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GRAMMATICAL JUDGMENTS OF AGRAMMATIC APHASICS*†

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Abstract—Effortful, agrammatic speech and relatively intact comprehension often appear to coexist in Broca's aphasia. The present study focusses on this discrepancy, and tests the claim that the agrammatic patient has more information about syntactic structure than is indicated in his speech. Agrammatic aphasics and non-neurological patients sorted words from a variety of sentences on the basis of how closely related they felt the words to be in each of those sentences. These word groupings served as input matrices for a hierarchical clustering analysis. The resultant subjective phrase structure trees show that while normal subjects are often constrained by surface syntactic properties, agrammatic patients operate on a hierarchical scheme that excludes anything nonessential to the intrinsic meaning of a sentence. These findings suggest that expressive agrammatism is only one aspect of an impairment involving all language modalities.

THE TERM agrammatism aptly characterizes a form of speech generally considered to result from lesions of the frontal speech zone and thus most often associated with Broca's or motor aphasia. Chiefly typified by the omission of articles, prepositions, and inflectional forms, agrammatism may persist even though the patient begins to recover a considerable speaking vocabulary [1, 2]. In Jakobson's words, the severely agrammatic patient reduces speech to 'primaries . . . nouns and nominal forms of verbs in holophrastic usage [3]."

Yet motor aphasia with agrammatism is usually thought to occur within a setting of relatively intact comprehension [4]. In fact, even when testing focusses on the comprehension of locative prepositions and prepostions involving grammatical relations, Broca's aphasics who seldom produce these function words in their speech, appear to understand them moderately well [5]. Of course, not all grammatical structures are comprehended normally [1, 6, 7], but on the whole, the agrammatic patient's comprehension of spoken language seems to be superior to his language production. Furthermore, agrammatic aphasics seem to be aware of their limitations, attempting time and again to bring their utterances into line with something more grammatically satisfactory [8].

The discrepancy between comprehension and an awareness of inappropriate grammatical structure, on the one hand, and production, on the other, suggests an intriguing question: namely, does the agrammatic patient have more syntactic strategies available

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to him than are indicated in his speech? Or, to make the issue more contentious, is this form of aphasic disturbance one of expressive performance systems only; leaving the underlying competence intact [cf., 9, 10]?

The present paper sets forth an attempt to deal with this question; at least, to deal with it in its more modest version. In this context, the data presented are intuitions about sentences elicited from recovering or moderately impaired agrammatic aphasics and, for comparison purposes, from non-neurological patients. These intuitions took the form of judgments on the relatedness of words in a sentence; that is, words presented three at a time from a given sentence, were sorted on the basis of "how they went together in that sentence." The result for each sentence was a word-relatedness matrix from which a phrase structure tree was induced by the application of an algorithmic scaling procedure. In essence, these sorting data and related analyses allow an estimation of the subjective organization of words in a sentence. Accordingly, we have used them to determine whether or not agrammatic aphasics have more information about sentence structures than would be expected from their speech.

Application of a hierarchical clustering scheme to sorting data

The scaling method adopted here is a hierarchial clustering scheme (HCS). Introduced to psychology by JOHNSON [11], a HCS has been applied to data based on the sorting of nonsentential lexical items [12, 13] and as in the present report, to the results of partitioning words in sentences [14, 15]. In each of the above studies the decision to use a HCS was motivated by the assumption that the words in the array are hierarchically organized. In the case of sentential words, then, the hypothesis is that sorting will be influenced by the hierarchically organized structures of the words in the sentence. That is, as LEVELT [15] has suggested, we may expect the degree of subjective relatedness between any two words in a sentence to be a function of the height of the node dominating the two words in the sentence. Since detailed discussions of the scaling method have been presented elsewhere [11, 12, 14], this review will focus only on the actual application of the analysis.

An example taken from MARTIN [14] will be used to demonstrate the procedure. In Martin's example, 20 subjects have been assigned the task of subjectively organizing a four-word sentence (e.g. He hit the ball.) by grouping the words that they feel go together in the sentence. They generate the following sort-types: seven subjects cluster all the words together; nine isolate word one from the remaining words (i.e. $W_1/W_2\ W_3\ W_4$); four group only words three and four together ($W_1/W_2/W_3\ W_4$); and no subject groups each word separately.

The first step consists of arranging these sortings into an unclustered similarity matrix (M_1 of Table 1).*

The numbers entered in M_1 simply represent the frequency with which any one word is grouped with another word. Thus, the entries in the W_1 row show that only those seven subjects who left the sentence intact sorted word one with each of the other three words; that is, every other sorting arrangement separated word one from words two, three, and four. In contrast it may be seen that 16 subjects grouped word two with words three and four: the seven who created no partitions plus the nine who formed the $W_1/W_2\ W_3\ W_4$ grouping. Finally, the W_3–W_4 cell shows that all 20 subjects grouped words

* Martin uses a distance matrix rather than a similarity matrix in his example. The two are inversely related by the equation $Dij = N - Nij$.

Table 1. Application of hierarchical clustering scheme to sorting data

Unclustered matrix (M_1) →

	W_1	W_2	W_3	W_4
W_1		7	7	7
W_2			16	16
W_3				20
W_4				

Matrix after first clustering (M_2) →

	W_1	W_2	W_3 W_4
W_1		7	7
W_2			16
W_3 W_4			

Matrix after second clustering (M_3)

	W_1	W_2 W_3 W_4
W_1		7
W_2 W_3 W_4		

three and four together in some manner. Since the matrix is symmetric and since each word must be sorted with itself, no entries are required for the diagonal or for the lower half of the matrix.

Cluster analysis consists of working backwards from the unclustered matrix to induce the hierarchical organization that may have influenced the sortings. This becomes an iterative procedure: at each stage the two words that are most closely related are then merged and treated as a single entry in a new and smaller matrix.

The results of applying this algorithmic procedure to Martin's example are shown in M_2 and M_3 of Table 1. The two most strongly related elements in M_1 are W_3 and W_4; thus they form the basis for the first clustering (M_2). The second strongest relation, that between W_2 and the clustered entry W_3–W_4 yields the next clustering (M_3). It should also be noted that for each of the two mergers shown, both members of the resultant cluster are equally related (or equidistant) to the other words of the sentence, and so in each case the merged set simply assumes these relations with the other words. For example, seven subjects sorted word one with word three and seven subjects sorted word one with word four; accordingly, the relation of W_1 to the single entry W_3–W_4 remains at seven.

The hierarchical tree shown in Fig. 1A is simply a graphic account of this sequence of mergings. As such, it only registers the relative strengths of the subjective groupings; it does not indicate the types of relations formed. A conceptual scheme is required to specify the latter, and this is shown in the accompanying phrase structure tree with its nodes labeled according to linguistic theory (Fig. 1B). Thus, in the present example, there is a perfect correspondence between the hierarchically organized relatedness judgments and the pattern of nested linguistic constituents.

However, intuitions about how words go together in a sentence need not be guided by the dictates of linguistic theory. For that matter, even if we accept the strong assumption that word relatedness judgments are mainly determined by syntactic structure, sorting data is unlikely to yield as idealized a hierarchy as in the example given. Semantic factors, idiosyncratic associations and possibly even left-to-right visuo-spatial processing strategies may be expected to influence sorting.

Because of this non-syntactic noise, when two words are merged they may not be equidistant to a third, and the problem arises of assigning a number relating this cluster

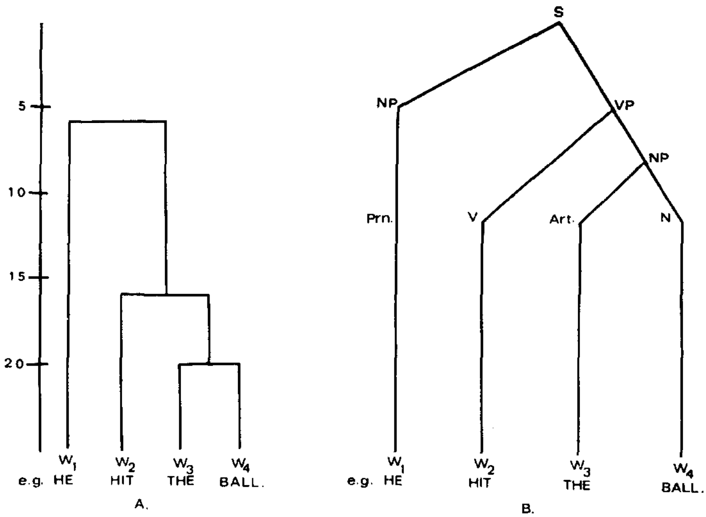

FIG. 1. Induced and linguistic phrase-markers compared.

to the third word. The solution here is to carry out two parallel cluster analyses: one always based on the stronger relations, the other always on the weaker relations. When the entry for the cluster-word cell is based on the stronger relatedness value, the method is called the minimum method (14); the term "minimum" describing the fact that in this method the distance from a word to a cluster equals the distance from that word to the nearest member of that cluster. On similar reasoning, always choosing the lesser relatedness value is called the maximum method.

LEVELT [16] has suggested, on intuitive grounds, that the minimum method offers a more appropriate form of analysis for the sorting of words in sentences. Nevertheless, both methods should be carried out and the solution from each compared. If they yield striking qualitative (topological) differences, it is unlikely that the data reflect any strong hierarchical organization, although MILLER [12] has cautioned that any such interpretation ultimately becomes a matter for individual judgment. Interpretation is made easier, however, if the minimum and maximum solutions produce only numerical differences; that is, if the difference takes the form of different heights, or strengths, of the *same* clusters. In fact, previous investigators have all accepted monotonic invariance as being the minimum requirement compatible with a hierarchical data structure.

Scope of present study

From the foregoing, it may be seen that applying a HCS to sorting data generated by aphasics and control subjects permits an empirical examination of the following:

(1) To what extent do normals and aphasics sort on the basis of an implicit hierarchical organization?

(2) If the sorting data for either group is hierarchically organized, how close a correspondence is there between the subjective and linguistic phrase markers?

In sum, then, the methods carried out here permit us to explore the possibility that aphasics who speak agrammatically might, nonetheless, retain a normal tacit knowledge of English syntax.

METHODS

Subjects

The aphasic group in this study consisted of three right-handed hemiplegic male patients selected from the Aphasia Unit of the Boston VA Hospital. All three were diagnosed as having Broca's aphasia; and all were alert and cooperative during testing.

One patient, a 66 year old man who had worked in advertising and had attended college for two years, had become aphasic in 1961 following a left hemisphere infarction within the distribution of the middle cerebral artery. An embolus was suspected as the cause. The remaining two patients had each suffered thrombotic infarcts. One was a 53 year old former truck driver who had become aphasic in 1970; the other was a 52 year old former printer who had become aphasic two months previous to testing.

According to their clinical records and follow-up charts, at approximately the time of the testing reported here, all three had dysprosodic, non-fluent speech characterized by frequent pauses, reduced phrase lengths, and agrammatism. In contrast, they were all considered to have intact comprehension.

For two of these patients,* clinical impressions of agrammatism were buttressed by the results of a more rigorous assessment of grammatical impairment. Specifically, we confirmed that these patients were agrammatic by using a story completion technique [8]. This consisted of orally presenting two or three sentences of a story situation to which the subject was asked to add to a highly predictable closing sentence.

Additionally the three aphasic subjects were tested on their ability to read. In fact, we required the subjects to read every sentence that was used in the sorting task. Each of the three subjects proved capable of doing so, although initial efforts sometimes involved awkward articulation, literal paraphasias and grammatical errors. However, any time a subject read a sentence agrammatically, he was asked to reread it attending closely to every word. When his attention was focused on each word the subject invariably read the sentence correctly, including its grammatical formatives.

Four male patients chosen from the urology ward of the Boston VA Hospital served as control subjects. None of these patients had been educated beyond the high school level. Both control and aphasic subjects were tested individually.

Stimulus materials and procedures

Sorting was assessed for a variety of common English sentence types. These constructions, which, in fact, were chosen from the story completion task, are listed in Table 2.

Table 2. Sentence types and associated examples

1. Declarative intransitive (NP+V):
   The baby cries.
2. Declarative transitive (NP+V+NP):
   The dog chases a cat.
3. Direct and indirect object (Prn.+V+NP+NP):
   She gives the girl a dollar.
4. Yes–no question (Aux.+prn.+V+prn.):
   Did you call me?
5. WH question (type 1—WH+be+NP):
   Where are my shoes?
6. WH question (type 2—WH+aux.+prn.+VP):
   Where did you find her?
7. Future (Prn.+aux.+V+NP):
   He will smoke a pipe.
8. Embedded sentence (Prn.+V)+S
   S→N+to+V+adv.)
   I want Tom to speak quietly.
9. Passive (NP+aux.+PP):
   The man was hurt.
10. Comparative (NP+be+adj.+ER):
    The girl was taller.

* The patient not examined on the story completion task presented an intermediate degree of agrammatism relative to the two that were tested. All three patients, however, were considered to be moderately aphasic.

There were actually five semantically distinct sentences for each construction. This number allowed the generation of sufficient data for us to analyze the subjective phrase structures on an individual as well as group basis. The sentences were presented in a predetermined random order such that the immediate succession of two sentences embodying the same sentence frame was prevented.

Sorting

Pilot work had indicated that aphasic subjects were incapable of sorting when the metalinguistic demands were too unstructured; that is, when their only instructions were to arrange the words of each sentence into subjectively natural groups. Accordingly, structure was provided by adopting the procedure of triadic comparisons [15, 16].

Each sentence was presented visually to the patient and kept before him throughout the comparison procedure. After making sure that the patient could read the entire sentence, all the possible three-word combinations from that sentence were presented, one at a time, to the patient, The order of presenting the triads was randomized for each patient.

For each triad, the patient was required to choose the two words that he felt went best together in relation to the sentence from which they were taken. The three words forming each triad were arrayed on one card in a triangular fashion which maintained the left-to-right order of the words in the sentence. For example, if the triad consisted of words two, four, and five (from a five-word sentence), word two appeared in the lower left-hand corner of the card, word four in the center just above the midline of the card, and word five in the lower right-hand corner. This left-to-right array was intended to emphasize the fact that the words were from the sentence, yet, at the same time, it permitted the grouping of non-adjacent words. However, to reinforce the notion that our concern was with how the words were related in the sentence, the examiner often repeated the sentence to the patient between triad presentations.

It should also be noted that the patient was forced to consider the three possible combinations within each triad before pointing to the two words he wanted to group together. This precaution was taken in order to minimize the role of subvocal rehearsal in the comparison process. That is, we wanted the groupings to reflect the patients linguistic intuitions and not to reflect his agrammatic production. In this connection, it is important to mention that all three aphasics often verbalized the possible groupings that existed for each triad, even when function words formed part of the array. This verbalization was spontaneous, since they were only required to indicate the possible combinations by pointing. If the aphasic patients had elected the strategy of grouping only after agrammatically repeating the sentence for themselves, they would probably not have even considered function words. Since they did, however, we feel that either subvocal rehearsal did not occur, or that it played little or no role in shaping their linguistic judgments. In fact, to anticipate some of the results, we found that when aphasics did sort articles and copulas with other words, these sortings reflected the syntactic structure of the sentence.

Prior to formal testing, subjects were trained in the process of grouping elements on a subjective basis. This training procedure also served to screen patients; it consisted of having the patient carry out triadic comparisons of geometric forms of various colors. There were three arrays. For the first two, the patient's task was unambiguous: grouping could only be carried out on the basis of color in the first array, while in the second array, shape was the only relevant dimension. The third array forced the patient to choose between shape and color and only those patients who appreciated the subjective nature of this last task were tested in the study. Actually, none of the patients reported on here had any difficulty with the concept that different grouping decisions were possible within one array.

Details of the analysis

Relatedness matrices were determined on an individual as well as group basis for each of the sentence types shown in Table 2. A HCS was applied to each matrix, and in all cases, parallel analyses were carried out by both the minimum and maximum methods. However, we ignored possible semantic factors and treated the five sentences for each frame as equivalent.

Since the number of triadic comparisons associated with each sentence type was a function of the number of words in the sentences representing that construction, the amount of data varied over sentence types. Further, since there were four control subjects and only three aphasic subjects, the trees for the normal group were based on more data than those for the aphasic group. For example, for the five-word declarative transitive frame, each patient carried out 50 comparisons (C_3^5 comparisons/sentence $\times$ 5 sentences). Thus, as a group, the aphasics carried out 50×3 comparisons, while the controls carried out 50×4 comparisons for the five, five-word sentences of that frame.

RESULTS

For the most part, both normals and aphasics sorted on the basis of an implicit hierarchical organization. That is, when the minimum and maximum methods of analysis were applied to the group relatedness matrices, they typically produced qualitatively identical trees. This form of hierarchical stability appeared for seven of the ten sentences types for the normal group, and for six of these sentence types for the aphasic group. Topological differences occurred only on the following frames: direct and indirect object and embedded sentence for both aphasic and normal groups; WH question (frame 6, Table 2) for the normal group; and future and yes–no question for the aphasic group. However, even when the minimum and maximum methods did generate topological differences, these differences only occurred for the weakest relationships (those which were based on the smallest number of groupings). The compact, lower-level constituents were invariably stable.

Furthermore, the group trees did not generally obscure intersubject differences. That is, there was no striking variability over subjects for those sentence frames that showed stable group structures. In fact, even though the individual triadic comparison samples were rather small, on the whole, they yielded stable hierarchies. Since the tree structures were stable across subjects and since the few differences that were present were uninformative, we have elected to present only group data.

Figures two to five show subjective phrase structure trees for several of the declarative constructions. Since the minimum and maximum solutions were qualitatively identical in each case, ony the minimum method outcomes are displayed.

Quite clearly, the relatedness judgments of the control subjects were constrained by the surface syntactic properties of these four utterances, while those of the aphasic subjects were not. Thus, the trees induced for the normal group show, first, a close affiliation between articles and nouns, resulting in tightly organized subject and object noun phrases, and second, a respect for the subject–predicate distinction in all four frames. In contrast, aphasics operated on these sentences by coupling the content words together, violating the linguistic unity of both the noun and verb phrases.

This pattern indicates either that the aphasics were unable to link function words with content words, or that they chose not to. While their utterances might suggest the former possibility, their unclustered relatedness judgments indicate the latter. Thus, using frame two sentences as an example (Table 2), the aphasic group clustered the article with

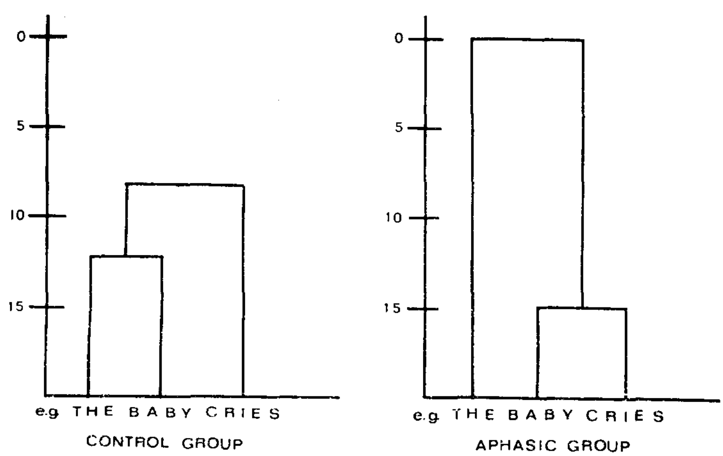

FIG. 2. Declarative intransitive frame: Induced phrase-markers for control group and aphasic group. (Vertical axis represents frequency of inter-word groupings).

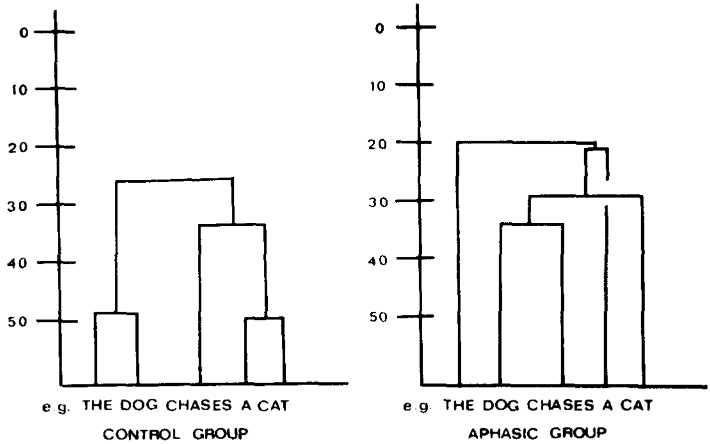

FIG. 3. Declarative transitive frame: induced phrase markers for control group and aphasic group.

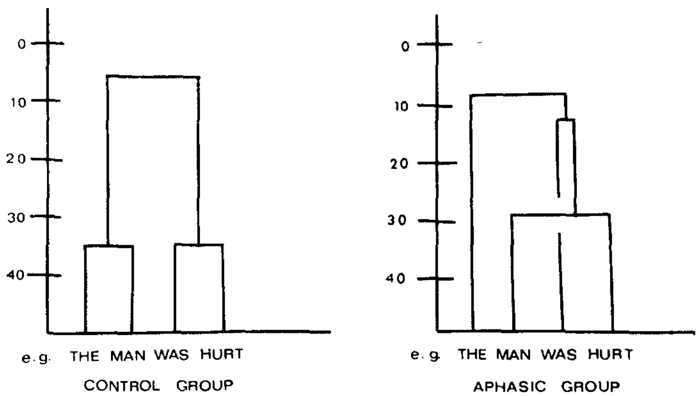

FIG. 4. Passive frame: induced phrase markers for control group and aphasic group.

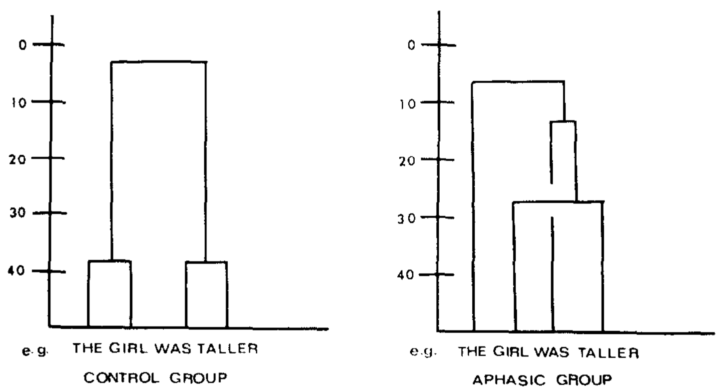

FIG. 5. Comparative frame: induced phrase markers for control group and aphasic group.

the noun of the subject phrase 20 times. In comparison, they grouped this article with the main verb only seven times, with the second article only once, and with the object noun only four times. That is, in this particular example, the aphasic subjects, when not ignoring the article, sorted it largely on the basis of a linguistic phrase structure organization.

In fact, for one frame, the WH question (frame 5, Table 2), the aphasic subjects did construct a stable noun phrase by closely linking the function word preceding the final noun with that noun (Fig. 6). The word preceding the noun was either a demonstrative article, as in the sentence "Who are these people?" or a possessive adjective as in, "Where are my shoes?" The tightly organized noun phrase generated by the aphasics for this frame constitutes an important exception to the weak article-noun relations found for the other structures. It suggests that when formatives were semantically marked, aphasics regarded them as playing an important role in the sentence. On the other hand, when a word served only as a syntactic marker, aphasics usually ignored the word in carrying out their relatedness judgments. In this respect, consider the sortings involving the copula which simply functioned as a link between the WH word and the predicate noun phrase in each of the five sentences of frame five (Table 2). Unlike the control subjects who consistently clustered the copula with the WH word, the aphasic subjects did not even remotely affiliate this informationally empty word with the interrogative form (Fig. 6).

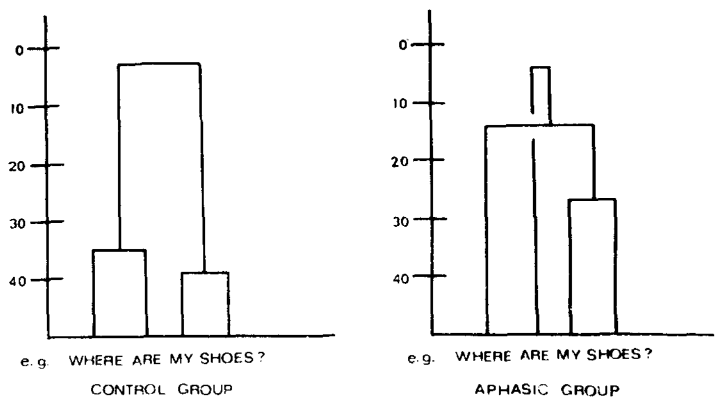

FIG. 6. WH question (type 1) frame: induced phrase markers for control group and aphasic group. (Note that only minimum solution shown since hierarchical stability resulted).

Actually, even the normal subjects did not always generate phrase structures that were entirely compatible with the dictates of linguisic theory. They clearly respected lower-level constitutent boundaries, but they did not treat major constituents as inviolable. In this connection, two examples of an [(SV)O] organization produced by the control subjects are presented in Figs. 7 and 8. The aphasic group's subjective hierarchies for these frames are also included and because of topological differences at the upper nodes of each frame, both the minimum and maximum solutions are presented.

The groupings of the control subjects departed from theoretical phrase structure by generating compact subject-main verb constituents for both frames. This outcome suggests that relatedness values may have been inflated for words that were adjacent to each other in the surface structure. Not that proximity exerted its effect independently of syntactic

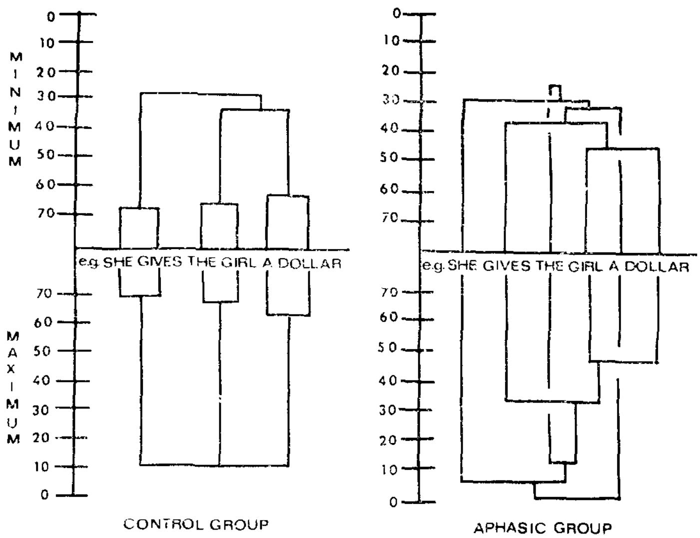

Fig. 7. Direct and indirect object frame: induced phrase markers for control group and aphasic group.

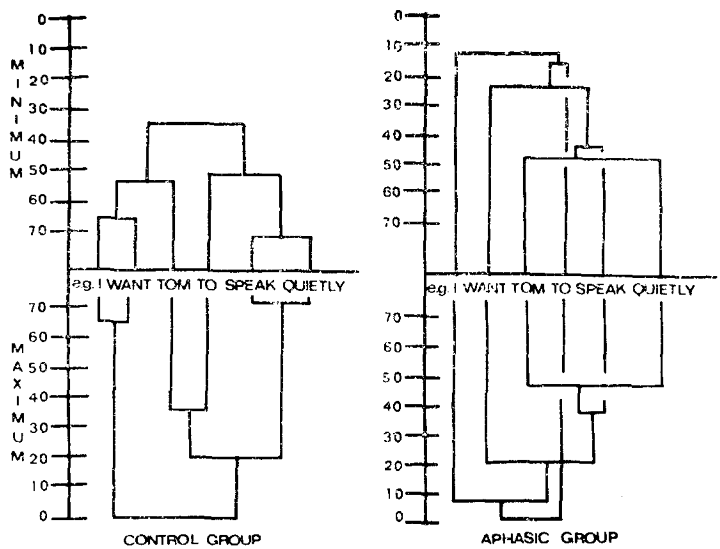

Fig. 8. Embedded sentence frame: induced phrase markers for control group and aphasic group.

structure; on the contrary, insofar as syntax was marked by the left-to-right word order of our test sentences, the control subjects tended to link adjacent words that fell within a constituent, where possible, rather than clustering those that crossed a boundary.

However, there were undoubtedly some determinants of the relatedness judgments that operated quite independently of syntax. For exmple, the complexity of the embedded sentence frame may have forced the control subjects to seek out small phrases which, although violating the phrase marking of the sentence were, in themselves, meaningful. Perhaps an example of this was the subjective constituent marked in the minimum distance tree, "I want Tom."

DISCUSSION

The cluster hierarchies derived from the relatedness judgments of the agrammatic aphasics differed considerably from the phrase structures induced from the control subjects' judgments. Despite the fact that the triadic comparison method may have collapsed the effects of syntactic organization, semantics, and idiosyncratic association, the normal group typically generated phrase structures corresponding to linguistic surface structure categorization. That is, they integrated the function words appropriately into the sentences, forming both compact NP constituents and tight auxiliary–main verb groups. In contrast, although the aphasic subjects also sorted on the basis of an implicit hierarchical organization, the structures that resulted showed loose relations between the grammatical elements and the major lexical items. The aphasics generally excluded the syntactic features that were not a necessary part of the intrinsic meaning of the sentence, and seemed concerned solely with the bare essentials necessary to communicate an idea.

Is it likely then, that an agrammatic's ability to understand speech is less disturbed than his ability to produce it? We think not. In essence, our task required the patients to use the information concerning sentence structure that they had available to them. It was not a test of speaking or listening to speech, but it did indicate the information they would use, and of equal importance, the information they would ignore in trying to understand a sentence. Thus, since they paid very little attention to the function words in their triadic comparisons, it is hardly to be expected that these syntactic elements would ever figure prominently for the aphasics in their actual processing of a spoken sentence.

If, as we suggest, Broca's aphasics are "agrammatic listeners," the problem remains of reconciling this notion with the long-standing neurological dictum that telegraphic speech occurs within a setting of relatively intact comprehension. To do so, however, it is only necessary to realize that when we listen to a sentence we use much more than our knowledge of syntactic relations to understand it. We rely heavily on our knowledge of words, on the context in which the sentence is spoken, and generally, on our extralinguistic knowledge of the topic being discussed. Thus, even though grammatically impaired, the Broca's aphasic has a great deal of information on which to operate in order to understand an utterance. Further, to the exent that the aphasic tries to correct his own utterances, his goal appears to be semantic relevance rather than stylistic editing, although he may have some residual memory of grammatical form [8].

Unfortunately, by isolating the syntactic impairment, attention may be distracted from the fact that the aphasic's syntactic violations, alone, never completely block him from conveying meaning. It is unlikely then, that these limitations will severely hinder his comprehension. Thus, agrammatic speech is probably just one externalized aspect of a particular impairment involving all language modalities.

The exact nature of the underlying physiological disruption remains elusive. However, JAKOBSON [3] has proposed a theoretical formulation that can encompass our findings. Within his theoretical framework, a disruption of the processes by which an intention or meaning is converted into an adequate output sequence probably exists as part of a more general contiguity disorder affecting the phonological as well as syntactic domains. COHEN and HÉCAEN [17] are also quite explicit in advancing this contiguity notion; however, they phrase the disorder in terms of "programmation." (In addition, see Pick's early writings on the topic, e.g. 18, and Howes' theoretical formulations [19]).

In any case, it should be emphasized that the intuitions gathered from the aphasics in this study seem to capture quite precisely the regularities of their own speech behavior. Thus, contrary to the proposal put forth by WEIGL and BIERWISCH [9], there does not seem to be a selective disturbance of performance mechanisms. Rather, since the agrammatic aphasic's tacit knowledge of English syntax appears to be as restricted as is his use of syntax, we may presume that agrammatism reflects a disruption of the underlying language mechanism.

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Résumé—On constate souvent dans l'aphasie de Broca la coexistence d'une parole agrammatique et difficile avec une relative intégrité de la compréhension. Cette étude insiste sur cette discordance et soumet à expérience l'affirmation que le sujet agrammatique a plus d'information sur la structure syntaxique que ne l'indiquent ses émissions verbales. Les aphasiques agrammatiques et des malades non neurologiques devaient choisir dans une série de phrases les mots qui, selon eux, avaient les relations les plus étroites dans chacune de ces phrases. Ces regroupements de mots étaient utilisées comme des matrices d'entrée pour une analyse en clusters hiérarchiques. Les arbres de structures syntagmatiques subjectives qui en résultant montrent que, tandis que les sujets normaux subissent souvent les contraintes des propriétés syntaxiques de surface, les sujets agrammatiques opèrent d'après un schème hiérarchique qui exclut tout ce qui n'est pas essentiel à la signification intrinsèque de la phrase. Ces constatations suggèrent que l'agrammatisme expressif n'est qu'un espect d'un désordre impliquant toutes les modalités du langage.

Zusammenfassung—Mühevolle agrammatische Rede und verhältnismäßig intaktes Sprachverständnis scheinen oft nebeneinander bei der Brocaschen Aphasie vorzukommen. Die vorliegende Arbeit konzentriert sich auf diese Diskrepanz der Leistungen und prüft die Behauptung, daß der agrammatische Patient mehr Kenntnis der syntaktischen Struktur besitze, als seine Rede angezeigt erscheinen läßt. Agrammatiker und nicht hirnpathologisch Erkrankte sortierten Worte aus einer Anzahl von Sätzen nach dem Gesichtspunkt, wie verwandt sie die Worte in den jeweiligen Sätzen empfanden. Diese Wortgruppierungen dienten als Eingabematrizen für die Analyse einer hierarchisch gegliederten Haufenhildung. Die sich ergebenden subjektiven Satzstrukturbäume zeigen, daß, während Normalpersonen sich oft durch Eigenheiten der Oberflächenstrukturen der Syntax leiten lassen, die Patienten mit Agrammatismus nach einem hierarchischen Schema vorgehen, das alles Unwesentliche bezüglich des wirklichen Bedeutungsgehaltes eines Satzes wegläßt.

Diese Ergebnisse legen nahe, daß der Agrammatismus nur ein Aspekt einer Störung ist, die alle Sprachmodalitäten einbezieht.