Language-based Compensatory Training for Closed Head Injured Patients

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The consequences of closed head injury are receiving increasing attention in the rehabilitation literature. Large scale recovery studies (Jennett and Bond, 1975; Bond, 1976; Oddy, Humphrey and Uttley, 1978) suggest that, although many individuals survive their injuries, only a small proportion of the population (12-26%) are said to make "good" or "complete" recovery. The remainder of this population have residual physical, social, cognitive and communication problems that bring them to the attention of rehabilitation specialists.

For the speech-language pathologist, young closed head injured patients form an increasingly large clinical population posing unique diagnostic and treatment problems. Few writers dispute the presence of communication problems in the early stages of recovery from closed head injury. However, labels which have been applied to this disorder vary. Luria (1970) felt that the language impairment resulting from head injury should be termed "traumatic aphasia." Thomsen (1975) suggested that this "aphasia" could not be considered an isolated disorder, but rather was "part of a neuropsychological syndrome in which residual effects of general memory (deficits) predominate." Halpern, Darley and Brown (1973) suggested the term "confused language," which implies "reduced recognition and understanding of and responsiveness to the environment, faulty short-term memory, mistaken reasoning, disorientation in time and space, and behavior which is less adaptive and appropriate than normal." Groher (1977) felt that the communication deficits he saw in these patients were a "combination of diagnostic categories," including both aphasia and confused language.

Closed head injured patients differ in several important respects from other patients with adult onset aphasia of vascular origin. Demographically, the closed head injured population is far from a random sample of the population at large. Occurrence of head injury is highest in the age group from 15-24 years of age (Kalsbeek, McLaurin, Harris and Miller, 1980). Jamieson and Kelly (1973) suggest that this population can be characterized by its high incidence of "antisocial behavior," including disturbances in family life.

Diffuse, rather than focal, lesions which occur in closed head injured patients result in language problems that are often superceded by other cognitive and memory deficits. Groher (1977) pointed out that despite the good language recovery of the closed head injured patients he followed for four months, poor performance in organizational and retention skills was characteristic. These reduced skills have devastating consequences for the patients' ability to function in daily living activities and in educational or vocational settings. This decrease in functional ability is in contrast to left CVA aphasic patients who often are able to function well in situations where heavy demands are not placed on their language skills. In short, the unique cognitive and social problems seen in the closed head injured patient necessitate treatment programs tailored to meet special educational and vocational needs.

The purpose of this paper is (1) to describe a "typical" closed head injured patient by means of standard measures of speech and language performance, (2) to present a language-based program for training sequencing skills, illustrating the use of rate measures for monitoring learning and planning program changes, and (3) to discuss some general issues related to the treatment of closed head injured patients.

THE PATIENT

RY was a 16-year-old high school junior at the time of her closed head injury. A period of coma lasted approximately one week. Medical problems included multiple subdural hematomas and brain stem contusions. RY came to the rehabilitation unit six weeks post onset. At that time, communication behavior was characterized by naming and single word reading errors and perseverative responses. Accuracy scores on selected auditory comprehension and reading subtests of the *Minnesota Test for Differential Diagnosis of Aphasia* (MTDDA) (Schuell, 1965) are presented in Table 1. Examination of Table 1 reveals that by 12 weeks post onset RY had made good recovery on simple language tasks. Errors on simple listening and reading tasks occurred only occasionally and appeared to be related to inattention rather than to specific language deficits. This patient follows the pattern suggested by Groher; i.e. language skills recovered rapidly but the patient continued to experience difficulty with memory, organizing, verbal reasoning and logical sequencing skills. These deficits were evident in her reduced ability to plan aspects of her daily life, to keep appointments, and to find her way from one therapy to another.

Table 1. Accuracy scores (percent correct) on selected subtests of the *MTDDA*.

	Weeks Post-Onset 6	12
Auditory Comprehension		
Pointing to pictures	90	100
yes/no questions	80	100
paragraph	66	100
Reading		
Matching words to pictures	60	100
Reading words	80	100
Reading questions	80	80
Reading paragraphs	0	100

THE TREATMENT PROGRAM

Initially, the treatment program designed for RY involved simple language tasks. Later, the program included academically related skills, including reading and spelling. The portion of the treatment program described here was begun nine months post onset. Neuropsychological testing suggested that this patient was beyond the period of rapid spontaneous recovery. For example, her Performance IQ (WAIS) increased only seven points during this five-month period of treatment. The program presented here was one aspect of a total rehabilitation effort involving a variety of daily living and educationally related activities. The general goal was to help RY learn to maintain a schedule. The ability to order or sequence activities correctly appears to be prerequisite to maintaining a schedule. In the treatment program, RY was taught to use her relatively intact language skills to compensate for her poor sequencing ability. Although data presented here represents only one treatment task, it is illustrative of some data collection and charting issues frequently faced in the management of closed head injured patients. The specific task was as follows: RY was given a series of ten randomly ordered pictures and asked to sequence them so that they told a story. The program contained three treatment phases. During the first phase, RY rehearsed the story as she initially sequenced the pictures. She then retold the story to her clinician as she checked the accuracy of her performance. She was instructed to complete the task as accurately as possible and was given feedback about the accuracy of her response. Rate data were not routinely obtained during this phase. During the second treatment phase, RY read written descriptions of the action in each picture as she sequenced them. She was told to be accurate, but also to perform the task as quickly as possible. She was given feedback about accuracy and rate through verbal descriptions and review of the performance graph. During the third treatment phase, instructions and feedback were the same as during the second phase, except that written cues were removed.

The results of this training program are presented in Figure 1. Performance rates (accurate responses per minute) are plotted on a logarithmic scale across consecutive treatment days. Performance rates taken before and after the first treatment phase changed only slightly, from .93 to 1.30 correct responses per minute. During a subsequent period without treatment, performance rates remained stable. Performance rate increased from 1.6 to 4.6 correct responses per minute during the second treatment phase when written cues were provided and both rate and accuracy information was provided to RY. During the third treatment phase, when written cues were removed, performance rates continued to improve. By the end of the third phase of treatment, this patient's performance rate was slightly over ten correct responses per minute. This near-normal performance rate remained stable when RY was retested approximately two months after the termination of treatment. Also included in Figure 1 are three data points (solid circles) which represent performance rates on a similar but untrained task. A review of these data suggest that although post treatment performance rates on untrained sequencing tasks are not as rapid as those on the trained tasks, they are higher than pretreatment rates. To summarize briefly, this closed head injured patient learned the sequencing task. Further, her efficiency was maintained without treatment. Rate of performance on similar but untrained tasks also improved, but not to the extent that the trained tasks improved.

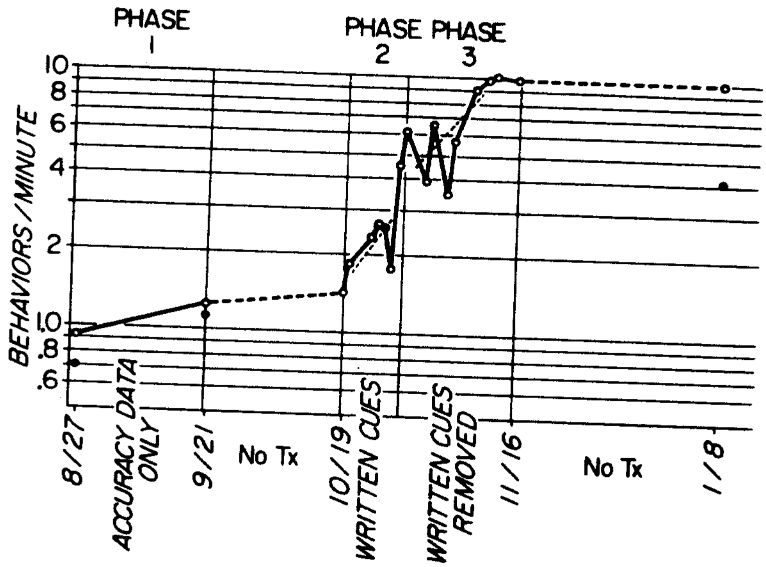

Figure 1. Rates of accurate responses (open circles) on a sequencing task across consecutive treatment days during Phases 1, 2 and 3. Solid circles indicate rates of accurate performance on a similar but untrained sequencing task. Dashed lines during Phases 2 and 3 are estimated slopes calculated using the Split-Middle Method of Trend Estimation (White and Haring, 1980).

DISCUSSION

Monitoring and Charting of Performance Rates.

The sequencing program described here can best be discussed by identifying the components of this training program and presenting a rationale for the selection of each component. The first component was the sequencing task itself. A sequencing task was chosen for two reasons. First, the patient was unable to perform this relatively simple cognitive task accurately or efficiently prior to training. Second, sequencing skills appear to be prerequisite to other organizational activities which were necessary for this patient to function independently. The second component of this training program is the cueing strategy used to facilitate learning. A cueing strategy which was heavily dependent on the patient's relatively intact language skills was selected. The third component of this training program involved use of rate in addition to accuracy measures as a means of monitoring performance and making program changes. The benefits of supplementing accuracy with rate measures can be illustrated by comparing rate and accuracy measures obtained during the three treatment phases. Figure 2 contains accuracy data only. Examination of this figure suggests that the patient's performance had reached the accuracy ceiling (100% correct) by the end of the first phase of treatment. If accuracy alone had been used to make program change decisions, treatment tasks would probably have been made more difficult after several consecutive days of perfect accuracy scores. However, changing the program after the first phase would have been inappropriate in this case.

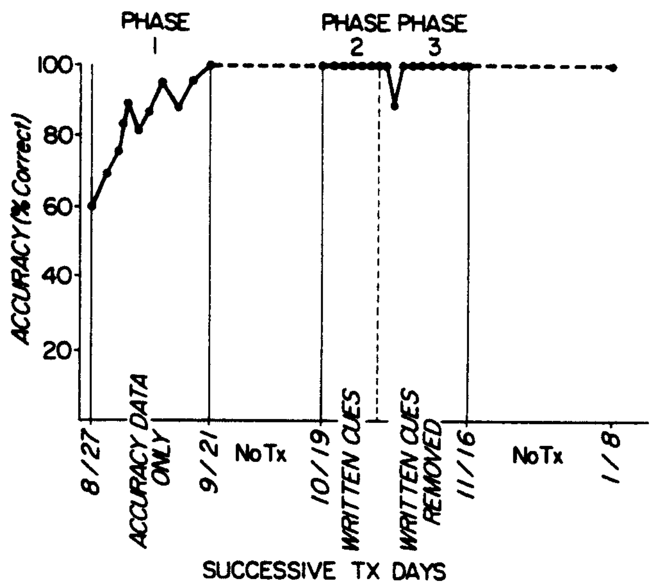

Figure 2. Accuracy of responses (percent correct) on a sequencing task across consecutive treatment days during Phases 1, 2 and 3 of treatment.

Although this patient had achieved ceiling in terms of accuracy score, her rate remained extremely slow compared to normal performance. Not until the end of the third phase did day-to-day variability in performance rates stabilize at near normal limits.

The use of rate data to direct program changes has still another benefit in that it allows the patient to perform consistently at high success rates. Closed head injured patients seem to be easily frustrated and confused by failure. Clinically, it is our impression that accuracy levels of 80 to 90%, which may be appropriate for aphasic patients, may be quite frustrating for the closed head injured patient.

The final component of the treatment program is the charting system. Performance rates generated during the treatment program are plotted on a logarithmic rather than a linear scale. The advantages of a logarithmic or proportional scale over a linear one can be illustrated by examining Figure 3, which has been adapted from White and Haring (1980). In this figure, rates of responding as a student does a reading task are plotted across consecutive days on a linear and on a proportional scale. On the linear scale the distance between each rate unit is equal. The numbers which appear between data points on the linear chart (Figure 3A) represent the units of increase between two consecutive data points. For example, the difference between the first and the second data points is 6 units while the difference between the last two data points is 35 units. Interpretation of the data presented in a linear charting system might lead to the conclusion that learning has been unstable with little learning occurring initially and very rapid learning occurring toward the end of the data collection period. The second chart is a logarithmic scale. The numbers which appear between data points on the logarithmic scale represent a ratio of the second to the first point. For example, the second data point (22 correct words per minute) is 140% of the first data point (15 correct words per minute). Interpretation of the learning data plotted on a logarithmic scale suggests that learning has been consistent throughout the training program. White and Haring suggest that learning or growth probably does not take place in linear increments but rather is a proportional phenomenon. If this is the case, then progress in learning tasks is best illustrated on a logarithmic rather than on a linear scale.

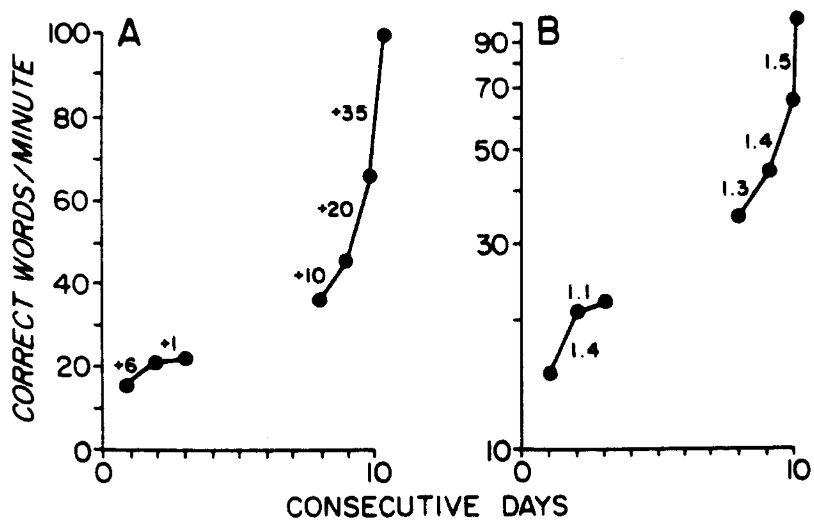

Figure 3. Rates of accurate performance on a reading task across consecutive days plotted on a linear (A) and a logarithmic (B) scale. The numbers between data points in Figure 3A represent absolute differences in rate units, while the numbers between data points in Figure 3B represent a ratio of the second point to the first. (Adapted from White and Haring, 1980.)

GENERAL ISSUES

The treatment of closed head injured patients is a relatively new area. Consequently, a variety of issues needs to be resolved as we develop programs for serving this population. Identifying some of the assumptions that underlie the approach taken with the patient described here may help to clarify these issues. The first assumption, of course, is that these patients should be treated in a complete rehabilitation program emphasizing and maximizing the patient's independence in all areas of functional activity, including mobility, self care, communication and vocation. The authors feel that an effort to rehabilitate these patients is clearly justified in light of the well-documented performance deficits and the typically youthful age of these patients. The second assumption is that speech-language pathologists have a role in assessment and treatment of the communication problems of the closed head injured patient. This role may include careful documentation of the language capacities of these individuals in order to assess whether or not their language base is adequate to serve as a compensatory system in overriding other organizational, memory, and cognitive deficits. In terms of treatment, the speech-language pathologist may initially train language skills and later, as we have illustrated here, train the patient to use their relatively good language skills to maximize other less intact skills.

The third major assumption is that treatment decisions should be data based. This has not always been the case with treatment programs for the closed head injured patient. Monitoring based on rate of performance in addition to response accuracy is particularly effective in documenting the impact of treatment.

The final issue concerns the question of what should be taught. Implicit in the program described here is a cognitive processing model which presupposes that strategies learned in one situation will generalize to other similar situations. With brain injured patients, generalization of training is a questionable assumption. As our training programs for closed head injured patients become more sophisticated, we may either confirm the presence of generalization of training, or we may move away from this "processing" model and select treatment tasks which are directed toward specific functional needs of these patients.

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DISCUSSION

Q: There are some studies by Ben-Yishay that suggest that generalization does occur. Might your "cognitive training" approach be more successful than you think?

A: I agree that the cognitive processing model is intuitively appealing in that it would be nice to teach a single cognitive strategy and influence a lot of areas. Our point is that you cannot assume generalization. Rather, you should try to confirm it in some data-based manner. If it has not occurred, then train the specific, functional task that the patient needs to perform.

Q: How did you measure rate? Was the data collection process time consuming?

A: Timing was initiated as the sequencing task was begun and was terminated when the patient indicated that she was finished. Performance rate was then calculated and she was told of her accuracy and rate. This charting system is relatively inexpensive in terms of a clinician's time. Since only one data point is plotted every day, I would guess that the calculation and charting on this task would take less than 30 seconds per day.

Q: Have you discovered any disadvantages to the use of rate measures?

A: Since we are all more comfortable with a linear scale, it takes a little time to get used to plotting data on a logarithmic rather than a linear scale. On the other hand, I am becoming firmly convinced that rate is a critical teaching variable; especially with closed head injured patients. There is nothing new about the notion of the importance of rate in treatment planning. Porch has talked about training on the fulcrum of the curve--teaching where there are processing problems, rather than accuracy problems. The use of rate measures is simply a slightly different way of reiterating a longstanding treatment principle.

Q: Do you use the term "aphasia" when you describe the language problems you see in closed head injured patients?

A: In the literature one sees a variety of terms applied, including "aphasia" and "confused language." I tend to reserve the term "aphasia" for an isolated language disorder. I do this in part because I believe that aphasic patients--those with isolated language disorders--behave differently and need somewhat different treatment approaches than do closed head injured patients. By using the same term for both of these types of patients you tend to obscure these differences.

Q: The closed head injured population obviously is a very diverse one. I worked with a patient where our major goal was to slow him down rather than to speed him up. He was so impulsive that he made frequent errors unless he slowed down.

A: You are right. Without accuracy, it makes no sense to be concerned about increasing rate. Our training priorities are to first achieve accurate performance then to increase rate. The emphasis on accuracy is reflected in White's charting system, which plots rates of <u>accurate</u> performance rather than simple rate measures.