A Comparison of Written and Spoken Language in Aphasia.

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The relationship between speech and writing has been a question of interest for centuries. For the better part of this century, the accepted point of view had been that writing was simply a transcription of spoken language. Linguistics has long considered spoken language to be its primary subject matter and, until recently, virtually excluded written language from the proper domain of linguistic science. Likewise, the study of pathological language has historically been concerned primarily with disturbances of spoken language, although disgraphic phonomena were reported in early literature on language disturbances. In recent years, however, the view that speech and writing are more-or-less autonomous variants of the same language or dialects, each with its own standards, has been gaining acceptance. Proponents of this view do not go so far as to maintain that the two variants are of equal status, but agree that speech has biological and historical precedence over writing. They support their position with examples of differences in the two variants, especially syntactic and lexical ones. Although it has been documented by Weisenberg and McBride (1935), and others that in aphasia, disruptions of written language often parallel accompanying disorders of speech, very few investigators have given the issue proper consideration. Goodglass and Hunter (1970) analyzed samples of spontaneous written and spoken responses to picture narratives by a Wernicke's and a Broca's aphasic patient, and showed some contrasting features in both means of expression. Both subjects produced longer grammatical runs in speech than in writing. In another study (Hier and Mohr, 1977) comparing the spoken and written performance of a Wernicke's aphasic patient, written naming was spared relative to oral naming, with some superiority of reading comprehension to auditory comprehension.

PURPOSE OF THE STUDY

The purpose of this investigation was to compare spoken and written language in a group of aphasic individuals and normal controls. The study focused on comparing production of isolated sentences to production of connected discourse. This comparison seems important for two reasons. First, in recent years linguists have claimed that discourse is really the natural unit of language in the context of speaker-listener exchange and that units such as the sentence or the clause are the creations of the analyst. This claim has led to a considerable number of discourse studies in different languages and in the area of language acquisition. However, most previous studies of both spoken and written language have dealt with the characteristics of isolated sentences only. The first study of discourse abilities in aphasic patients was reported by Berko-Gleason, Goodglass, et al. (1977)

only at the last Academy of Aphasia meeting. Second, a new concern has emerged in the field of aphasiology, emphasizing the need for studies dealing with the communicative abilities of aphasic individuals in natural environments. These studies by necessity involve connected discourse.

In this paper, we considered a number of variables, only some of which will be discussed here. Performance on each variable was compared by group (aphasic patients vs. normals), by task (sentences vs. discourse), and by medium (speech vs. writing). The variables measured included:

1. Formal characteristics of the language produced in terms of
   a) length of T-Units as measured by number of words, where a T-Unit is defined as one independent clause plus any dependent modifier of that clause (Hunt, 1965),
   b) syntactic characteristics of T-Units, including phrases, clauses, and amount of embedding.
2. Time required to complete the experimental tasks.
3. Amount and types of disruption of language as reflected in errors.
4. Communicative adequacy of discourse, defined in terms of successful transfer of meaning despite disruptions of the surface structure of language.

The above variables were related to performance on the Boston Diagnostic Aphasia Examination and to performance on a set of cognitive nonverbal tasks.

METHODS

Subjects

Eleven aphasic subjects were selected for this investigation. Eight males and three females between the ages of 26 and 72 were studied. Etiology of the 11 patients was a single cerebral vascular accident in the left hemisphere. Six of the patients exhibited right hemiplegia. All patients had good auditory comprehension, and the majority were classified as mildly impaired. Table 1 describes the two groups.

TABLE 1
DESCRIPTIVE DATA FOR APHASIC AND NORMAL SUBJECTS

Measure	Aphasic		Normal	
	Mean	Range	Mean	Range
Age (years)	55.6	26 - 72	57.4	23 - 78
Education (years)	14.0	11 - 17	14.2	8 - 19
Months post onset	25.1	6 - 97	--	--

Materials and Procedures

The diagnostic battery administered to the aphasic population consisted of the following tests:

1. Standardized tests to evaluate language and cognitive functioning, including subtests of the Boston Diagnostic Aphasia Examination and three nonverbal tests taken from the Wechsler Adult Intelligence Scale (Block Design, Object Assembly, and Picture Arrangement).
2. Experimental tests to elicit spoken and written language in the form of isolated sentences and discourse. The sentences were constructed from stimulus words given. The discourse consisted of a self-generated account of a memorable experience, and a "cat" story elicited with the help of a sequence of pictures. In addition, a task consisting of writing a letter was included. Subjects were asked to perform all the above tasks in both spoken and written modalities. The tests given are shown in Table 2.

TABLE 2
STANDARDIZED AND EXPERIMENTAL TESTS

STANDARDIZED	
LANGUAGE TESTS	COGNITIVE TESTS
BOSTON SUBTESTS	W.A.I.S. SUBTESTS
Rating Scale Profile	Block Design
Auditory Comprehension	Object Assembly
Verbal Expression	Picture Arrangement
Reading	
Writing	

EXPERIMENTAL		
TASK	SPOKEN	WRITTEN
Single Sentence Production	+	+
Discourse: Self Generated		
Important Event	+	+
Letter	-	+
Discourse: Pictorial Stimulus		
Picture Sequence	+	+

TABLE 3
APHASIC SUBJECTS' PERFORMANCE ON BOSTON DIAGNOSTIC APHASIA EXAMINATION

Subject No.	Severity Rating (0: severe 5: mild)	Boston Total (404 poss. points)	Auditory Comprehension (99 poss. points)	Oral Expression (165 poss. points)	Reading (46 poss. points)	Writing (94 poss. points)	Writing Rating (0: severe 4: normal)
1	3	359	96	145	38	80	2
2	4	378	99	153	43	83	2
3	4	391	98	158	45	90	4
4	4	382	97	151	42	92	4
5	3	396	99	160	43	94	3
6	3	351	85	144	40	82	2
7	3	369	90	153	43	83	3
8	2	377	91	157	40	89	2
9	5	400	98	162	46	94	4
10	2	297	74	126	27	70	2
11	4	368	87	161	40	80	2

The tests were administered in four 45-minute sessions by speech pathologists and a psychologist in either a clinical setting or in the patients' homes. In addition, since writing was an important variable in the study, a test for visual acuity was included. A questionnaire was also administered to the aphasic patient's spouse to gather background information on premorbid and current performance of the aphasic individual on various writing tasks. All the tests were administered to the control group, with the exception of the Boston Diagnostic Aphasia Examination.

RESULTS

In the following section, the results will be discussed according to the variables selected for the study.

1. Language and Cognitive Functioning

The language profile obtained from the Boston Diagnostic Aphasia Examination characterizes the aphasic patients in the following way (Table 3).

1. Severity ratings ranged from two to five. A majority of aphasic patients obtained a rating of three or four.
2. Good auditory comprehension.
3. Good oral expression for all aphasic patients except one.
4. Relatively high writing performance.

As shown in Table 4, performance on the three nonverbal tasks, as calculated in scaled scores, does not show any significant differences between aphasic individuals and controls, since aphasic individuals have only slightly lower scales, with wider ranges of performance. However, a difference between the groups is shown in higher median times on the Block Design and Object Assembly tasks for aphasic subjects.

TABLE 4
PERFORMANCE ON NON-VERBAL TASKS (WECHSLER).

Task	Aphasic		Control	
	Mean	Range	Mean	Range
Block Design				
Scaled Score	8	3 - 13	10	7 - 13
Median Time	30"	16" - 60"	17"	7" - 40"
Picture Arrangement				
Scaled Score	10	4 - 18	11	4 - 15
Median Time	42"	21" - 60"	43"	18" - 60"
Object Assembly				
Scaled Score	8	3 - 13	10	9 - 13
Median Time	67"	25" - 125"	52"	33" - 115"
Overall Non-verbal				
Scaled Score	26	10 - 37	31	20 - 40

TABLE 5
LENGTH OF T-UNITS AND CLAUSES AND AMOUNT OF EMBEDDING

	Task	Aphasic		Control	
		Mean	Range	Mean	Range
Words/T-Unit					
Spoken	Sentences	6.4	4.9 - 8.3	6.6	4.4 - 12.3
	Discourse	8.9	6.8 - 12.0	12.3	9.7 - 15.9
	TOTAL	7.6	5.1 - 9.3	10.1	7.0 - 12.4
Written	Sentences	5.6	4.8 - 6.7	5.3	4.1 - 7.7
	Discourse	9.6	5.4 - 14.2	12.0	9.8 - 15.8
	Letter	9.3	6.0 - 17.0	9.6	8.6 - 11.0
	TOTAL	7.9	5.3 - 9.7	8.6	7.1 - 10.1
Words/Clause					
Spoken	Sentences	4.9	3.9 - 6.4	4.7	3.5 - 6.1
	Discourse	6.3	5.4 - 7.3	6.7	5.5 - 7.7
	TOTAL	5.5	3.4 - 6.3	6.2	5.2 - 8.6
Written	Sentences	5.0	4.2 - 6.3	4.7	4.1 - 6.5
	Discourse	6.1	4.9 - 7.8	7.0	5.3 - 10.1
	Letter	6.4	4.5 - 14.9	5.8	4.3 - 7.8
	TOTAL	5.7	4.8 - 7.2	5.8	5.2 - 6.6
Clauses/T-Unit (embedding)					
Spoken	Sentences	1.3	1.1 - 1.5	1.4	1.1 - 2.0
	Discourse	1.4	1.1 - 2.1	1.9	1.4 - 2.5
	TOTAL	1.5	1.2 - 2.7	1.6	1.3 - 1.9
Written	Sentences	1.1	1.0 - 1.2	1.1	1.0 - 1.4
	Discourse	1.5	1.0 - 2.1	2.1	1.4 - 3.8
	Letter	1.5	1.1 - 2.4	1.7	1.4 - 2.0

2. Formal Language Characteristics

The comparison of length of T-Units as measured in words indicates longer T-Units in discourse as compared to isolated sentences in both spoken and written language (Table 5). This finding holds true for both aphasic patients and controls, with controls producing longer T-Units in discourse than aphasic patients. However, the length of isolated sentences is nearly the same in both spoken and written language for both populations. The length of clauses is the same for both populations. Syntactic complexity as measured by amount of embedding of clauses within T-Units is higher in controls, especially in the written discourse.

Characterization of T-Units in terms of sentence type, i.e., declarative, interrogative, imperative, and quoted speech, reveals higher ratios of interrogatives in isolated sentences in both written and spoken language in the controls, and higher ratios of imperatives in written language in the controls. However, direct quotes occur more often in the discourse produced by aphasic patients than in that of the controls. The analysis of dependent clauses reveals that the aphasic patients produce the entire inventory of clauses both in spoken and written language as compared to the controls. The ratio of occurrence of those clauses in spoken and written language is usually the same as that in the controls. However, the total number of adverbial clauses and relative clauses is considerably reduced in aphasic patients.

Analysis of verbs according to tense shows a predominant use of the present in isolated sentences and a predominant use of past tense discourse in both spoken and written language in both populations. The entire range of tenses, i. e., present perfect, past progressive, and future, as well as modal verbs, are used in both spoken and written language in both populations.

3. Time Required to Produce the Tasks

Although both populations produced comparable amounts of language in terms of T-Units, time required for the production of that language sharply differentiates aphasic patients from controls (Table 6). This is especially evident in the time taken by aphasic individuals to produce isolated sentences in spoken language as compared to controls. Time differences between populations are even more pronounced in the production of both isolated sentences and discourse in written language.

TABLE 6
MEAN AMOUNT OF TIME PER TASK

	TASK	Aphasic	Control
Spoken	sentences	8.4 min.	3.8 min.
	discourse	5.3 min.	3.9 min.
Written	sentences	17.7 min.	6.4 min.
	discourse	29.9 min.	10.4 min.
	letter	17.1 min.	4.5 min.

4. Amount and Types of Disruptions of Language

Table 7 indicates lower numbers of correct T-Units with wider ranges of correct T-Units in both spoken and written language for the aphasic patients. The ratio of correct T-Units in written as compared to spoken language is lower for both populations. However, while spelling errors account for 55% of the total errors in the controls, they constitute only 25% of the total errors in the aphasic group. Also, both populations show lower ratios of correct T-Units on discourse, as compared to isolated sentences.

TABLE 7
PERCENTAGE OF CORRECT T-UNITS PER TASK

Percentage Correct	Task	Aphasic		Control	
		Mean	Range	Mean	Range
Spoken	T-Units/Sentence	73%	31 - 100%	96%	81 - 100%
	T-Units/Discourse	63%	18 - 89%	89%	76 - 94%
	Total T-Units	65%	10 - 93%	90%	76 - 100%
Written	T-Units/Sentence	67%	25 - 100%	94%	75 - 100%
	T-Units/Discourse	46%	0 - 92%	75%	18 - 100%
	T-Units/Letter	45%	0 - 100%	78%	40 - 100%
	Total T-Units	55%	15 - 97%	83%	56 - 100%

*Note: Spelling and punctuation errors constitute 55% of total errors in controls and only 25% in aphasics

Error analysis reveals parallel types of errors in spoken and written language in both populations, in terms of word-classes affected, and syntactic and semantic errors.

In both populations, verbs constitute the largest error category, followed by articles and pronouns. However, the large number of preposition errors and semantic errors in both spoken and written language differentiates the aphasic patients from the controls. In producing isolated sentences with specific content words and function words, both populations have a higher number of errors on function words than on content words in both spoken and written langua

5. Performance on Letter Writing

Since the letter is the most frequently used form of written discourse, some of the findings from the letter writing task are included. Results of the analysis of letter writing indicate that both populations produced business and personal letters. In aphasic patients, the features of letter format are preserved in terms of salutation, closing, and punctuation required for them. Moreover, the conventions appropriate for business versus personal letters are observed. The formal features of length of T-Units and clauses and amount of embedding do not differentiate aphasic individuals from controls.

6. Communicative Adequacy

Communicative adequacy of spoken and written discourse produced in response to the "cat" story was evaluated by three independent judges. The scoring

criteria are shown in Table 8. The evaluations focused on the intelligibility and specificity of the message to be communicated, disregarding the disruption of the surface structure of language. Interjudge reliability of judgments of intelligibility and specificity was 97%. Results of the rating indicate that the communicative adequacy of aphasic patients is considerably higher than their scores of overall linguistic functioning, especially when writing was involved, as revealed by the Boston Diagnostic Aphasia Examination (Table 9).

In general, communicative adequacy is either better or the same in written language, compared to spoken language in both populations. Only two aphasic patients and two controls show a lower rating on communicative adequacy of written language than on the communicative adequacy of their spoken language.

7. Statistical analysis

Rank-order correlations were calculated among the scores on the variables involved in this study (Table 10). Percentage of correct T-Units in writing has a high positive correlation with the Boston overall score, auditory comprehension, writing scale score, writing narrative, reading, and with picture arrangement. Correlation with overall cognitive ability is lower. Percentage of correct T-Units in spoken language has an equally high positive correlation with reading, and somewhat lower correlations with Boston overall, writing scale score, and picture arrangement. Intercorrelation between percentage of correct T-Units in written and spoken language is high.

TABLE 10
CORRELATIONS BETWEEN PERFORMANCE ON WRITTEN AND SPOKEN WITH PERFORMANCE ON BOSTON EXAMINATION AND COGNITIVE TESTS FOR APHASIC SUBJECTS

% Correct	Boston Overall	Aud. Comp.	Writ. Scale	Writ. Score	Read-ing	Cog. Total	Picture Arr.	% Correct T-Units Written	% Correct T-Units Spoken
T-Units Written	77 .01	74 .005	74 .01	72 .01	80 .005	53 .05	73 .01		78 .005
T-Units Spoken	54 .05	40 N.S.	70 .01	47 N.S.	81 .001	26 N.S.	50 .06	78 .005	

CONCLUSIONS

In interpreting the above results, two issues should be emphasized; (a) the parallelisms between spoken and written language in aphasic patients and controls, and (b) features which differentiate spoken from written language in the two populations. Parellelisms can be summarized as follows:

1. Writing reflects speech in the length of T-Units and clauses, amount of embeddings, and ratios of occurrence of syntactic structures in both aphasic patients and controls.
2. In both spoken and written language, isolated sentences are shorter than discourse sentences for both populations.

TABLE 8
COMMUNICATIVE ADEQUACY RATING SCALE

Part I

Instructions

Read all of the stories once. Concentrate on the context and its logical organization only, disregarding aphasic patients' errors. After you read answer the first 3 questions only. Rate each story using the following s

4: if "yes" to question 1, 2, 3
3: if "yes" to question 1 and 2 only
2: if "yes" to question 1 only
1: if "no" to all three questions

1. Do you know what's happening in the story? _____yes ____
2. Does the sequence of events make sense? _____yes ____
3. Is the story unambiguous as to what each of the participants did? _____yes ____

Oral _____ Written _____ Rating

Part II

Instructions

After you have finished the above ratings on all the subjects, read each story again. This time, concentrate on the details of the story. You wi look at 3 categories:

1. The participants in the story
2. The setting
3. The main events in the story

Rate each story using the following scale:

4: all 4 participants, at least 3 elements of setting, 4 events
3: all 4 participants mentioned, at least one element, 3 events
2: at least 3 participants, 1 element of setting, 2 events
1: less than the above

1. Are the basic participants identified? _____yes ____
2. Is the setting identified? _____yes ____
3. Are the main events identified? _____yes ____

Oral _____ Written _____ Rating

Part III

Overall Rating Oral _____ Written _____

TABLE 9
PERFORMANCE ON STANDARDIZED LANGUAGE AND COGNITIVE TESTS AND COMMUNICATIVE ADEQUACY OF SPOKEN AND WRITTEN LANGUAGE

Aphasic						Control			
Subject	Boston Aphasia Exam		Communicative Adequacy		Wechsler	Subject	Communicative Adequacy		Wechs
Number	Severity Rating	Writing Narrative	Written	Spoken	Nonverbal	Number	Written	Spoken	Nonver
1	3	2	3	3	26	1	4	3	29
2	4	2	4	3	31	2	3	4	28
3	4	4	4	4	31	3	4	3	20
4	4	4	4	4	37	4	3	4	40
5	3	3	3	4	24	5	4	4	29
6	3	2	4	3	34	6	4	4	30
7	3	3	2	3	21	7	4	4	29
8	2	2	3	1	30	8	4	4	32
9	5	4	4	3	22	9	4	3	34
10	2	2	1	1	10	10	4	3	33
11	4	2	4	3	21	11	4	3	31

* Performance on all tasks calculated in ranking scales, highest being the best.

3. Spoken language has more correct T-Units than written language for aphasic patients and controls.
4. Patterns of errors in spoken and written language are similar; for example, verb errors are the most frequent in both populations.

The differentiating features are as follows:

1. Aphasic patients produce more preposition and semantic errors in both spoken and written language but especially in written language.
2. The complexity of T-Units, i.e., the amount of embedding, especially in written language, is reduced in aphasic individuals.
3. Aphasic patients need more time to produce language in both spoken and written form.

Moreover, it should be stressed that aphasic patients can achieve relatively high levels of communicative adequacy if given a task of producing communicatively viable units of language, such as discourse, despite considerable disruptions of the linguistic formal structure. This finding obviously cannot be generalized to aphasic patients with more severe disruptions of both linguistic and cognitive performance, but nevertheless, the study confirms some of our previous findings on functional communication, in which we considered patients with wider ranges of impairment (Ulatowska, Haynes, Hildebrand, Richardson, 1977).

It should be kept in mind, however, that the time required to perform the task is the primary price to be paid in achieving this communicative adequacy. This is particularly evident in aphasic patients' performance on written tasks. For instance, it took one aphasic individual 30 minutes to produce a written discourse consisting of 13 sentences which a normal subject completed in three minutes. Both of them produced language which was rated the same on the communicative adequacy scale. Last year in a longitudinal study, we observed a patient producing his written memoires at a rate of several lines per day (Ulatowska, Baker, Freedman, Stern, 1978).

Luria (1972) in his account of Zasetsky's experiences writes: "When his writing went well he managed to write a page a day, two at the most and felt completely drained by this. Writing was his one link with life, his only hope of not succumbing to illness but recovering at least a part of what has been lost."

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DISCUSSION

Q: What is the definition of a T-unit?

A: T-unit or "minimal terminable unit" is defined as one independent clause plus all the modifiers attached to it, the smallest unit that can be punctuated as a sentence. For example "When I arrived he was gone" is one T-unit, whereas "John went home and Mary stayed at school" are two T-units, since the sentence consists of two independent clauses.

Q: Was the communicative adequacy rating higher than that of the Boston Severity Rating?

A: Ratings are not comparable, since the rating on the Boston Diagnostic Aphasia Examination is based on the amount of correct language used, whereas the communicative adequacy rating evaluates language in terms of successful transfer of meaning disregarding disruptions of grammatical structure.

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