CHAPTER

23

A Computer Program to Improve Written Confrontation Naming in Aphasia

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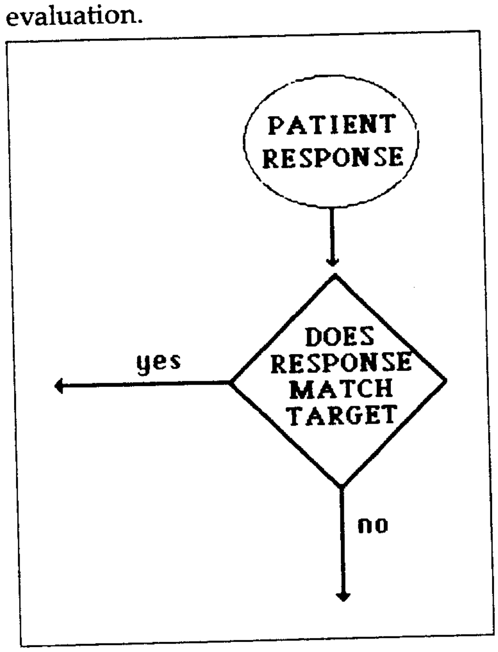
One goal of aphasia treatment is to help patients reach their language potential in all communicative modalities. However, treatment time and resources are limited, and necessity may dictate focusing treatment on auditory and verbal skills, as these modalities are more functional and social. Treatment of reading and writing skills is usually minimal and limited to assigned homework and workbook drills in which patients work alone and without immediate knowledge of results. In this situation, the clinician sees only the final product, and the patient's progress is not monitored or modified.

Reading and writing can affect aphasic patients' quality of life and independence. Speech pathologists seek means to treat these modalities without usurping time devoted to auditory comprehension and verbal expression. Computers are a potential solution because they are designed to administer and monitor reading and writing tasks.

Many reading activities have been easily transferred to the computer. Writing activities, however, are less easily adapted to the computer. At the simplest level, writing programs can assess accuracy by comparing a typed response with a model of the target (Fig. 23-1). One of two contingencies is presented depending on the accuracy of the response. More sophisticated programs use a series of binary branching steps to evaluate a typed response and present appropriate contingencies (Fig. 23-2). Each branch presents the patient with new information, selected to enhance and stabilize performance and to help learning generalize from typing to writing.

Figure 23-1. Simplest level of evaluation.



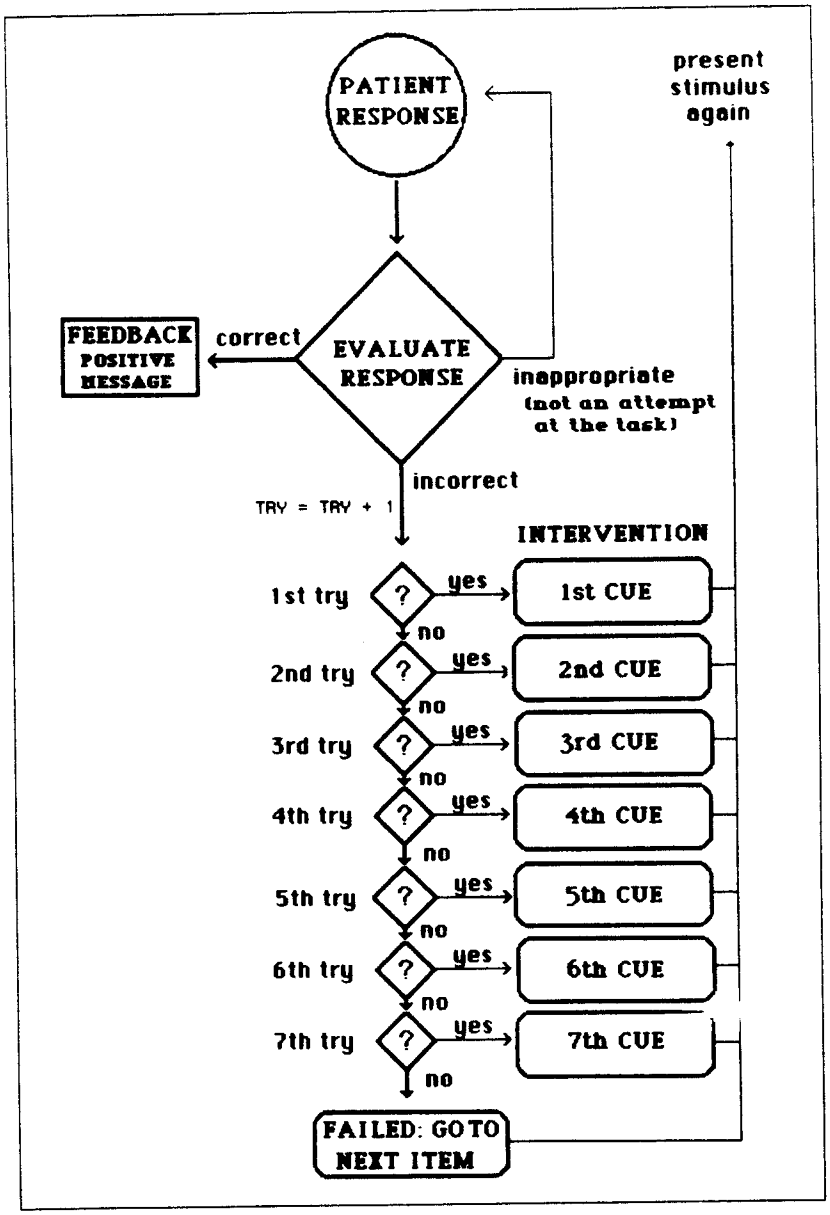


Figure 23-2. Series of binary conditional branching steps to evaluate a response.

Several investigators have incorporated complex branching techniques in computerized writing programs to provide multilevel intervention. Seron, Deloche, Moulard, and Rouselle (1980) described a rudimentary program on a minicomputer that helped aphasic patients learn to type words to dictation. Intervention consisted of three levels of feedback: the number of letters in the target word; whether the letter was typed in the word; and when the correct letter was typed, whether that letter was in the correct position (Fig. 23-3). After an average of 15 sessions completed

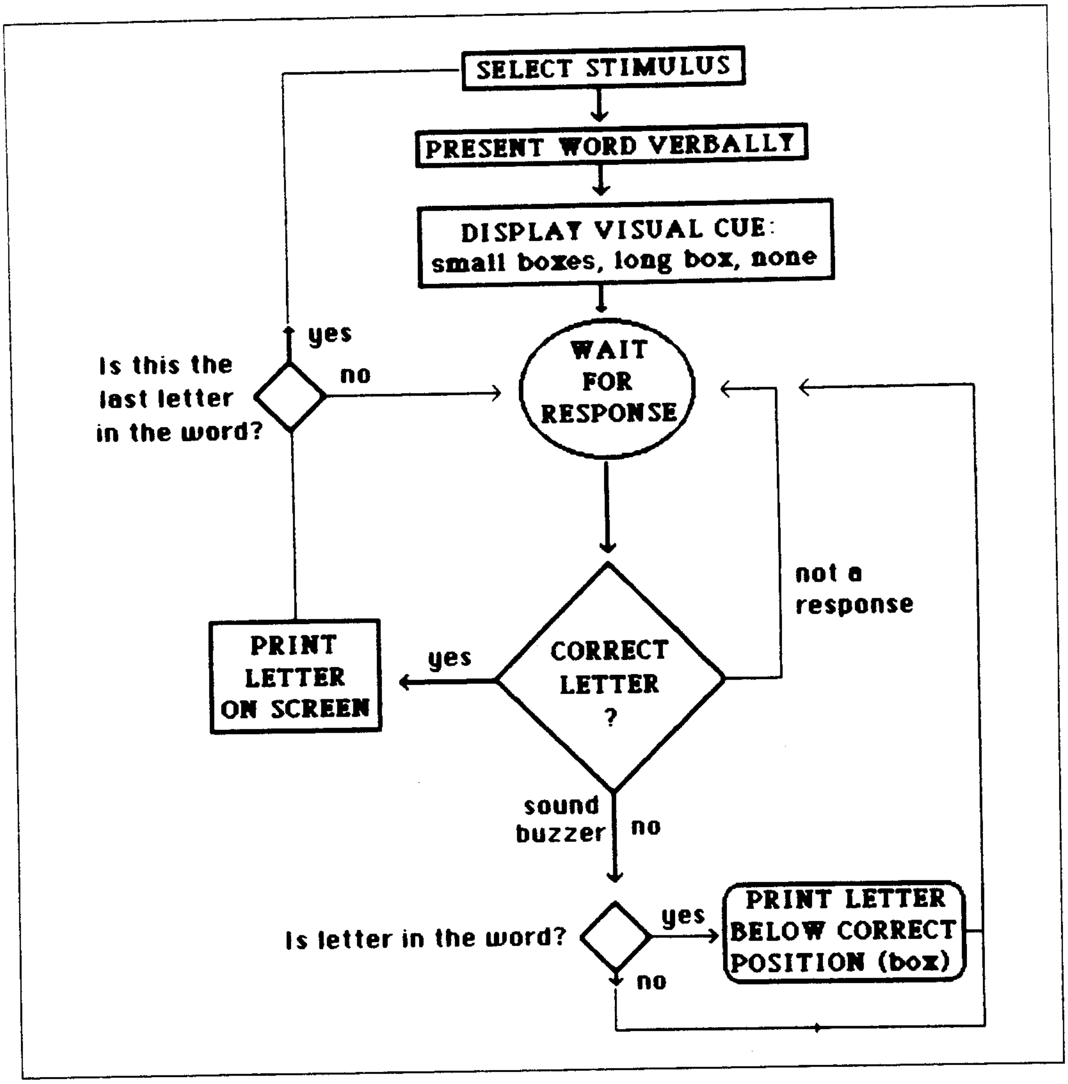


Figure 23-3. Flow chart of Seron, Deloche, Moulard, and Rouselle (1980) program.

within about 2 months, the group of five subjects wrote words more accurately on a pre/post-treatment set of words.

Katz and Nagy (1984) used complex branching steps to evaluate responses and provide patients with specific feedback in a computerized spelling task. Single and multiple cues from a hierarchy of six were selected by the program in response to the number of errors made for each of 10 stimuli (Fig. 23-4). Additional feedback included repetition of the successful and most recently failed cues and pencil-and-paper copying assignments automatically generated by the computer printout. Pre- and post-writing tests revealed improved spelling of the target words for seven of the eight aphasic subjects.

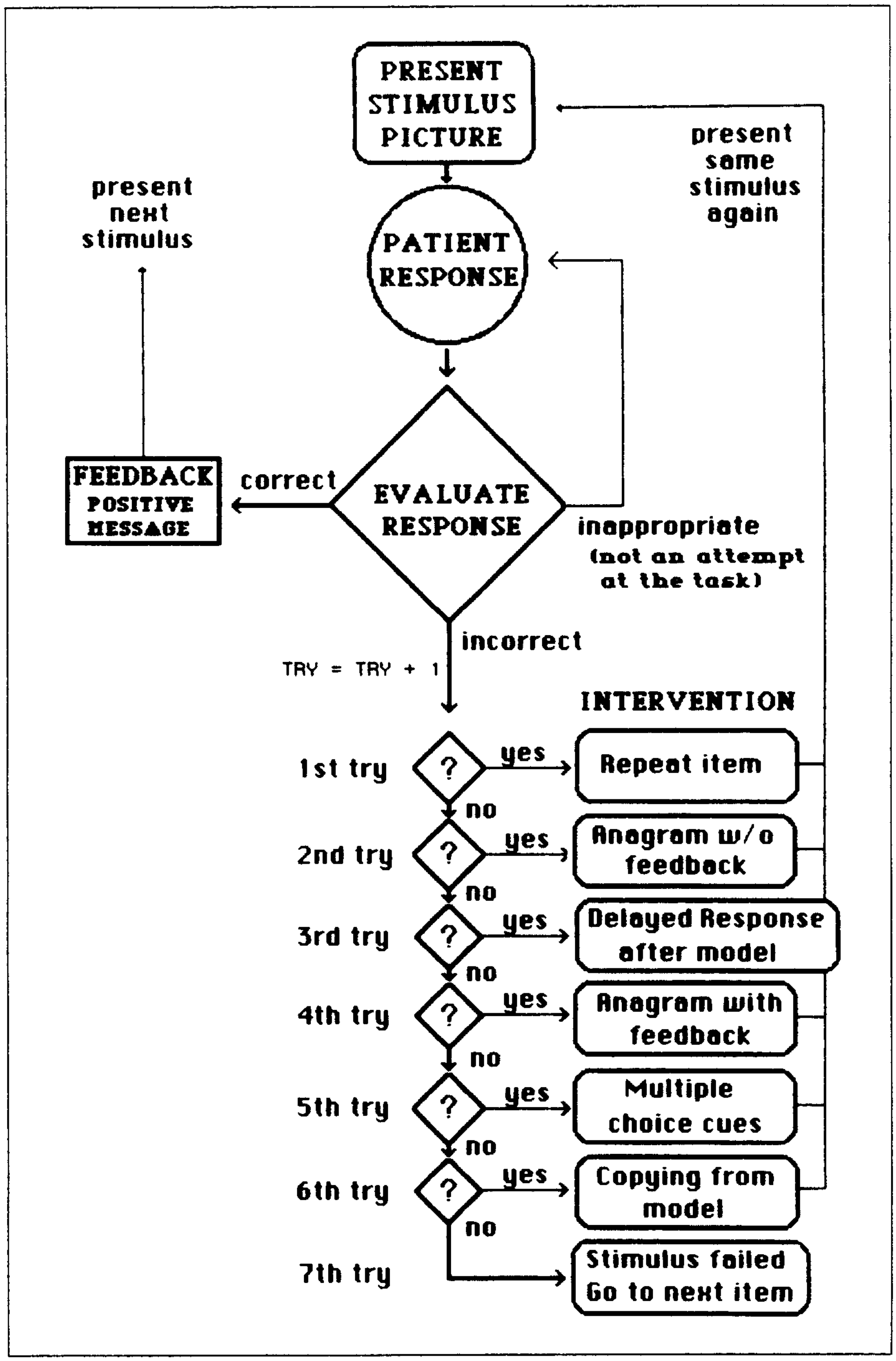


Figure 23-4. Flow chart of Katz and Nagy (1984) program.

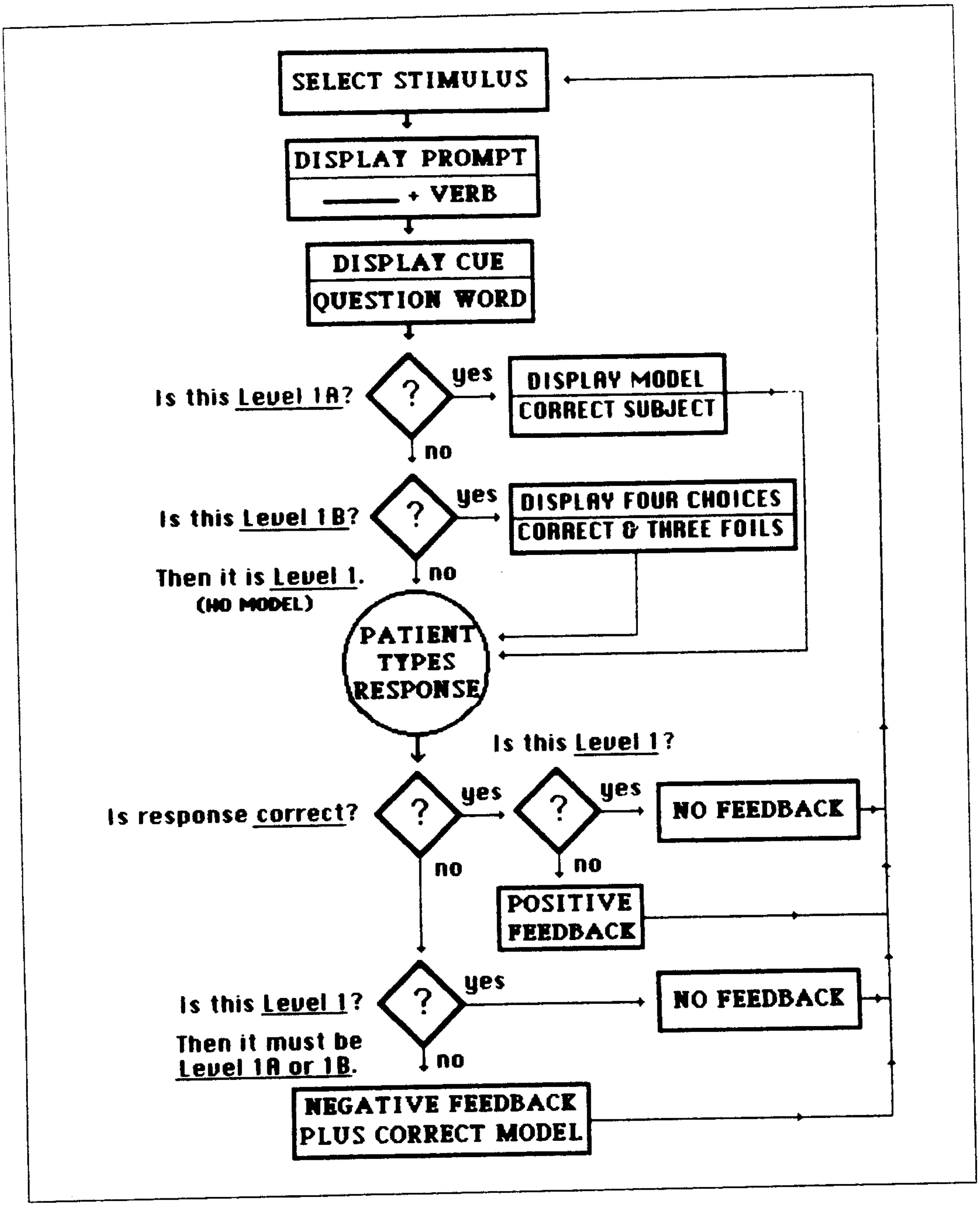


Figure 23-5. Flow chart of level one of Loverso, Prescott, Selinger, Wheeler, and Smith (1985) program.

Loverso, Prescott, Selinger, Wheeler, and Smith (1985) used a computer to present cues and verbs (Fig. 23-5). In response, the aphasic patient was required to type subject, verb, and object combinations on the computer. The primary purpose of the study was to compare treatment provided by a clinician with similar procedures presented by a combination of computer and clinician. Based on the patient's improvement, both on the treatment tasks and on subsequent administrations of the Porch Index of Communicative Ability (PICA) (Porch, 1967), the authors concluded that the reading and typing computer activities had a positive effect on language performance and were an effective mode for providing supplemental language treatment.

Glisky, Schlacter, and Tulving (1986) reported the ability of four memory-impaired nonaphasic patients to type words in response to definitions displayed on the computer screen. Cues included displaying the number of letters in the word and displaying the first and subsequent letters in the word, one at a time, as needed (Fig. 23-6). Cues continued until either the patient typed the word correctly or the program displayed the entire word (Fig. 23-7). All patients improved in the ability to type the target words without cues. Patients maintained their gains after a 6-week period of no treatment and demonstrated generalization to another *typing* task, although generalization to *writing* was not measured.

The purpose of this study was to develop and test a computer program designed to improve writing confrontation naming in aphasic patients with minimal assistance from a clinican. The following two questions were asked: (1) Can aphasic patients learn a written naming task when treatment is provided solely by the computer? and (2) Does performance generalize to noncomputerized written naming tasks?

Nine adult make veterans, average age 61, served as subjects (Table 23-1). Each had suffered a single occlusive left-hemisphere cerebrovascular accident resulting in aphasia of at least 8 months' duration. All subjects were outpatients receiving speech and language treatment at one of two Veterans Administration medical facilities. During the study, however, regular speech treatment did not involving writing or confrontation naming activities. All subjects completed high school, and none had a his-

Figure 23-6. Example of stimulus and cues (Try #1–7) in Glisky, Schlacter, and Tulving (1986) program.

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The sequence of instructions for a computer is called a _______

        Try #1        P _ _ _ _ _ _
        Try #2        P R _ _ _ _ _
        Try #3        P R O _ _ _ _
        Try #4        P R O G _ _ _
        Try #5        P R O G R _ _
        Try #6        P R O G R A _
        Try #7        P R O G R A M
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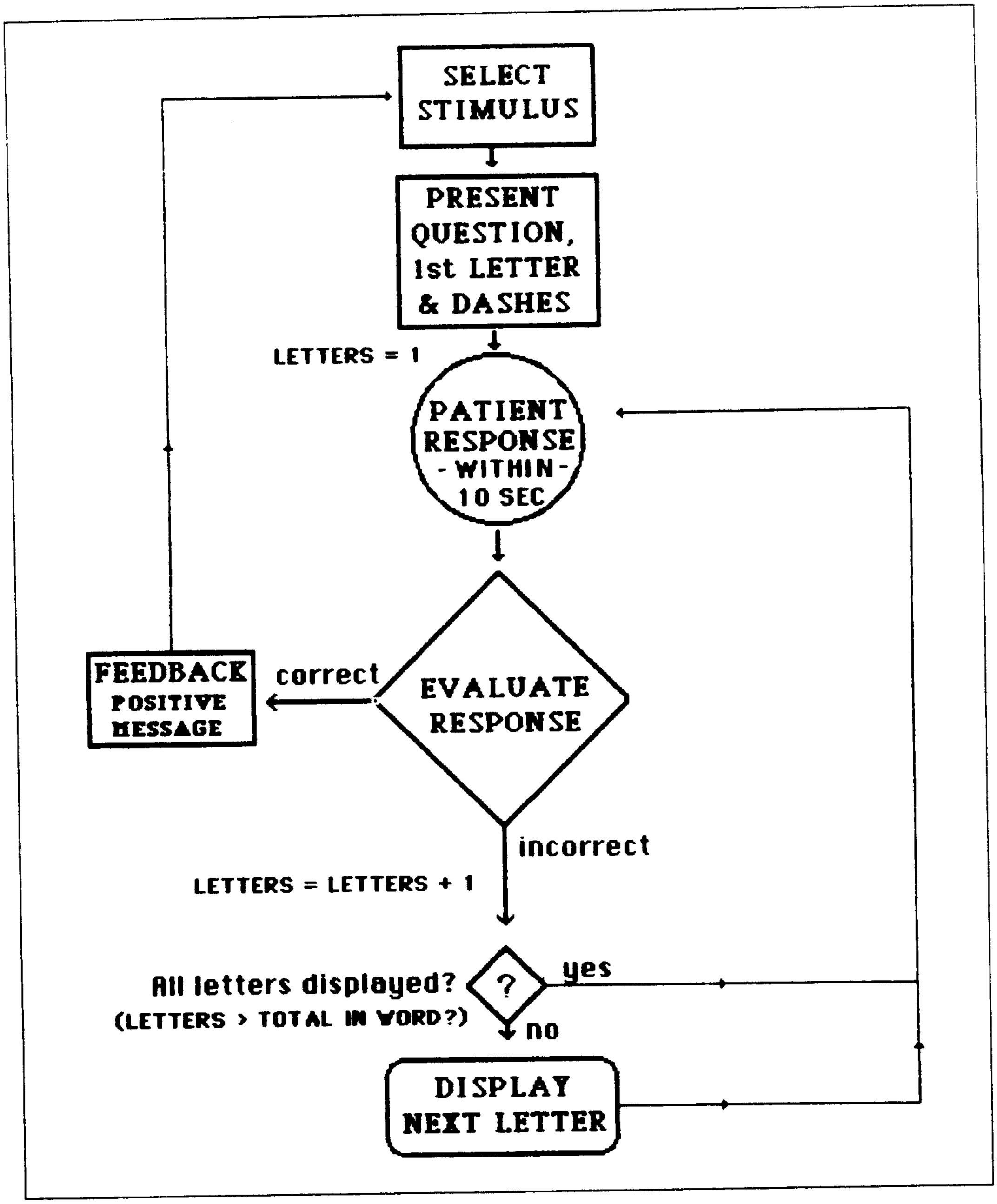

Figure 23-7. Flow chart of Glisky, Schlacter, and Tulving (1986) program.

tory of premorbid psychiatric, reading, or writing problems. Visual acuity was normal or corrected to normal. Subjects had to score below 75-percent correct on our computer baseline test and be able to perform the computer task without assistance after three sessions.

The study utilized an A-B-A design and therefore was divided into three phases: baseline, treatment, and post-treatment. Five measures designed to assess generalization were administered during the *baseline*

TABLE 23-1. PATIENT DESCRIPTIVE DATA — PRETREATMENT (N = 9)

Measure	$\bar{X}$	*Range*
Age in years	60.5	49–71
Education in years	13.8	12–18
Months post-onset	38.8	8–96
PICA overall percentile	60.2	40–86
PICA reading percentile	66.3	32–88
PICA writing percentile	58.9	11–89

phase and the *post-baseline phase:* (1) written confrontation naming of 10 pictures of animals used in the treatment phase, (2) written word fluency measure of names of animals in 3 minutes, (3) written word fluency measure of names of fruit in 3 minutes, (3) typing confrontation naming on the computer of 10 animal pictures used in the treatment phase, and (5) adminstration of the PICA. To obtain a baseline and to assess performance during post-treatment, all measures were administered once during the baseline phase and once during the post-treatment phase, except for typing confrontation naming, which was administered three times in both baseline and post-treatment phases. The sequence of the baseline and post-treatment measures was counterbalanced to minimize the effect of order on performance.

Two computer programs were administered during the *treatment phase:* the *treatment* program and the *test* program. The *treatment* program (Fig. 23-8) required subjects to type the names of 10 animals in response to pictures displayed on the computer monitor. If the name was typed correctly, feedback was provided and another picture was displayed. If an error was made, additional, hierarchically arranged cuese were presented in response to the number of attempts made to type the word. The treatment program applied additional controls on the subjects' responses. On the first, second, and third attempts, the subject could type any combination of letters to be evaluated by the program as an attempt at the task. On the fourth attempt, the computer accepted only letters in the target word, although the typed letters could be out of sequence. On the fifth attempt, the computer accepted *only* the correct letters in the correct order. If a subject pressed a wrong key, a "beep" was sounded and no letter was printed. The program would advance in the fifth level only when the correct letter was pressed.

If a correct response was elicited following a cue, then that cue was presented again, and the patient was prompted to respond a second time. If

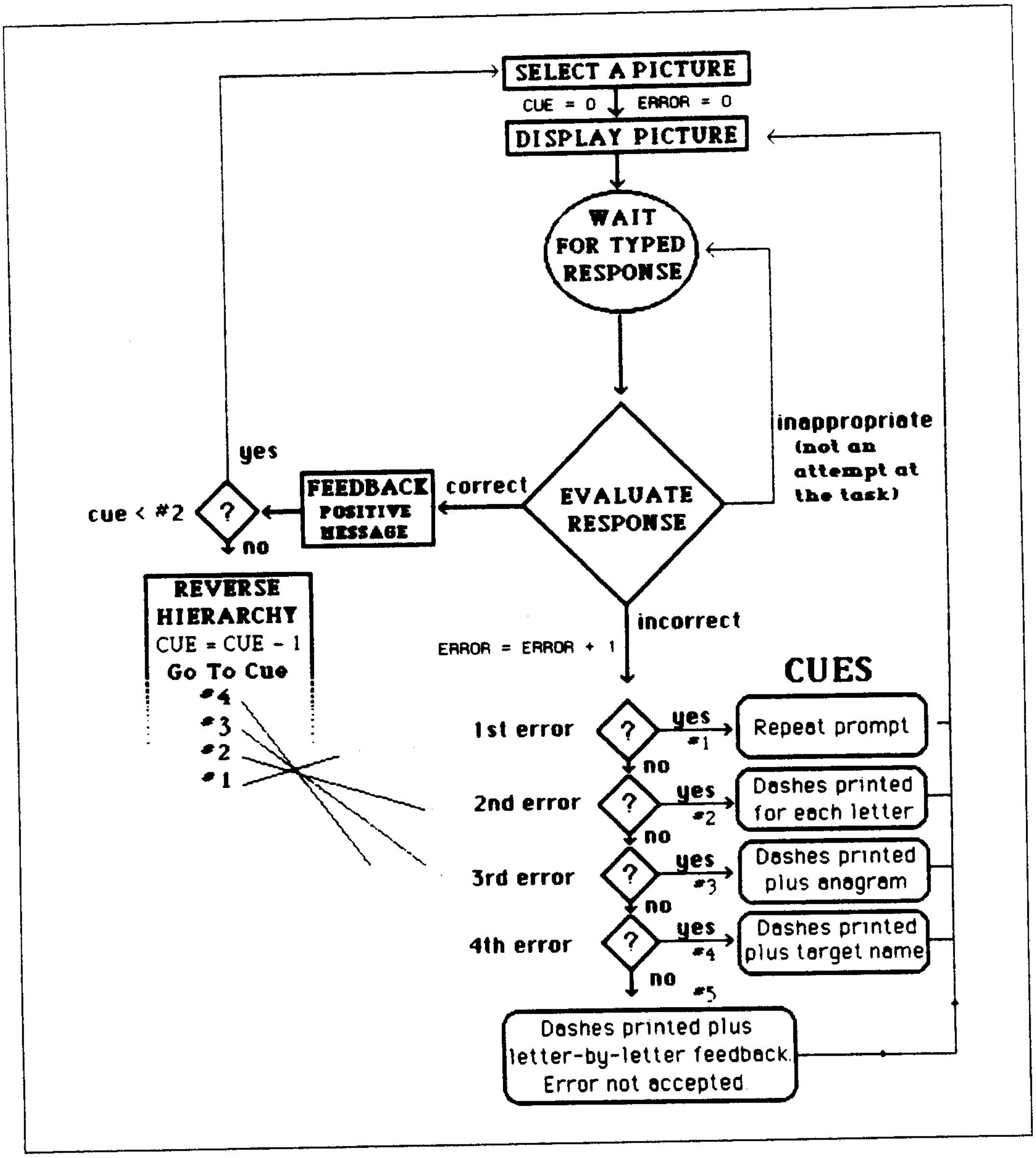

Figure 23-8. Flow chart illustrating sequence of steps in confrontation naming treatment.

that response was correct, the program increased the difficulty by backing up and presenting the previous cue, and the subject was prompted again. This reverse hierarchy, intended to stabilize the correct response, continued until the patient responded correctly with only a prompt, that is, level 1 or 2, or the patient made an error. In the latter case, the correct target name and a soothing message were presented, after which the next stimulus picture and prompt were displayed. Patients received no other intervention from the computer or experimenter. After responding to the tenth picture, a summary was printed on the screen displaying task performance.

The *test* program was presented following each treatment sesson (Fig. 23-9). The test program was identical to the computerized naming test administered during the baseline and post-treatment phases. The same 10 computerized drawings of animals used in the treatment program were displayed. The subject was prompted to type the name of each animal, but no feedback was provided. Performance on the test served as a measurement of each subject's ability to learn the task. Subjects participated in the study until they reached or exceeded the criterion level of 90-percent accuracy on the test program over three consecutive sessions, or until 15 treatment sessions were completed, whichever came first.

RESULTS

The first question we asked was whether aphasic patients could learn a written naming task when treatment was provided by a computer (Table

Figure 23-9. Flow chart illustrating sequence of steps in confrontation naming test program.

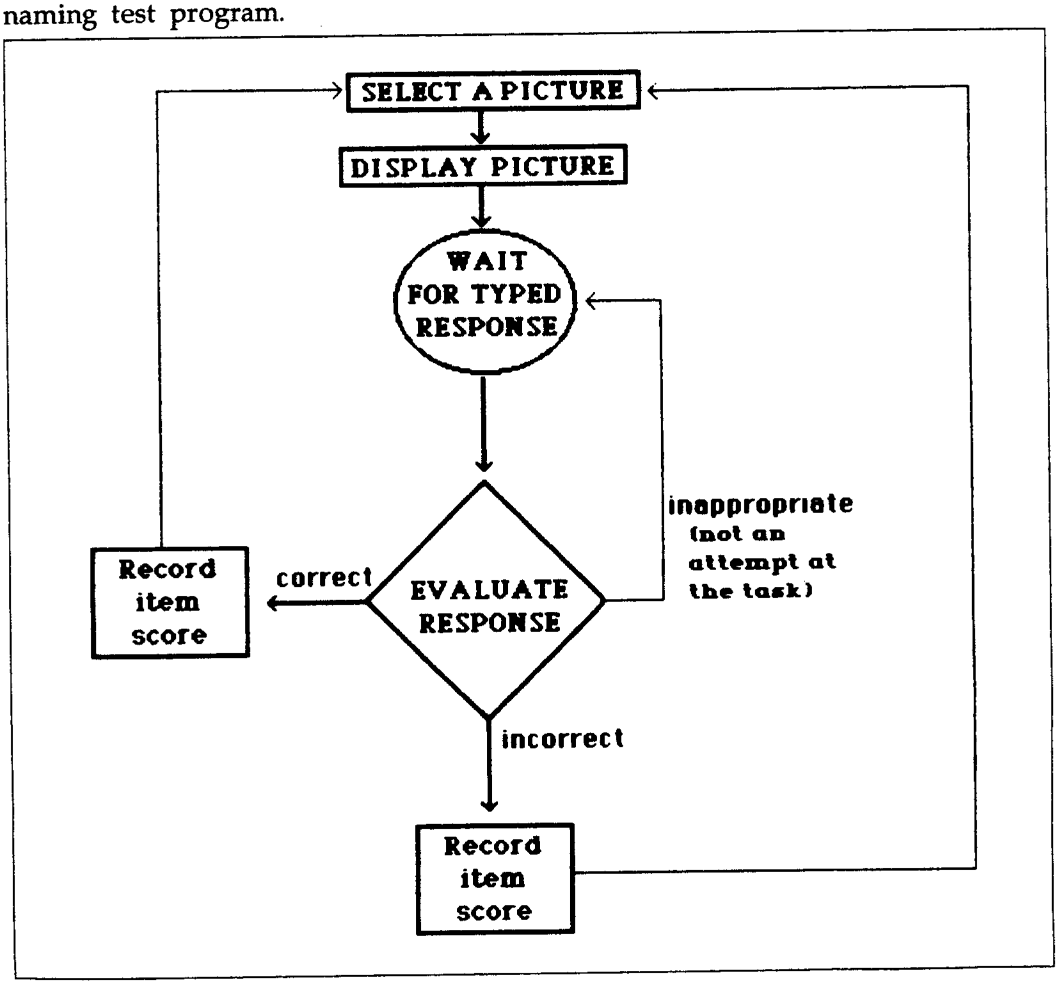

TABLE 23-2. PATIENT PERFORMANCE ON THE COMPUTERIZED WRITTEN NAMING TASK (N = 9)

	X̄ performance (%)			*Criterion*	
Patient	***Baseline***	***Treatment***	***Withdrawal***	***Yes***	***Session #***
1	67	92	93	+	6
2	30	97	93	+	3
3	63	93	93	+	3
4	67	93	87	+	3
5	73	90	97	+	5
6	3	33	40	−	
7	13	52	57	−	
8	10	49	83	−	
9	30	69	80	−	
X̄	40	74	80	-	-
Range	3–73	33–97	40–93	-	-

23-2). Mean performance on the task for all nine subjects during baseline was 40-percent correct. This increased to 74-percent correct during treatment and 80-percent correct during withdrawal. An ANOVA showed an effect for treatment statistically significant at $p < .0001$. Five of the nine patients reached criterion, three within three sessions, one within five sessions, and one within six sessions. The remaining four patients did not achieve criterion after 15 sessions. All patients, however, whether or not criterion was achieved, demonstrated improvement in the ability to type the names of the animals pictured correctly.

The second question, and of greater concern, was whether language skills learned on the computer generalized to performance on noncomputerized language activities (Table 23-3). Mean change for the nine patients on the PICA overall and reading scores was minimal, while writing showed a change of +4.1 percentile units. No change in the PICA was statistically significant at or below .05.

On written confrontation naming of the animal pictures, average group improvement was 38 percent, from about four correctly written names to eight. PICA scoring of the responses improved by 2.5 points. Group means for written animal word fluency within 3 minutes more than doubled from 2.3 words to 5 words. T-tests revealed improvement on these measures was statistically significant at $p < .001$. Written word fluency for fruits did not change.

TABLE 23-3. PRE- AND POST-PERFORMANCE ON OUTCOME MEASURES (N = 9)

	Pre		Post		
Measure	$\bar{X}$	*Range*	$\bar{X}$	*Range*	*Difference*
PICA overall percentile	60.2	40–86	62.0	46–88	+1.8
Reading percentile	66.3	32–88	66.4	34–83	+0.1
Writing percentile	58.9	11–89	63.0	31–90	+4.1
Writting naming animals					
Percent correct	41.1	10–90	78.9	40–100	+37.8
PICA score	8.5	5.9–12.1	11.0	8.2–13.5	+2.5
Written word fluency — animals (number)	2.3	1–4	5.0	3–9	+2.7
Written word fluency — fruit (number)	1.2	0–4	1.3	0–4	+0.1

SUMMARY

We have tentative answers for our two questions. First, can aphasic patients learn a written confrontation naming task when treatment is provided by a computer? Our results indicate they can. Five of the nine patients reached criterion with six treatment sessions, and the performance of all nine subjects improved on the computer task.

Second, does performance generalize to noncomputerized written naming tasks? Our results indicate it does to related tasks such as *written* confrontation naming of the treatment stimuli and *written* word fluency for *animal* names. Improvement was also noted on the PICA writing modality score. Improvement, however, did not extend to PICA overall and reading scores or to written word fluency for an unrelated category. The lack of change in *these* language activities underscores the general stability of our chronic aphasic patients and helps emphasize the improvement noted in the treatment-related measures.

This study, along with the others reviewed, shows how computer programs can be used for treating aphasic writing deficits. It still is not apparent how effective computer programs are in providing all aspects of treatment and how well the programs respond to patients suffering from different types and severities of aphasia. We found that compterized treatment for a small group of aphasic patients improved their ability to perform a specific, limited task — writing words. Our results support the contention that computer programs can be used to improve written confrontation naming in aphasic patients and that the treatment can be administered with minimal assistance from a clinician.

ACKNOWLEDGMENT

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DISCUSSION

Q = question; A = answer; C = comments.

Q. What was your patients' oral naming performance on the items you used in the naming task? Do you feel that you were addressing word retrieval as well as specific graphic processes?

A. We did not measure verbal confrontation naming for the patients. We felt that word retrieval, typing, and writing are all skills required by this computer task.

Q. What is the role of the computer, and what should it be in the overall treatment management of aphasic patients?

A. Aphasia intervention frequently occurs within a treatment room. Some clinicians see treatment as a succession of different environments. At our outpatient facility, we begin with individual treatment, then work to generalize skills to group and computer activities within the clinic, and finally other activities outside the clinic. At this time, computers are most helpful with reading tasks; writing and listening tasks are just beginning to develop a sufficient level of complexity on the computer to be truly useful.

Q. What criteria do you use when putting a patient on the computer? I'm concerned that we are fitting patients to the software rather than the other way around.

A. Some obvious factors include the patient's visual and motor limitations, familiarity with typewriters and computers, and reception to working alone on a computer. In treatment, we sit down next to each patient at the computer to explain and model the procedures for starting the computer and running specific programs. This help is faded out over about three sessions. If they can perform these procedures without assistance, we let them continue with software in which they score about 100-percent accuracy, so that procedures for operating the computer can stabilize and the patient can become more familiar with the types of information presented and requested by the computer. We feel that a patient at this level may benefit from the stimulation effect of the computer activity, and certainly it is preferable to having the patient waste time in the waiting room or smoke a cigarette in the lobby. At higher levels, more difficult programs are presented. Most reading comprehension activities are for stimulation and provide a patient with immediate feedback. Other programs allow a clinician to manipulate the task actually to teach a patient new information, such as typing the patient's name. Occasionally, a severely impaired patient strongly wants to use the computer even though the clinician may feel the patient will not benefit linguistically from the activities. In this case, we usually allow the patient to work on easy activities focusing on basic keyboard or word recognition skills before or after the treatment session to give the patient a sense of accomplishment and that allow him to develop fundamental skills necessary for using the computer.

Q. Did your patients include in the word fluency measures any animal names other than those used in the treatment task?

A. During the post-test, patients usually repeated the names they wrote during the pretest and added names from the treatment set, but I don't recall seeing new names in the post-treatment test that were not included in the treatment set.

Q. Have you used anagrams?

A. The program uses anagrams as a cue when an error was made. After correctly typing the name from a model, an anagram was displayed on the screen. If the patient pressed a letter in the word, the letter disappeared from the anagram and reappeared as part of the word. No letter was printed if a letter was typed that was not in the word or anagram. In this way, the patient either typed the word correctly or made a sequencing error.

Q. Have you thought of a system where the patient is given credit for a response that is not exactly right but still is recognizable?
A. At this point, our program will only accept an exact match, but certainly a program that accepted close approximations would be more functional and in line with what clinicians do and accept in therapy.

Q. How did you choose your 10 animal names? Did you attend to frequency or natural subgroups? We found that patients do better when we provide them with a cognitive structure for retrieving the names.
A. We worked from a pool of commercially available computer drawings and selected those that were the easiest for aphasic patients to recognize.

Q. I assume you are trying to train a process, trying to get at the lexical-semantic retrieval system. How are we going to verify that that process is truly being improved?
A. The closest we have come to that was to train a global aphasic patient on the computer to write his name, his wife's name, and the word *loves,* so that he could write his wife a Valentine's Day card. What we are trying to develop is a program into which functional material can be inserted for the patients to learn and use outside of the treatment room. We chose animal names as stimuli for this study because the effect would be easy to measure, but certainly this is not the goal of the program itself.

Q. What did they learn? I assume the purpose of the program was to treat a process.
A. Our results showed that while patients wrote more animal names, the improvement did not generalize to the nonrelated word fluency measure, suggesting that the word retrieval process was not treated directly. Our purpose was not to treat a process per se, but simply to teach the patients to type 10 words. The actual cues used — a model, an anagram, and the number of letters in the word — are not self-generating and not readily available to the patient when he is away from the computer. These cues were used to teach the patient the 10

stimuli. We observed that they included these words in a standard 3-minute written word fluency task that used animal names. If in the course a process was stimulated and other new words were written, then the computer activity has a greater effect than originally anticipated. The primary goal, however, was to measure the effect of a program designed ultimately to teach patients to write 10 functional words or phrases, such as name, address, telephone number, etc., so that the clinician does not have to do that in therapy.