Agrammatism and Inflectional Morphology in English

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Many aphasic patients, while beginning to recover a considerable speaking vocabulary, continue to omit articles, relational words, and inflectional endings from their speech. These patients, speaking in disconnected words rather than sentences, are said to exhibit 'agrammatism' or 'telegraphic speech.' The phenomenon of agrammatism has been described by many clinicians in the classical literature on aphasia; it continues to be cited by Goldstein (*3*), Weisenburg and McBride (*12*), Brain (*2*), Wepman, Bock, Jones, and Van Pelt (*13*) as part of the syndrome of motor (or expressive) aphasia, as opposed to the speech pattern in the sensory and amnesic types of aphasia. Pick (*8*) undertook an analysis of grammatical disturbances in aphasia in 1913, but the problem then lay dormant for many years. Agrammatism and telegraphic speech have remained essentially subjective terms, based on clinical impression, in spite of their potential importance for clinical diagnosis and neuropsychological theory.

Recently, a series of contributions by Jakobson (*6*), Wepman, Bock, Jones, and Van Pelt (*13*), Goodglass and Mayer (*5*), and Luria (7) have applied psycholinguistic concepts and methods in the effort to define and make measurable the deficit which produces the symptoms of agrammatism. Jakobson applied the term 'contiguity disorder' to this phenomenon and stated the symptoms in linguistic terms as follows: (a) reduction in the variety of sentences, (b) loss of syntactic rules, (c) dissolution of ties of grammatical coordination and subordination, (d) loss of words with purely grammatical function and loss of inflectional endings. Jakobson thus implicates inflections of grammar, which are obligatory in English, as well as syntactic arrangements, which are not so highly coded by the language. Contiguity disorder and agrammatism thus refer to language disturbances that more specifically fall under the linguist's headings of 'morphology' and 'syntax.' Syntax here refers to the arrangement of words into sentences, and morphology includes the study of the rules for suffixes that are used to indicate grammatical relationships between words.

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Goodglass and Mayer (*5*) selected five agrammatic and five nonagrammatic aphasics on the basis of clinical judgment. They found that these groups differed sharply with respect to errors with syntactic constructions (that is, positioning of words by grammatical function), and differed much less in their tendency to omit or confuse inflectional endings and the 'small words' of grammar. These findings suggested that the morphological aspect of agrammatism might well be studied separately from the syntactical. Goodglass and Hunt (*4*) compared the ability of aphasics to answer questions correctly with words ending in a plural '-s' as opposed to a possessive '-'s.' They also required their subjects to judge the correctness of tape recorded sentences from which either a final plural 's' or a final possessive '-'s' was omitted. The possessive was clearly more difficult than the plural, both in the expressive and the auditory-receptive parts of the experiment.

The present study is an investigation of the aphasic individual's ability to produce orally common English words with inflectional endings appropriate for the completion of English sentences. It affords some interesting comparisons with Berko's (*1*) study of this ability in preschool children. The principal questions to be answered by the data were conceived as follows:

a. Does there appear to be, in general, an order of difficulty for the English inflectional forms among aphasics and, if so, how does this order compare with the difficulty of these forms for children?

b. Is there any evidence from correlational data that a common factor governs the use of the various inflectional morphemes?

c. What relation can be discovered between impaired use of any of the inflectional morphemes and other, independently measured, aspects of aphasic disturbance?

The English inflectional items investigated were the regular forms of the plural and possessive of the noun, the simple past and the third person singular present indicative of the verb, and the comparative and superlative of the adjective, to make a total of 10 inflectional morphemes. These items include all of English inflection with the exception of the progressive 'ing' form of the verb. All of these inflectional forms, except the comparative and superlative, occur in one of three differing forms, or allomorphs, depending on the last phoneme of the stem of the word; they are therefore said to be phonologically conditioned. These allomorphs are as follows:

a. The third person present singular indicative of the verb, the noun plural, and the possessive singular, phonologically identical and formed by [-əz], [-s], or [-z].

b. The past tense of the verb, formed by [-əd], [-t], or [-d].

c. The comparative and superlative of the adjective, formed by [-ər] and [-əst], respectively, endings which have no variants.

Ideally, a test aimed at the problem under consideration here uses nonsense words. That is, if a subject says that the plural of 'watch' is 'watches,' it is always possible that he has no internalized rule for the formation of the plural, that his production represents a specific memorized form, and that

he may be unable to form the plural of a word he has never before heard. Thus if the request is for the plural of a nonsense form like 'gutch,' these difficulties are overcome. The subject who produces 'gutches' demonstrates the possession of an abstract rule. Berko (*1*) used such nonsense forms in her experiment with preschool children. In the present experiment with aphasic patients, real words were used because it was found that in the majority of instances the individual was unable or unwilling to complete a sentence containing nonsense words. Since inflections are obligatory in English, it was possible to construct sentences that necessitated their use, and the individual's deficits were readily measured.

Procedure

Subjects. The subjects were 21 aphasic patients in the neurological wards of the Boston Veterans Administration Hospital and in the speech therapy program at Lemuel Shattuck Hospital.[1] They ranged in age from 24 to 65 years, with a mean of 48.1. Three were college graduates, including one physician; seven others had completed high school. The criterion for inclusion of a subject was that he have sufficient speech to complete the test sentences with scorable responses, but sufficient residual aphasia to make two or more errors. Two patients with minimal residual aphasia were excluded because they made no errors at all. One patient with a moderate anomic aphasia also was excluded because she made no errors in the experimental task.

[1]Testing of patients at Lemuel Shattuck Hospital was carried out by Miss Mary Hyde, Speech Therapist.

Tests Used. A 60-item sentence completion test was composed to include six opportunities for the use of each of the 10 inflectional morphemes chosen for study. The test was designed to be given in two equivalent sections of 30 items each. The 10 morphemes were plural [-z] or [-s]; plural [-əz]; past [-t] or [-d]; past [-əd]; present [-s] or [-z]; present [əz]; possessive [-s] or [-z]; possessive [-əz]; comparative [-ər]; superlative [-əst]. An example of an item (simple past) follows: 'It rains pretty often around here. It did rain last night. Last night, it _____.'

Each sentence was read aloud by the experimenter with a natural or slightly exaggerated phrasing and intonation, in order to elicit the final word from the subject. The initial sound of the response word was supplied as a starting cue for subjects who needed this assistance, and the score of plus or minus depended solely on the correctness of the inflectional suffix. In some instances subjects misunderstood the item or gave a paraphrased answer and it was felt injudicious to press them to listen once more to the item. For this reason 18 (1%) of the responses could not be scored as right or wrong. These items were arbitrarily assigned plus or minus scores in alternation as they happened to fall on the data sheet. These ambiguous responses were evenly scattered; no test sentence elicited more than one unscorable response among the 21 subjects and no inflectional category (each involving 126 responses) had more than two. The error thus introduced is insignificant and random.

In the listing of test items it will be noted that final [-s] items are scored together with final [-z] items, and that

final [-d] items are scored together with final [-t] items. The use of the unvoiced form in each of these cases does not depend on knowledge of the inflection, but is determined by prior phonological rules which are universal for English. That is, the final alveolar stop following [p, k, č, f, θ, s, š] is unvoiced and so is the final sibilant following [p, t, k, f, θ]. The assumption was made that the voiced and unvoiced forms were homogeneous in difficulty. A further assumption in the use of this test is that the six samples of each type of inflection are homogeneous in difficulty and that they reliably represent the level of difficulty of the entire class of inflections to which they belong. The basis for this assumption was that the task for the subject was phonologically and grammatically the same in all six samples of each type of inflectional ending. It was felt that differences in difficulty among the stems of the response words did not appreciably influence scores since, with the help of a cue, if necessary, the subjects were capable of supplying the stem in every case. The validity of this assumption concerning homogeneity is examined statistically under *Results*.

As part of their examination routine, 15 of the subjects had had an aphasia examination which included objective ratings of effective 'Functional Speech' and articulation. These subscores served as criteria of impairment in aspects of language performance apart from word endings. The Functional Speech score is obtained from a five-point rating, based on the Interjectional Speech and Spontaneous Expository Speech subtests of the Boston VA Hospital Diagnostic Aphasia Test.[2] This portion of the examination consists of a structured conversation, ranging from expletives and conversational automatisms to extended propositional utterances, including a narrative about a picture-situation. Subjects' performance was scored on a scale from *0* to *4* with *0* indicating no impairment and *4* indicating severe to total aphasia.

The rating scale was originally validated on 25 patients against the judgment of two clinicians who knew the patients well through testing and therapy. It has since been applied to more than 100 tested subjects with satisfaction that the objective scoring standard coincided with clinical judgment, based on extended observation, as to the patients' over-all verbal efficiency. Statistical evidence, though still scanty, supports the use of the Functional Speech rating as an index of the over-all severity of aphasic speech defect. In a study with 20 aphasic patients, rank order correlation coefficients obtained between Functional Speech and each of two subtests, Commands and Word Finding, were .71 and .72, respectively; intercorrelation of the two latter tests was only .49. The Functional Speech score is also based on performance closely similar in content to the two subtests (Giving Information and Picture Description) which Schuell and Jenkins (*11*) found to be tied for the second highest phi coefficient among 29 subtests which were tested for correlation with their full battery.

[2]The term 'Functional Speech' applied to the rating of a structured conversation test and the principle of scoring several levels of speech productivity on a picture-situation were taken from the Minnesota Test for Differential Diagnosis of Aphasia by Schuell (*10*).

TABLE 1. Errors made by 21 aphasics in use of 10 inflectional endings on sentence completion test in which each ending appeared six times.

Class of Inflection	*Number of Subjects Failing each Item*	*Total Errors*	*Mean Errors per Subject*
Plural [-s, -z]	4, 0, 6, 7, 5, 4	26	1.2
Plural [-əz]	7, 3, 5, 3, 5, 4	27	1.3
Past [-t, -d]	10, 9, 10, 10, 9, 6	54	2.6
Past [-əd]	13, 9, 13, 7, 5, 3	50	2.4
Present [-s, -z]	7, 9, 5, 4, 10, 11	46	2.2
Present [-əz]	10, 11, 11, 10, 9, 11	62	3.0
Possessive [-s, -z]	11, 10, 10, 6, 12, 9	58	2.8
Possessive [-əz]	12, 15, 10, 16, 14, 16	83	4.0
Comparative [-ər]	4, 8, 3, 6, 5, 4	30	1.4
Superlative [-əst]	10, 6, 7, 7, 6, 7	43	2.0
Total		479	22.8

The articulation or Verbal Agility subtest required the rapid reiteration of a series of test words. Either one or two points per item could be earned, depending on the number of repetitions in a five-second span. Test words were presented both orally and visually, and timing of each word did not begin until the subject had succeeded in saying it, or clearly could not master its articulation. This task was designed as a wide range test of articulatory facility, as independent as possible of difficulties in auditory comprehension and in word-finding. It was included in the present experiment because of the impression gained during preliminary investigations that subjects who performed easily on the experimental task were facile in their articulation.

Results and Discussion

Order of Difficulty of the Inflectional Endings for Aphasic Subjects. The difficulty of each type of inflectional ending for the aphasic subjects was measured by the number of errors on the six items representing each ending. Table 1 summarizes the data. From the column which gives the number of subjects failing each item it is possible to get a rough estimate of the uniformity of the difficulty of items within a class, as compared to the differences between classes. The Cochran Q test, as described by Siegel (*12*, pp. 161-166) was applied to each of the 10 sets of error scores. The null hypothesis in this test is that the items have equal probability of being passed. Rejection of the null hypothesis would indicate that the items in a set are clearly heterogeneous in difficulty. The null hypothesis could not be rejected at the .05 probability level in any case except that of the past [-əd], where it could be rejected at the .01 level. Homogeneity of item difficulty thus may be assumed for all but one of the 10 sets.

Inspection of the several widely discrepant items suggests the possibility that some, but not all, of the easiest ones were more probable in English conversation than the others. On the whole, however, the assumption of homogeneity of difficulty within classes

TABLE 2. Significance level of differences in number of errors made, each inflectional ending having the larger error score (listed from highest to lowest) compared to each ending having the lesser error score of pair. Figures are based on the application of the Wilcoxon signed ranks test (two-tailed) to paired arrays of error scores of the 21 subjects.

Inflectional Ending (Larger Error Score)	*Inflectional Ending (Lesser Error Score of Pair)*								
	Present [-əz]	*Poss* [-s, -z]	*Past* [-t, -d]	*Past* [-əd]	*Present* [-s, -z]	*Superl* [-əst]	*Compar* [-ər]	*Plur* [-əz]	*Plur* [-s, -z]
Possessive [-əz]	.05	.01	.05	.01	.01	.01	.01	.01	.01
Present [-əz]		ns*	ns	ns	ns	.05	.01	.01	.01
Possessive [-s, -z]			ns	ns	ns	ns	.05	.01	.01
Past [-t, -d]				ns	ns	ns	.05	.01	.01
Past [-əd]					ns	ns	.05	.01	.01
Present [-s, -z]						ns	ns	ns	.01
Superlative [-ər]							ns	.05	.05
Comparative [-əst]								ns	ns
Plural [-əz]									ns

*Not significant.

appears to have been justified. Consideration of the significance of differences between the error totals is therefore a legitimate next step.

Differences in error totals were tested for significance by means of the Wilcoxon signed ranks test, with results summarized in Table 2. It will be noted that the inflectional endings fall into at least three distinguishable groups with respect to difficulty, with the complex possessive by far the most difficult, the comparative and the two forms of the plural by far the easiest, and the remaining six occupying a middle range.

The decisive importance of grammatical function over phonological structure in determining the difficulty of an inflectional ending is illustrated by those items in which exact homonyms were used in different grammatical settings. For example, 'horses' as a noun plural was failed by only three subjects in the item 'The millionaire bought a new horse. He now has a whole stable full of _____.' The possessive form 'horse's' was failed by 15 subjects in the item 'This blanket is for the horse. Whose blanket is it? It is the _____.' 'Watches' as a noun plural was failed by five subjects in the item 'The doctor has a wrist watch and a pocket watch and a stop watch. He certainly has a lot of _____.' The verb form 'watches' was failed by 11 subjects in the item 'John likes to watch while Tom draws pictures, so Tom draws and John_____.'

The interpretation of the differences between the error scores may be limited by systematic differences in the probability structure of the incomplete sentences which were used to elicit the responses. That is, the order of difficulty of inflectional forms in free conversation is not necessarily the same as that obtained under the experimental conditions. It may be pointed out, for example, that the last word in the plural-demanding sentences is often preceded by a strong cue for a plural noun, such as 'a lot of . . .' or the plural form of the verb. Yet, the item which had no such strong cue 'My rose bush is in bloom. It is all covered with beautiful red _____.' is just as easy, on the average, (five errors) as the other five items in its class.

A strong predominance in errors with the possessive was found also by Goodglass and Hunt (*4*). They used a stimulus structure that was apparently free of bias in the transitional probabilities of the words in the plural as compared to the possessive items. Their items were in the form: 'The dog chewed up my sister's gloves. (Read twice by examiner.) What did the dog chew up? Whose gloves were they?' It is therefore suggested that the differences in level of difficulty for the various inflectional endings, for aphasic subjects, cannot be dismissed as artifacts of the particular sentence structures chosen for the test items.

Comparison with Performance of Nonaphasic Subjects. The sentence completion tests used in the present study were given also to 15 brain-injured nonaphasic individuals who were neurological patients at the Boston Veterans Administration hospital. They were somewhat older than the aphasic subjects, ranging in age from 39 to 65 years with a mean age of 52.6. They closely resembled the aphasic subjects in educational attainment; two had graduated from college, four from high school. The two groups were not matched on performance IQs but the nonaphasic individuals appeared to have at least as much intellectual impairment as the aphasic subjects. The majority had right-sided brain damage or diffuse bilateral disease; two had been aphasic early in their illness.

Of the nonaphasic individuals, 10 performed with no errors at all, two made three errors, two made two errors, and one made one error. All five who made errors omitted the complex possessive [-əz]; this error occurred seven times. Three of the five omitted a simple possessive, as well, and one twice substituted a past tense for the third person present. None of these five had ever been considered aphasic. The most grossly deteriorated of these brain-injured individuals, who was confused, disoriented in time and place, and almost devoid of memory, performed without error under the conditions of the experiment. It is interesting to note that the items occasionally failed by the nonaphasics were also the most difficult for the aphasic subjects.

Comparison with Data on Children. According to Rapaport's (*9*, p. 186) summary, Ribot's rule holds that organic defects, such as aphasia, injure the latest learned patterns before they affect the earliest learning. One might therefore expect the aphasic's loss to mirror the pattern of the child's acquisition: that is, that the forms most difficult for the aphasic should be the ones acquired latest by the children. Data in the present study indicate that the pattern of aphasic deficit in English inflectional morphology only partially resembles the pattern of the child's learning, as found by Berko (*1*). For example, Berko found that children regularly have more difficulty with the phonologically complex[3] [-əz] and [-əd] than with the simpler [-s, -z] or [-t, -d] allomorphs in all the grammatical functions in which these endings are used. Percentages of correct responses of 80 children (four to seven

[3]The expression 'phonological complexity' here refers to the fact that the [-ez] and [-ed] forms apply to fewer cases and constitute exceptions to more general (hence 'simpler') rules; it does not mean that these forms are harder to pronounce than their simple allomorphs.

TABLE 3. Percentage of correctly inflected nonsense words supplied by 80 children, aged four to seven, as reported by Berko (*1*).

Inflectional Class	*Required Response*	*Percent Correct*
Plural [-z]	wugs	91
Plural [-əz]	tasses	36
	nizzes	28
Possessive [-z]	wug's	84
Possessive [-əz]	niz's	49
Present [-əz]*	loodges	56
	nazzes	48
Past [-d]	binged	77
Past [-əd]	motted	33

*The simple [-z] form of this inflectional morpheme was not sampled.

years) to a sentence completion test, using nonsense words, are given in Table 3. For aphasics the corresponding difference in difficulty of the complex over the simple allomorph was found to a significant degree for the possessive; the difference between the simple and complex allomorphs of the third person singular also tends in this direction; however, there is no difference, for aphasics, between the two forms of the plural or past tense endings. The errors of aphasics, as compared to children's, are much more influenced by morphemic differences than by phonological complexity. In some instances aphasics were unable to supply any of the allomorphs of a given inflectional morpheme, regardless of phonological simplicity. For example, three aphasics failed all of the possessive ending in the simple [-z] form. In the Berko study four-year-old children were consistently able to supply a simple possessive ending.

In making the comparison with children, it should be recalled that the aphasics were required to supply actual English forms; the children, on the other hand, had to demonstrate their generalization of the inflectional rules to nonsense words. Berko reports two instances in which real English words were to be supplied by the children.

TABLE 4. Intercorrelations between the error scores for the 10 inflectional endings. (With 21 subjects a correlation coefficient of .37 is required for significance at the .05 level.)

	Plur [-əz]	*Past* [-t, -d]	*Past* [-əd]	*Pres* [-s, -z]	*Pres* [-əz]	*Poss* [-s, -z]	*Poss* [-əz]	*Compar* [-ər]	*Superl* [-əst]	*Combined Error Score*
Plural [-s, -z]	.45	.34	.50	.65	.63	.65	.33	.15	.53	.67
Plural [-əz]		.35	.72	.54	.65	.40	.46	.60	.53	.79
Past [-t, -d]			.32	.03	.16	-.18	-.02	.26	.21	.43
Past [-əd]				.42	.56	.40	.52	.43	.81	.70
Present [-s, -z]					.72	.62	.41	.03	.47	.63
Present [-z]						.62	.60	.19	.61	.74
Possessive [-s, -z]							.75	.18	.33	.60
Possessive [-əz]								.28	.35	.56
Comparative [-ər]									.21	.41
Superlative [-əst]										.51

The past tense 'melted' was supplied by 73% of her children as compared to 33% for the nonsense form 'motted'; the plural 'glasses' was supplied by 91% as compared to 36% for the nonsense form 'nizzes.'

Correlations among the Subscores. Rank order correlations were computed among the 10 arrays of error scores, with the results listed in Table 4. As a measure of the agreement between each of the subscores and their combined total, the rank order correlation was computed between each of the subscores and the total error scores of the 21 subjects. For this purpose the total error score was summed separately for each computation, omitting the score with which the total was being correlated. These correlations are also included in Table 3. Because of the small number of subjects, it would be rash to draw conclusions from any but the grossest differences between correlations. There appears to be a common factor contributing to the error scores of all the inflectional morphemes, with the possible exception of the simple past.

Relationship with Other Measures of Severity of Aphasia. The total error score on the experimental task was tested for correlation with the Functional Speech score and the Verbal Agility (articulation) score, which were described earlier. Unfortunately, these scores were available for only 15 of the 21 subjects. The obtained rho of .32 between Functional Speech and the total inflectional error score is well below the level required for statistical significance. This low correlation is illustrated clinically by the subject ranking fifth in the experimental task, who nevertheless had such a severe expressive aphasia that he could initiate practically no speech, although he could repeat words or short phrases. The patient ranking highest on the experimental task obtained a Functional Speech rating at the 'moderately severe' level.

For the same group of 15 subjects, a correlation of .69 was obtained between the Verbal Agility subtest and the total inflectional error score. This correlation accords with the clinical impression, gained in exploratory study, that patients who articulate individual words easily also have few omissions of inflectional endings.

Among the subjects who did well in the experimental task were some who had extreme word-finding difficulty and some whose speech was essentially limited to one-word sentences. That is, among the subjects who would be called clinically agrammatic because they speak in isolated words or short phrases, there are some—usually subjects having facile articulation—who are not much impaired in the test of grammatical morphology. It should be noted, however, that the correct syntactical context in each test sentence was already structured for the subject and was extremely important in determining the inflections supplied. This cue is absent in the normal speech of the patient who lacks a repertory of sentence patterns so that the correct inflections may be less in evidence under the conditions provided by their spontaneous speech. Under the present experimental conditions, at least, there appears to be a degree of independence between the morphological and syntactical aspects of agrammatism.

Significance of Findings and Research Implications

The present study has shown that aphasic subjects vary widely in their ability to supply inflectional endings under a particular experimental condition; that inflectional endings vary, according to their grammatical function, in their availability to aphasics. It further appears that if one eliminates the minimally aphasic and the totally aphasic, then the degree of aphasic handicap has little predictive value for the ability to supply inflectional endings. On the other hand, facility with articulation appears to be positively correlated with this ability. However, a considerably larger sample of aphasics should be tested before either of the two latter relationships can be claimed with any assurance.

As yet, there is no information on the relation between performance on the experimental task and use of inflections in a sample of free conversation; neither is the relation known between performance on the present test and facility with English syntactic forms, either in structured tests or in free conversation. A larger sample is necessary also before it can be determined whether any of the inflectional endings of the present test are differentially related to each other or to other diagnostic indicators. The present authors propose that continued application of linguistic categories to the design of experimental tasks offers the most promise for identifying agrammatism more precisely. As greater precision is gained in stating operationally *what* is meant by 'agrammatism' it should be possible to suggest *how* or through what psychological processes this defect operates.

From a comparison of the present experimental data with the performance of preschool children, it appears that no simple parallel can be drawn between the normal acquisition of inflectional forms and their loss through brain injury. However, the order of acquisition of regular inflectional endings by very young children is still not known. If they are acquired in a definite order, Berko's data suggest that this learning is nearly complete by the age of four when children are able to handle the more simple and regular forms of all English inflectional categories. In addition to information on the inflectional usage of three-year-olds, it would be useful to have a frequency count for the occurrence of the various English inflectional endings in normal adult speech.

Summary

This study was concerned with the morphological, as distinct from the syntactical, aspects of grammatical disturbance in aphasia. Specifically, it investigated the ability of 21 aphasic subjects to supply, by means of a sentence completion test, correct inflectional endings for nouns, verbs, and adjectives. The results suggest the following tentative conclusions:

a. For aphasics, the difficulty of various inflectional endings follows a definite order which is based on grammatical function, not phonological similarity.

b. Phonological complexity is not as important for aphasics as for children in determining the difficulty of inflections.

c. A common factor appears to underlie adequate performance with all inflectional endings studied except the simple past.

d. The inflectional ending score is related to verbal agility in articulation, but is not related to over-all adequacy of speech. It is suggested that, in some aphasics, the syntactic and the inflectional aspects of grammar may be impaired independently of each other.

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