A Study of Verbal Behavior in Recovery of Aphasic and Nonaphasic Persons

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Background

The description of verbal behavior in recovery from aphasia has received considerably more systematic study than perhaps any other neuropsychological disturbance associated with brain injury. Clinical aphasiology has benefitted from nearly 40 studies of various aspects of aphasia recovery. It is difficult to draw specific conclusions based on these studies since, as a group, they represent a vast array of assessment procedures, testing intervals, subject sizes, and sampling differences relative to age, etiology and other factors. There is, however, remarkable agreement on a number of general observations that have been made regarding recovery.

The most frequently noted and overwhelmingly supported phenomenon in aphasia recovery is the dramatic improvement occurring during the acute stage (Alajouanine, 1956; Marks, Taylor and Rusk, 1957; Culton, 1969; Lynch, 1969; Sarno and Levita, 1971; Ludlow, 1977). Nearly every recovery study reports the most change during their first assessment interval. The second most frequently discussed observation is the relationship between age and recovery. In general, older persons are described as having more severe deficits acutely and a less favorable prognosis (Eisenson, 1964; Vignolo, 1964; Culton, 1969; Sands, Sarno and Shankweiler, 1969; Sarno, Silverman and Levita, 1970). In studies classifying aphasic persons by type, recovery patterns are said to vary remarkably little (Weisenburg and McBride, 1935; Schuell, 1955; Ludlow, 1977; and Kertesz and McCabe, 1977). There is support for the notion that globally or severely involved persons recover more slowly and less well than others (Sarno, Silverman and Levita, 1970; Henri and Canter, 1975; Hanson and Cicciarelli, 1977); and in at least one study, the severity of verbal deficits outweighed other variables--including age (Keenan and Brassell, 1974). Etiologic factors are said to influence the recovery pattern and degree of improvement (Eisenson, 1949; Butfield and Zangwill, 1946). This is supported by the clinical observation that etiology can influence the recovery patterns evident on PICA recovery curves (McNeil, 1972). The extent and location of neurologic damage is, of course, related to the degree and type of impairment and is an important factor in prognosis (Yarnell et al., 1976; Kertesz et al., 1979). It was of interest to this reader, however, that one study demonstrated that aphasic behavior continued to evolve and recover even after CT findings were stable (Kertesz et al., 1979).

In studies which have carefully examined the process of language recovery, there is support for the observation that receptive abilities improve earlier and continue to improve over a greater range of time than expressive abilities (Vignolo, 1964; Kenin and Swisher, 1972; Henri and

Canter, 1975; Hanson and Cicciarelli, 1977; and Prins et al., 1978). Furthermore, nonverbal cognitive functions appear to be intricately related to the recovery of language (Culton, 1969; Smith, 1971; Henri and Canter, 1975) and, in that light, the intact right hemisphere appears to play a major role in favorable recovery, according to some writers (Smith, 1971; Pettit, 1969). Parallel patterns of recovery are found in both languages of bilingual aphasic persons (Weisenburg and McBride, 1935; Watamori and Susanuma, 1976).

It can be argued that the relationship between treatment and outcome is not well understood since there has been little attempt to test this variable independently. Finally, as a criticism of the way recovery has been studied in the medical literature, there is a definite interest in prognosis in aphasia, but there is occasionally a lack of the most rudimentary requirements of scientific method. The most striking observation one can draw from all of these studies is the overall homogeneity of their findings. Although there are considerably different procedures and populations used among recovery studies, the factors in outcome and patterns of recovery reported are similar.

Recovery studies differ in that they may emphasize either the psychological or physiological aspects of prognosis, without considering the process as an integrated model. Certainly a great deal of recovery can be related to physiologic factors in the neurologic substrate of the brain. This would account for the importance of age, etiology, size and location of neurologic damage as factors in outcome. Language recovery apparently also involves a cognitive or psychological process of reorganization. The rationale for treatment presupposes that this process can be manipulated or maximized through training and stimulation. There is considerable support for the role of cognitive reorganization in studies which have emphasized the importance of the right hemisphere in lnaguage recovery, described the disparities in expressive and receptive recovery, and described the evolution of language beyond the point of neurologic stability.

We were interested in the physiologic effects of acute strokes on the overall functions of the brain during the first month post-stroke. Theoretically, we felt part of acute aphasic deficits stem from the generalized, bilateral effects of acute strokes. Consequently, one could expect to find depressed verbal functions in anyone, aphasic or not, who was recovering from acute stroke. Secondly, we felt the evidence in the literature supported a process of psychological or cognitive reorganization co-occurring with and influencing recovery. We were interested in looking for evidence of this process during the first month post-stroke.

PURPOSE

The purpose of this paper is to describe a study of expressive language behavior in the recovery of nonaphasic and aphasic persons during the first month post-stroke.

METHOD

Subjects. Subjects included in this study consisted of ten aphasic and ten nonaphasic persons. There were seven right hemisphere damaged persons and three left hemisphere damaged persons in the nonaphasic group. Each subject had experienced a cerebrovascular accident. Acute CT scans were

available in all cases to confirm the diagnosis of stroke and rule out bilateral involvement. The mean ages of the aphasic and nonaphasic groups were 64.7 and 62.5 years, respectively. Subjects included only persons who could tolerate 15 to 30 minutes of testing at one week post-stroke. None of the aphasic persons was in a treatment program.

Language Assessments. Language evaluations, other than the experimental task, included subtests from the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1972), as well as the reading subtest from the Aphasia Language Performance Scales (Keenan and Brassell, 1975). None of the persons in the nonaphasic group had clinical evidence of aphasia. In other words, we did not feel that any member of the nonaphasic group had either blatent or latent evidence of a primary language disorder.

Nine of the ten aphasic persons described in this study were given the Porch Index of Communicative Ability (Porch, 1971) at approximately one month post onset. Table 1 describes the subjects relative to age, etiology and aphasic language status. PICA scores ranged from the 26th to the 95th percentile.

Experimental Samples. Connected language samples included verbatim transcriptions of responses to a standard stimulus picture. These procedures have been described by Yorkston and Beukelman (1977). For this study the measures analyzed were syllable rate, content units per minute, and number of grammatical strings within each sample.

Sampling Intervals. Samples were obtained at two intervals. The first sample was taken within a period of 5 to 7 days post-ictus and the second at 28 to 32 days post-ictus.

Data Analysis. Group means and standard deviations were derived. t-test comparisons were used to examine inter-group differences and significance of changes over time.

RESULTS

Differences between the groups were significant for all the variables measured. There were no differences between the right and left hemisphere damaged nonaphasic persons in syllable rate, content rate, or number of grammatical strings assessed at either testing interval. A summary of the aphasic and nonaphasic group means, standard deviations and levels of t is provided in Table 2. The change occurring for syllable rate and content rate was significant for both groups. The increase in grammatical strings approached significance for the aphasic group, but neither group had significant changes on this measure at one month post.

Figure 1 illustrates the changes that occurred relative to syllable rate. The aphasic group (on the left) had a mean score of 55.91 syllables per minute which improved to 85.94 syllables per minute. This change was significant ($p < .05$). The nonaphasic group had a syllable rate of 111.73 at one week and 175.99 by one month post-ictus. This difference was also significant ($p < .05$). The content rate within the samples is illustrated in Figure 2. Aphasic persons in this sample had a content rate of 4.79 content units per minute, which improved to 7.19 by one month post-ictus. This change was significant ($p < .05$). In the nonaphasic sample the mean was 25.11, increasing to 30.84 content units per minute, representing a significant increase ($p < .05$). These values may be compared with the rates one would expect to find among a normal geriatric sample. The mean for

Table 1. Description of subject population.

Subject	Sex	Age	Handedness	PICA O.A.
Group I. Left hemisphere damaged, aphasic persons				
1	M	62	R	75th
2	M	60	R	n.a.
3	F	67	R	37th
4	F	45	L	95th
5	M	77	R	46th
6	M	65	R	53rd
7	M	65	L	38th
8	M	63	R	26th
9	F	85	R	82nd
10	M	58	R	50th
Group II. Nonaphasic left hemisphere damaged persons				
1	M	70	L	
2	M	62	R	
3	F	62	R	
Group III. Nonaphasic right hemisphere damaged persons				
4	F	57	R	
5	M	52	R	
6	M	53	R	
7	M	52	L	
8	M	59	R	
9	F	71	R	
10	M	77	R	

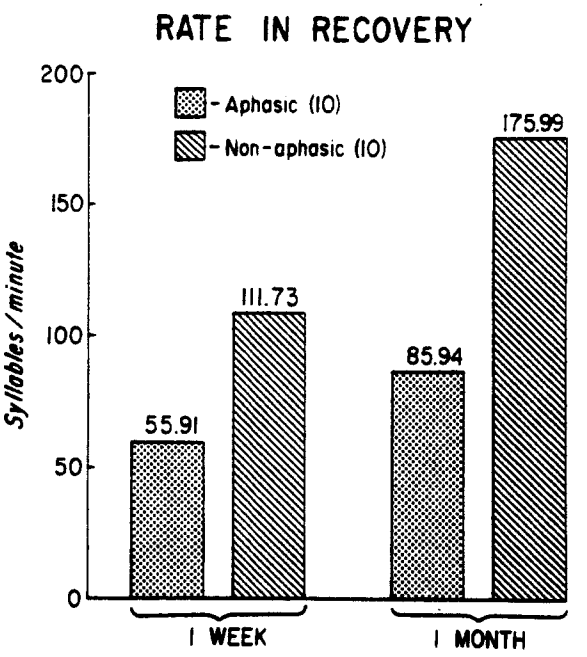

Figure 1. Changes in syllables per minute between one week and one month post ictus.

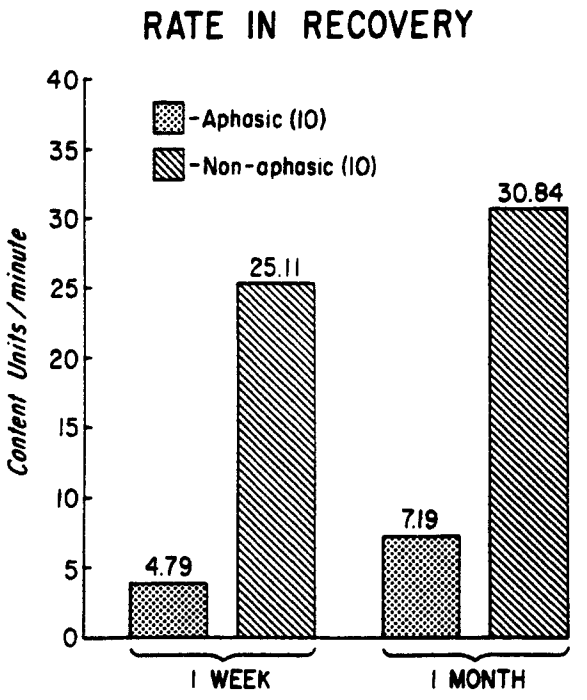

Figure 2. Changes in content units per minute between one week and one month post ictus.

Table 2. Mean scores and t-test comparisons for each group by test interval.

	1 week		1 month		levels of t
	x	SD	x	SD	
Syllables/minute					
Aphasic	55.9	38.9	85.9	53.9	3.22*
Nonaphasic	111.7	17.98	175.99	38.6	7.50*
Content/minute					
Aphasic	4.79	4.49	7.19	6.38	2.85*
Nonaphasic	25.11	6.40	30.84	10.78	6.40*
Grammatical strings					
Aphasic	8.6	7.9	12.6	6.81	2.14 ns
Nonaphasic	7.4	3.02	9.8	2.44	1.86 ns

Yorkston and Beukelman's (1977) geriatric sample for syllables per minute was 193.2, with a SD of 39.8. Content units per minute in their sample were 33.7 per minute, with a SD of 13.5.

In examining the results of this sample from a qualitative standpoint, there was only one right hemisphere damaged person who demonstrated evidence of a visual perceptive deficit that might have influenced his score. There were clearly fewer misperceptions in this patient's sample at 1 month post. Another qualitative change that was evident as the seven right hemisphere damaged persons recovered from their strokes was that they began to have an increased number of redundant or unrelated content statements within their samples. As you know, this behavior could not be counted as a content unit when applying the criteria described by the authors of this system (Yorkston and Beukelman, 1977). Consequently, although the right and left hemisphere damaged nonaphasic persons did not differ in the absolute values of their content rates, the right hemisphere damaged persons were in fact considerably more "verbal" at one month post-ictus.

With reference to "communicative style" in recovery, both aphasic subjects and left hemisphere damaged nonaphasic subjects acquired a more efficient response to this experimental task. That is, these subjects increased the ratio of content within a grammatical string over time, while all of the seven right hemisphere damaged subjects demonstrated a lower ratio of task-relevant content within a grammatical string by one month post-ictus. This decrease is illustrated in Figure 3.

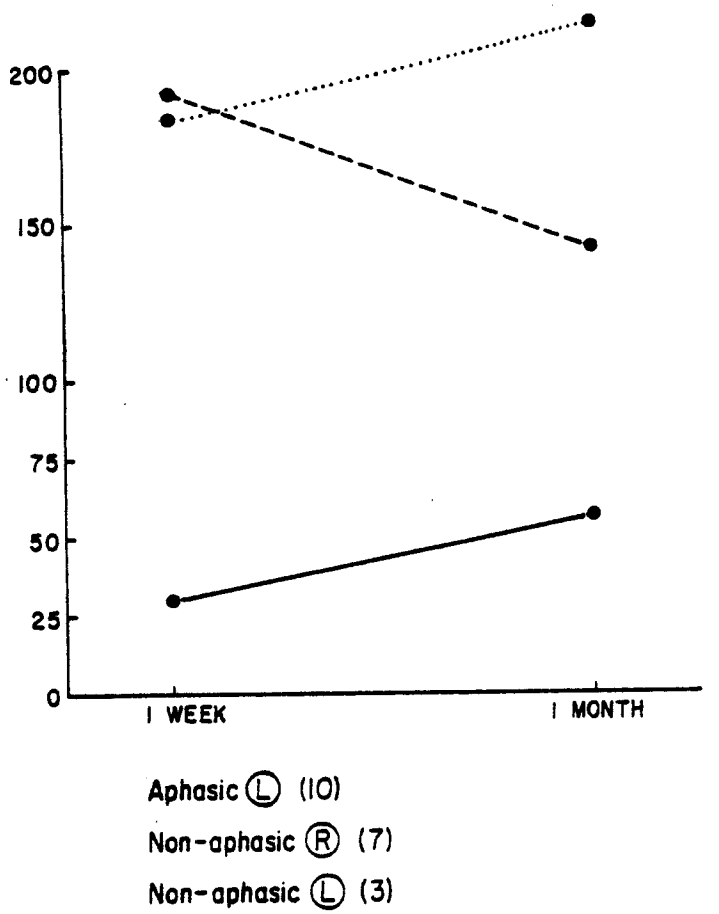

Figure 3. Changes in content units per grammatical string between one week and one month post ictus.

DISCUSSION

These data suggest that the generalized effects of acute stroke can produce a reduced rate of word retrieval (content per minute) and syllable rate. Since the first assessment period represents what is sometimes described as the point where brain edema is greatest, this behavioral change in response to physiologic disturbances is hardly surprising. One might expect a bilateral depression of brain function to have an effect on motor speech function and, consequently to influence verbal rates. This generalized disturbance did not produce frank aphasic anomia but did appear to have an effect on the ability to efficiently evoke content among the nonaphasic persons.

Qualitatively, the similarities between aphasic and nonaphasic persons were greater at one week than at one month post onset. This emphasizes the difficulty in diagnosing or ruling out aphasia at one week post onset. These data represent a small sample of behavior, but does suggest some trends and differences in the psychological responses of dominant and non-dominant infarcts. The three persons with left hemisphere damage and no aphasia had a style of language recovery that was similar to the aphasic

group. The recovery of the right hemisphere damaged group was similar in some respects to the other subjects, but right hemisphere damaged subjects demonstrated a tendency to use redundant content and expressions unrelated to the task.

CONCLUSIONS

Based on this limited sample, several suggestions or conclusions emerge. All of the subjects in this study recovered similarly in that their verbal behavior moved toward the norm. They all began to talk faster, say more, and communicate information more efficiently as they recovered from their acute stroke.

We know that bilingual persons recover both languages in a similar manner. We know that different aphasic types have similar patterns of recovery. We know that nonverbal functions improve in a manner parallel with verbal functions. So it is not surprising that there are changes in aphasia that can be demonstrated in nonaphasic verbal behavior as well. These changes may represent different levels of the same continuum.

With these limited data we have left as many questions unanswered as we have answered. Better tools and a wider sample can help us to explore cognitive differences in verbal style which occur in the recovery of right and left hemisphere damaged persons. The qualitative differences in our sample may have been due to what some authors have described as "inter-hemispheric disinhibition effects." The evolutionary changes of verbal and nonverbal behaviors in recovery from various brain injuries need further exploration. We need a model of recovery. Language clinicians, unlike any other professional group involved with brain injured persons, presume to intrude upon the process of recovery. Consequently, we, more than anyone else, can contribute most to understanding what that process of recovery is.

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DISCUSSION

Q: What about dysarthria? Were any of your patient's dysarthric? And would that make a difference in your measures, since they are so heavily dependent on rate?
A: There was a range of motor speech problems ranging from obvious intelligibility problems to patients without obvious problems. That's a point we were trying to make--that in acute patients we sometimes discuss aphasia as if it were something not influenced by motor speech problems.

Q: Do you know how many were dysarthric?
A: The severity and incidence is in the record. But no, it depended on what we wanted to call dysarthria. It was hard to separate out weakness from acute aphasic characteristics. If they had a seventh nerve palsy we noted that (and the degree of intelligibility) but did not look at the relationship.

Q: How could you tell who was aphasic and who wasn't?
A: You mean among the left hemisphere damaged group?
Q: Any of them.
A: Well, as I said we gave tasks from the Boston, i.e., reading comprehension, naming, repeating, etc. These were patients who had virtually flawless performance.

Q: It's interesting that your right hemisphere damaged persons did so well on those tasks.
A: Well, they made some errors. Certainly the acute patients as a whole have more language deficits than they do later, whether or not they have damage in primary language areas. But their performance on the Boston was a useful screening measure.

Q: Did you use the "complex ideational materials" subtest?
A: No. We tested whether the patient could name, repeat, understand, express propositions, and so forth, to classify our patients.

Q: In my experience, right hemisphere damaged persons are certainly not going to get 12's on that task on the "complex ideational materials" subtest.
A: If they do score low, do you call them aphasic?
Q: Well, no.

Q: Are you saying that based on the measures you took you can't say whether or not a person is aphasic?

A: What I'm saying is that aphasic and nonaphasic persons are a whole lot more alike at one week than they are at one month post.

The nonaphasic persons were talking slower, using shorter phrases, and so forth at one week post. There were significant differences between aphasic and nonaphasic persons but much of their behavior in recovery was similar.

The point is that we have to think of recovery as an integration. We have to think about the fact that both sides of the brain have reduced blood flow and metabolic disturbances. And what we're looking at when we look at recovery from aphasia is in part recovery from these changes. Those are some of the things we are measuring and we're also measuring the way that the brain reorganizes itself in response to the side and site of a lesion. What psychological processes are available as the patient recovers physiologically? We can't think of "recovery from aphasia" as something occurring apart from psychologic and physiologic changes in the brain. This can be demonstrated by looking at so-called "nonaphasic recovery."

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