IMPROVEMENT OF RECEPTIVE FUNCTIONING IN ADULT APHASICS

Joyce A. West
Veterans Administration Hospital, New York

INTRODUCTION

Although routine clinical examination of language functions may fail to reveal disturbances in auditory comprehension, it is generally agreed that most aphasics do suffer some such impairment (Weisenburg and McBride, 1935; Boller and Vignolo, 1966). That auditory processes are always impaired in aphasia is particularly fundamental to the theory and treatment of aphasia advanced by Schuell (1953) and her associates (Schuell, Carroll, and Street, 1955; Schuell, Jenkins, and Jimenez-Pabon, 1955). Because of the widespread acceptance of Schuell's approach, intensive auditory stimulation appears to be the most commonly used therapeutic approach with aphasics (Sarno, Silverman, and Sands, 1970). Yet, while there have been clinical descriptions of the effects of such stimulation on recovery processes (Schuell, 1953; Sefer, J. and Schuell, 1969), there are few published studies in which the value of controlled auditory stimulation has been confirmed by the presentation of objective data.

The present study attempted to improve auditory receptive functioning in aphasics with mild or moderate impairment in auditory comprehension by a systematic retraining program based on items similar to those presented in the Token Test (TT) (DeRenzi and Vignolo, 1962). The aim of the study was to determine whether the treatment program enhanced performance on the TT and whether similar changes could be demonstrated on other measures of auditory comprehension.

MATERIAL AND METHOD

Patients

Patients were five male aphasics enrolled in language rehabilitation programs in the New York Veterans Administration Hospital. All had been referred to the Speech Pathology Service because of obvious communication deficits. Neurological symptoms and neuroradiological data available from their medical charts indicated that the vascular lesions for all five patients were apparently confined to the left cerebral hemisphere. Two of the patients were classified as exhibiting Broca's aphasia; the remaining three were classified as fluent aphasics (Goodglass, Fodor, and Schulhoff, 1967). Clinical rating classified the

severity of the aphasia as mild in two cases and moderate in three cases. Mean months poststroke was 13 months with a range of four to 32 months. Age ranged from 37 to 60 years with a mean age of 50.6 years. All patients had completed high school; three had completed college. All were right handed, native English speakers. Table 1 presents relevant biographical data.

TABLE 1. Biographical information.

Patient	Age	Education	Type of Aphasia	Severity	Months Poststroke
P-1	37	college	fluent	mild	10
P-2	51	high school	Broca	moderate	32
P-3	59	college	Broca	mild	4
P-4	60	high school	fluent	moderate	12
P-5	46	college	fluent	moderate	8

The Token Test

The TT is most useful in distinguishing patients with minimal aphasic impairment. Besides its obvious advantages of ease of administration and scoring, all studies with the TT have demonstrated its reliability in distinguishing left brain-damaged patients from right brain-damaged patients or normal controls (Orgass and Poeck, 1966; Swisher and Sarno, 1969). In addition, performance on the TT seems to be largely independent of such factors as educational or intellectual level, age, or sex (Orgass and Poeck, 1966). Finally, a high correlation between the clinical evaluation of the severity of aphasia and TT scores has been observed (Orgass and Poeck, 1966; Swisher and Sarno, 1969).

The TT was administered according to the method described by Boller and Vignolo (1966). They used tokens varying in two sizes (large and small), two shapes (circle and rectangle), and five colors (red, green, yellow, blue, white). In our test battery, squares were used instead of rectangles. The tokens are arranged on a table in front of the patient in a prescribed order. Before the test begins, presence of visual agnosia is ruled out by asking the patient to match the tokens for the five colors and the two forms. Then the patient is

asked to touch or manipulate the tokens in response to oral commands which are nonredundant and require him to grasp the semantic significance of each word in the command. These commands become progressively longer and more difficult. In our administration of the test, each command was given only once.

The TT consists of five parts; examples of the commands for each of the parts follows:

Part I: "Touch the blue square." (10 commands;
               large squares and large circles only)

Part II: "Touch the small green square." (10 commands;
               large and small circles and squares)

Part III: "Touch the red circle and the yellow square."
               (10 commands; large squares and large circles
               only)

Part IV: "Touch the small red square and the small
               yellow circle." (10 commands; large and small
               circles and squares)

Part V: "Put the blue circle under the white square."
               (22 commands; large squares and circles only)

Responses were scored as correct or incorrect. The maximum score was 62, therefore each command was scored as one point.

The Experimental Treatment Program (ETP)

Common household objects and decorative items were collected which varied in size and color. Combs, pencils, paper napkins and plates, notebooks, thread, yarn, and plastic Easter eggs varied in size and color. Plastic cups, knives, forks, and spoons, and straw baskets varied in color. Where size varied, the objects were otherwise identical.

Three programs at each level of difficulty were written that utilized the objects following commands similar to those presented in the TT. Levels of the experimental treatment program (ETP) corresponded to Parts of the TT; thus, Level I of the ETP corresponded to Part I of the TT. Examples of each program at each level follow:

LEVEL I

Program A -- Touch the red pencil (yarn and pencils in
             5 colors)
Program B -- Touch the yellow fork (forks and spoons in
             5 colors)
Program C -- Touch the green yarn (yarn and baskets in
             5 colors)

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LEVEL II

      Program A -- Touch the big yellow comb (combs and napkins
                in 5 colors and 2 sizes)
      Program B -- Touch the small orange egg (eggs and combs
                in 5 colors and 2 sizes)
      Program C -- Touch the small red plate (napkins and plates
                in 5 colors and 2 sizes.

LEVEL III

      Program A -- Touch the red fork and the green spoon (spoons
                and forks in 5 colors)
      Program B -- Touch the blue napkin and the yellow yarn
                (napkins and yarn in 5 colors)
      Program C -- Touch the orange basket and the yellow cup
                (baskets and cups in 5 colors)

LEVEL IV

      Program A -- Take the large green thread and the small
                orange egg (eggs and thread in 5 colors and
                2 sizes)
      Program B -- Take the large green notebook and the small
                yellow pencil (notebooks and pencils in 5
                colors and 2 sizes)
      Program C -- Take the small red yarn and the large green
                egg (yarn and eggs in 5 colors and 2 sizes)

LEVEL V

      Program A -- Put the green spoon on the blue plate (plates
                and spoons in 5 colors)
      Program B -- If there is a red cup, touch the yellow plate
                (cups and plates in 5 colors)
      Program C -- Instead of the blue fork, pick up the yellow
                napkin (forks and napkins in 5 colors)

Although only five colors were utilized in any one program, seven colors were used throughout all programs (blue, orange, yellow, green, red, pink, and white).

Procedures

    A program at a given level (i.e., Level III, Program A) consisted of eight groups of ten oral commands or 80 commands. Since there were three programs at each level there were two hundred and forty commands per level. Stencils were prepared listing the commands and a response record for each program.

    Three male speech pathologists administered the ETP. The therapist first gave the TT. Six subtests from the Minnesota Test for Differential Diagnosis of Aphasia (Schuell, 1965) were also administered. According to Schuell, all six of these sub-

tests evaluate auditory disturbances: identifying items named serially, understanding sentences, following directions, understanding a paragraph, repeating digits, and repeating sentences.

The patient began the ETP at the Level where he had made any errors on the TT. Thus, if the patient had made errors on Part II of the TT, he began the ETP at Level II. The therapist randomly selected a program at that Level (that is, A, B, or C). He then utilized a table of random numbers to determine the order in which the eight groups of commands were to be administered.

The therapist gave a command once and waited for the patient to respond. Correct responses were verbally reinforced by such remarks as "good," "that's correct," etc. The command was repeated if the patient did not perform the required command correctly within approximately two seconds. If, after the original command and two repetitions, the patient was still incorrect, the therapist performed the required object manipulation for him. The therapist recorded the number of correct responses following one repetition, the number following two repetitions, and so forth.

A patient remained at a given Level of the ETP until he was able to perform correctly 90% of the commands in three consecutive groups of ten commands. That is, he was allowed three errors in thirty consecutive commands. At that time, he moved to the next Level of the ETP and the above procedure was repeated. If all three programs at a given Level had been administered and the patient was still unable to satisfy the 90% criterion, he repeated the program.

Each patient was originally scheduled for forty minutes of therapy four times a week. Thirty minutes of the period were devoted to the ETP. The remainder of the period was devoted to other types of therapy not related to the ETP. Holidays and attendance irregularities extended the program for longer than the designated five weeks. For three patients, six weeks elapsed between the initiation of the program and its completion. The remaining two patients completed the program in nine weeks. However, each patient did receive twenty experimental sessions, each thirty minutes in duration.

RESULTS

All patients began the program at Level I or II and ended at Level IV or V. They spent an average of 1.8 days at Level I, 2.8 days at Level II, 5.4 days at Level III, 6.0 days at Level IV, and 4.9 days at Level V. Only two patients satisfied the criterion to receive treatment at Level V, and only one patient required extensive treatment at Level I.

Table 2 presents the TT scores and the percent correct for each patient before and after treatment. Before treatment, the

mean percentage of correct responses was 47.8% with a range of 29-74%. After treatment, the mean percentage of correct responses was 65% with a range of 42-90%. All patients showed improvement in their TT scores following treatment. The mean increase was 17.2% with a range of 13-22%.

TABLE 2. Comparison of Token Test scores* before and after treatment

Patient	Before Treatment		After Treatment		Improvement	
	Score	%	Score	%	Score	%
P-1	35	56	45	73	10	17
P-2	18	29	26	42	8	13
P-3	46	74	56	90	10	16
P-4	25	40	36	58	11	18
P-5	25	40	39	62	14	22
Mean	29.8	47.8	40.4	65.0	10.6	17.2

* Number of items correct.

The patient showing the least improvement, P-2, scored lowest on initial testing (29%). However, P-5, who showed the most improvement (22%), also scored relatively low performance on initial testing (40% correct). For P-2, more months had elapsed since onset of his stroke (32 months) than for any other patient.

Each patient's TT scores before and after treatment were compared by parts using the Wilcoxan Test (Siegel, 1956). The T value of 16.5 (N=25) indicated significant improvement (p < .01). Table 3 presents the percentage correct for each part of the TT. Improvement was noted on all parts. The least amount of improvement occurred on Parts I and II, each showing a mean increase of 8%. Mean error rates on these parts were rather minimal at initial testing (78% and 84% correct respectively) and did not allow for much improvement to be made. The patient (P-4) who had made the most errors on Part I (20% correct) at initial testing showed a gain of 40% at final testing.

TABLE 3. Percent correct on each part of the Token Test

Patient	Part I			Part II			Part III			Part IV			Part V		
	Pre %	Post %	Diff %	Pre %	Post %	Diff %	Pre %	Post %	Diff %	Pre %	Post %	Diff %	Pre %	Post %	Diff %
P-1	100	100	0	90	90	0	40	90	50	30	20	-10	41	68	27
P-2	70	80	10	80	90	10	20	50	30	0	20	20	5	9	4
P-3	100	100	0	100	100	0	70	100	30	20	80	60	77	82	5
P-4	20	60	40	80	90	10	60	70	10	50	40	-10	18	45	27
P-5	100	90	-10	70	90	20	40	80	40	20	30	10	9	45	36
Mean	78	86	8	84	92	8	46	78	32	24	38	14	30	60	30

Mean error rate increased rather markedly on Part III of the TT (46% correct) at initial testing. Boller and Vignolo (1966) also observed error rate to increase substantially on Part III for their aphasic patients. Our patients required an average of 5.4 days at Level III of the ETP to satisfy the 90% criterion, enabling them to move to Level IV. Post-testing revealed rather substantial changes in the TT scores on Part III following treatment. The average score was 78% correct for a mean improvement of 32%. All patients except P-4 showed marked changes in their TT scores for this part of the test, the range being 10-50%.

Poor performance on Part IV at initial testing was also noted. The average score was 24% correct. Patients required an average of 6.0 days of the ETP at this level, and three patients never satisfied the 90% criterion which would have enabled them to receive treatment at Level V.

A mean increase in TT scores on Part V was observed from initial testing (30% correct) to final testing (60% correct). Two patients, P-1 and P-5, showed substantial increases (27% and 36% correct, respectively) even though they had not received treatment at this level. Boller and Vignolo (1966) report Level V to be the most discriminating part of the TT. Even after treatment, all but one of our patients continued to perform below the level expected for nonaphasics on Part V on the entire TT.

For all but one of the patients (P-5), the most substantial gain in TT scores occurred on the part of the TT immediately below the final treatment level on the ETP. For example, if Level IV were the final level of treatment on the ETP, the greatest gains on the TT were noted at Level III. None of the patients had, however, reached the 90% correct criterion for their final level of treatment.

Changes in performance on the six subtests of the MTDDA were much less impressive. Although improvement was noted on every subtest, this improvement was minimal. As shown in Table 4, a mean gain of 6.3% with a range of 0-12% was noted. Similarly, every patient showed improvement on the MTDDA, however individual improvement was minimal.

On initial testing, patients showed a mean of 73% correct on the MTDDA subtests and 47.8% correct on the TT. A total score of 49 items correct was possible on the MTDDA subtests, and a score of 62 was possible on the TT. More impressive gains on the MTDDA might have been noted had there been more items, but, undoubtedly, many MTDDA subtests evaluate skills not closely related to the ETP.

TABLE 4. Percentage of improvement on six subtests of the
          MTDDA

Subtests	Before Treatment	After Treatment	Improve-ment
	% Correct	% Correct	%
Identifying Items Named Serially (6)*	70	77	7
Understanding Sentences (15)	91	97	6
Following Directions (10)	80	92	12
Understanding a Paragraph (6)	97	93	6
Repeating Digits (6)	53	60	7
Repeating Sentences (6)	57	57	0
Mean	73.0	79.0	6.3

* Number in parentheses refers to number of possible errors

DISCUSSION

The results of this study demonstrate that it is possible
to enhance performance on the TT. Scores for all patients
showed an increase following the ETP. According to DeRenzi and
Vignolo (1962), the difficulty of the TT items must lie in the
lack of redundancy in the message transmitted and the necessity
of grasping its significance from the semantic value of every
single word heard. At least three kinds of demands are placed
upon the comprehension of the patient. One arises out of the
difficulty in retaining the items in memory long enough for them
to be decoded. Another arises out of the difficulty of iden-
tifying a particular token specified by three independent
features. The final demand is that of grasping the semantic
complications introduced by the addition of the relational or

conditional phrase structures in Part V. For these reasons, it seems unlikely that the changes noted in TT scores following the ETP could be attributed solely to the practice effects of taking the test more than once. Preliminary data in our clinic suggest that any such effect is small. Rather, we hypothesize that what was improved during the ETP was (1) verbal retention span, (2) the ability to decode semantic units separately and then unify them into a conceptual whole for appropriate response, and, finally, (3) an ability to analyze the units in Part V in terms of the grammatical relationships expressed.

Whether or not changes in TT performance altered auditory comprehension for other tasks is difficult to assess. Boller and Vignolo (1966) and DeRenzi and Vignolo (1962) report that the TT reveals defects in comprehension not observable with other tests. We noted improvement in scores on the six subtests of the MTDDA, but the changes were quite small. Furthermore, the MTDDA subtest showing the most improvement, following directions, is probably the most closely related to the performance demanded in the ETP. Our patients, however, reported improvement. One patient noted that he was better in following the news on radio. Another reported that he was able to enjoy a movie for the first time since his stroke. These, of course, are subjective observations and difficult to assess.

All but one of the patients were more than six months poststroke. Presumably, the period of "spontaneous recovery" had passed (Sarno and Levita, 1971), yet changes between pre- and post-testing were demonstrated.

Our results have been encouraging. The ETP is now being used with other patients. Evaluation of such effects as age, months poststroke, type of aphasia, and variations in time spent on the ETP would be worth investigation. The ETP requires no equipment, the items are readily available and inexpensive, and we have found that the program can be administered by paramedical personnel once it has been assembled and the patient properly evaluated.

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REFERENCES

Boller, F. and Vignolo, L.A. Latent sensory aphasia in hemisphere-damaged patients: An experimental study with the Token Test. *Brain*, 89, 1966, 815-830.

DeRenzi, E. and Vignolo, L.A. The Token Test: A sensitive test to detect receptive disturbances in aphasics. Brain, 85, 1962, 665-678.

Goodglass, H., Fodor, I.G., and Schulhoff, C. Prosodic factors in grammar: Evidence from aphasia. J. Speech Hearing Res., 10, 1967, 5-20.

Orgass, B. and Poeck, K. Clinical validation of a new test for aphasia: An experimental study on the Token Test. Cortex, 2, 1966, 222-243.

Sarno, M.T. and Levita, E. Natural course of recovery in severe aphasia. Arch. Phys. Med. Rehab., 52, 1971, 175-178.

Sarno, M.T., Silverman, M., and Sands, E. Speech therapy and language recovery in severe aphasia. J. Speech Hearing Res., 13, 1970, 607-623.

Schuell, H. Aphasic difficulties understanding spoken language. Neurology, 3, 1953, 176-184.

Schuell, H. Auditory impairment in aphasia: Significance and retraining techniques. J. Speech Hearing Dis., 18, 1953, 14-21.

Schuell, H. Differential Diagnosis of Aphasia with the Minnesota Test. Minneapolis: The University of Minnesota Press, 1965.

Schuell, H., Carroll, V., and Street, B.S. Clinical treatment of aphasia. J. Speech Hearing Dis., 20, 1955, 43-53.

Schuell, H., Jenkins, J.J., and Jimenez-Pabon, E. Aphasia in Adults. New York: Harper and Row, 1964.

Sefer, J. and Schuell, H. A year of aphasia therapy: A case study. British J. Dis. Com., 4, 1969, 73-82.

Siegel, S. Nonparametric Statistics. New York: McGram-Hill, 1956.

Swisher, L.P. and Sarno, M.T. Token Test scores of three matched patient groups: Left brain-damaged with aphasia; right brain-damaged without aphasia; non brain-damaged. Cortex, 5, 1969, 264-273.

Weisenburg, T. and McBride, K.E. Aphasia. New York: The Commonwealth Fund, 1935.