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