The Effect of Grammatic Context On Repetition By Aphasic Adults

A. Damien Martin
Steven Kornberg
Audrey Hoffnung
Louis Gerstman

Dept. of Commun. Arts & Sciences
New York University, New York, NY

This spring, Dr. Joyce West and I taught an advanced course in aphasia therapy. This course was open solely to clinical aphasiologists working in the field. The constant refrain from these professionals was "But I need something practical"! or "But what do I do"? Our oft repeated response was, "There is nothing so practical as a good theory."

All therapy is based upon a theory, a model, if you will. It is based upon a theory of the disorder itself, a theory of the nature of the clinical interaction, and a theory of the appropriate intervention strategies. For example, Dabul and Bollier (1976) proposed a therapy based upon a theory which separates "motor problems" from "symbolic problems." They claimed that lack of such separation resulted in "... the erroneous treatment of apraxia with a language rehabilitation emphasis." (p.268). I have stated my difficulties with such a view in earlier papers and discussions. (Martin, 1974a, 1974b, 1975). There is no need to do an extensive review of the disagreement at this time. However, it is important to stress that this is not just a disagreement in terminology, but rather reflects a basic disagreement in the theoretical model which underlies two therapeutic approaches and two opposing views of the disorder. This study attempts to investigate further the theoretical model which underlies therapy techniques which I have proposed in earlier papers. (Martin, 1974b, 1975; West, Helm and Martin, 1977.)

All spoken utterances, whether correct or not, and including those of the individual with aphasia, are the phonetic representations of various interacting cognitive processes which support language. Implicit in this view is the concept that a phonetic error is not just an error on an articulatory level, but rather demonstrates the functioning, no matter how disordered, of several interdependent processes (Martin, 1974). Thus, it may be reasoned that an investigation of an aphasic patient's phonetic production can and should give us some indication of the underlying processes involved and the manner of their interaction. An earlier study (Martin, Wasserman, Gilden, Gerstman and West, 1975) attempted to demonstrate just this. This study proposed a model composed of various processes which acted upon the stimulus in a repetition task. The interactions between and among these processes were investigated in terms of the number, type and position of phonemic errors. The results indicated that the presence or absence of inflection in a single word stimulus had a significant effect upon error performance in terms of the above parameters.

The present study was a direct outgrowth of the previous study. We wished to investigate the effect context would have on the repetition of single inflected words. It was hypothesized that context would have a highly specialized and beneficial effect. Since the context to be used would have a direct link with the inflection, and since inflection generally occurs at the end of a word in English, many effects were expected to be seen primarily in the second cluster position. These effects were again expected to be shown in terms of number and type of error as well as position [as in the Martin et al. study (1975)].

A second area of investigation was the relative difficulty of the various inflections. Three inflections -- plural "s," third person singular "s" and past "d" as shown in the past participle, were used. It was hypothesized that the relative difficulty would be the same as that reported by Goodglass and Hunt (1958), Goodglass and Berko (1960) and by DeVilliers (1974); plural "s" the least difficult, third person singular "s" the most difficult, with past "d" between the other two.

Subjects. Subjects were nine adult male and one adult female aphasic subjects (see Table I). All subjects were Caucasian, native americans with English as a first language, had normal hearing for their age, and showed no signs of dysarthria. The racial criterion was chosen because of recent work which suggests that there are linguistic as well as dialectical differences between so-called "black" and "white" speech (Labov, 1969). It was felt that consideration of such differences would unnecessarily complicate the study.

Materials and Methods. A list of 50 CCVC (C-consonant, V-vowel) words such as "slap," "train," was composed. Each word was inflected twice, once with an appropriate allomorph of the "s" inflection, and once with an appropriate allomorph of the "d" inflection, which created a list of 100 words, fifty with an "s" ending, fifty with a "d" ending. These were randomized for presentation to the subjects using a table of random numbers.

A list of 100 nonsense syllables was created by changing the vowels in the word list. Therefore, the two lists, words and nonsense syllables, had exactly the same consonant cluster content.

A third and fourth list were formed by placing each of the original words and non-words with the appropriate inflection within three separate contexts. Thus, the word "slap" (and its equivalent nonsense syllable) would occur three times on the list, three slaps, he slaps, he had slapped. This created a list of 150 phrases, 100 of which had an appropriate "s" inflection, 50 of which had an appropriate "d" inflection.

On the first day, the subject was presented with the single words and nonsense syllables, the two lists presented separately. A Sony TC-140 tape recorder was placed on the table next to him, and all exchanges were recorded. The task was explained to each patient and did not proceed until the patient demonstrated that he understood the task, which was to repeat the word or nonsense syllable read by the examiner.

The context lists were given on a separate day, within a five day period. In this particular task, the examiner read the whole phrase, for example,"he slaps," and the subject was asked to repeat the last word only. During the course of the task, some subjects realized they had made errors and attempted to correct them. For the sake of consistency,

an arbitrary decision was made to accept the last response given by the subject, whether correct or incorrect.

Three judges separately transcribed the subject's responses. These transcriptions were compared and in cases of disagreement, the judges listened to the tape together and made a judgement. If there was no agreement, a response that had been chosen by two out of three judges was accepted Errors were classified as substitutions, omissions, and additions. Out of a total of 4546 phonemic errors made by the subjects, 4390 had a unanimous judgement, while 156 had a two out of three judgement.

Vowel errors, all of which were substitution errors, were not considered in the analyses between words and nonsense syllables. In all analyses, only consonantal errors are considered.

Results:

Total Number of Errors. In all cases there was almost double the number of errors in nonsense syllables as in the repetition of words. This was, of course, highly significant (see Figure 1).

Type of Error:

Single Items. There was significant variation in the overall occurrence of the three types of error, (substitutions, omissions, and additions) in both words ($Xr^2 = 16.8$) (Friedman two-way analysis of variance, Siegal, 1956) and nonsense syllables ($Xr^2 = 18.2$) with substitution errors occurring most frequently and addition errors appearing least frequently (see Figure 1). This significant difference in words appeared to be the result of the relative paucity of addition errors, since a subsequent pairwise comparison (Wilcoxon Signed Ranks Test, Siegel, 1956) between substitution and omission errors in words did not produce significant results. However, in nonsense syllables, the higher incidence of substitution errors as opposed to omission errors was found to be significant beyond the .005 level (T=0). (The difference in occurrence between addition errors created a significant variation in all subsequent analyses involving the three types of errors. To time in this presentation, this result will not be reported for each analysis.)

Context Items. Pairwise comparison of substitution and omission errors (T=0) indicated that the greater incidence of substitution errors in context items was significant beyond the .005 level for both words and nonsense syllables (see Figure 1). While the change in relationship between substitution and omission errors appears to be in an increase in incidence of substitution errors, the change actually takes place in a decrease in omission errors, since the context items represent 150 stimulus items, and the single items represent 100 stimulus items. Expressed in terms of ratios, the relationship between substitution errors and omission errors in single words was 1.4; for words in context 2.9; in single nonsense syllables, 2.5, in nonsense syllables in context, 3.7.

Thus it appeared that context had its major effect on overall errors in the decrease of omission errors. This decrease was highly specific, however, occurring primarily in the second cluster position. This will be discussed in greater detail below.

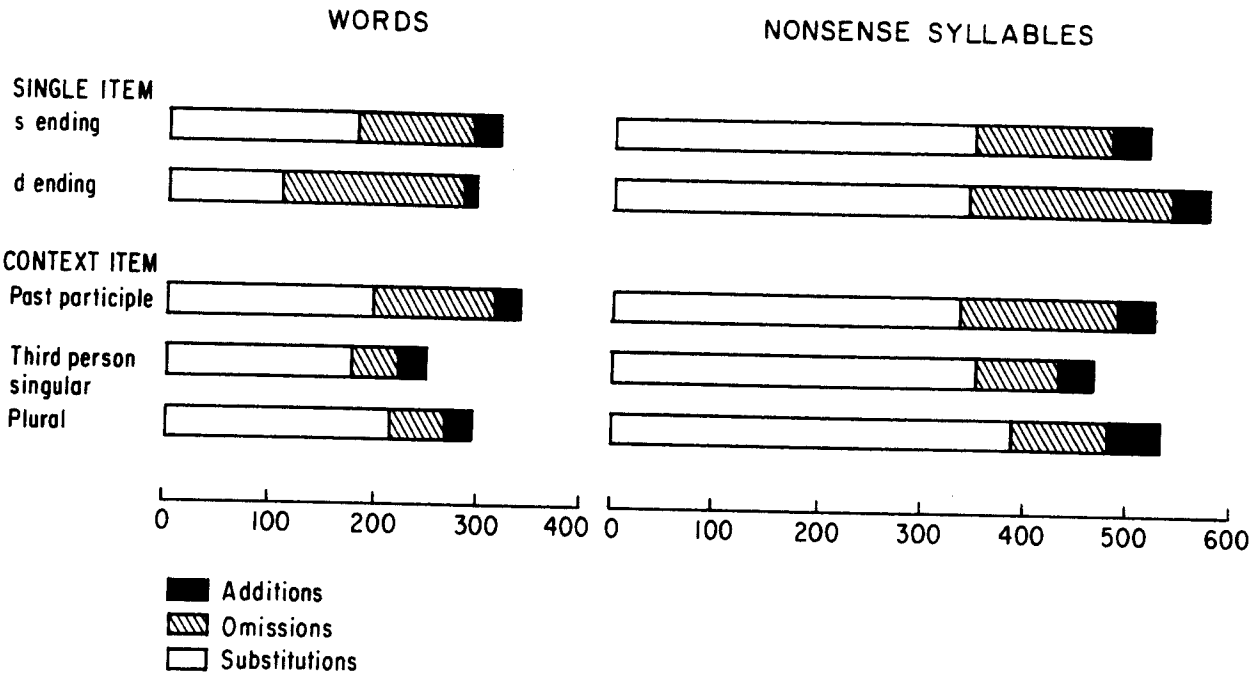

Figure 1. Incidence of addition, omission, and substitution errors in words and nonsense syllables for single and context items.

Position of Error.

First vs. Second Position. In both words and nonsense syllables there were a greater number of errors in the second position than in the first position for both single and context items (see Figure 2). For single items, this was found to be significant beyond the .005 level for both words and nonsense syllables (T=0), but nonsignificant for words (T=8) and nonsense syllables (T=16) in context. Thus, it appeared that, at least in terms of the relationship between the first and second position, context had an effect upon incidence of error as hypothesized.

One additional bit of analysis was done. It was assumed for this study that the single stimulus items were equivalent to the inflected stimulus items in the first study (Martin et al., 1975). As a means of checking this, the percentage of error within positions for the two sets of stimuli were examined. For words in the first study, 73.7% of the errors occurred in the second cluster position, while in this study, 71.4% of the errors occurred in the second position, a difference of 2.5%. For nonsense syllables, 67.2% of the errors occurred in the second position in the first study, while 67.0% occurred in the second position in this study, a difference of only.2%. Apparently, then, the two sets of stimuli could be considered as equivalent.

Type of Error and Position of Error. The only significant variation in the occurrence of a particular type of error according to position was found in the number of omission errors within the second cluster position. This variation was found to be significant beyond the .001 level ($Xr^2 = 23.22$) for words and beyond the .01 level ($Xr^2 = 13.0$) for nonsense syllables (see Figure 2).

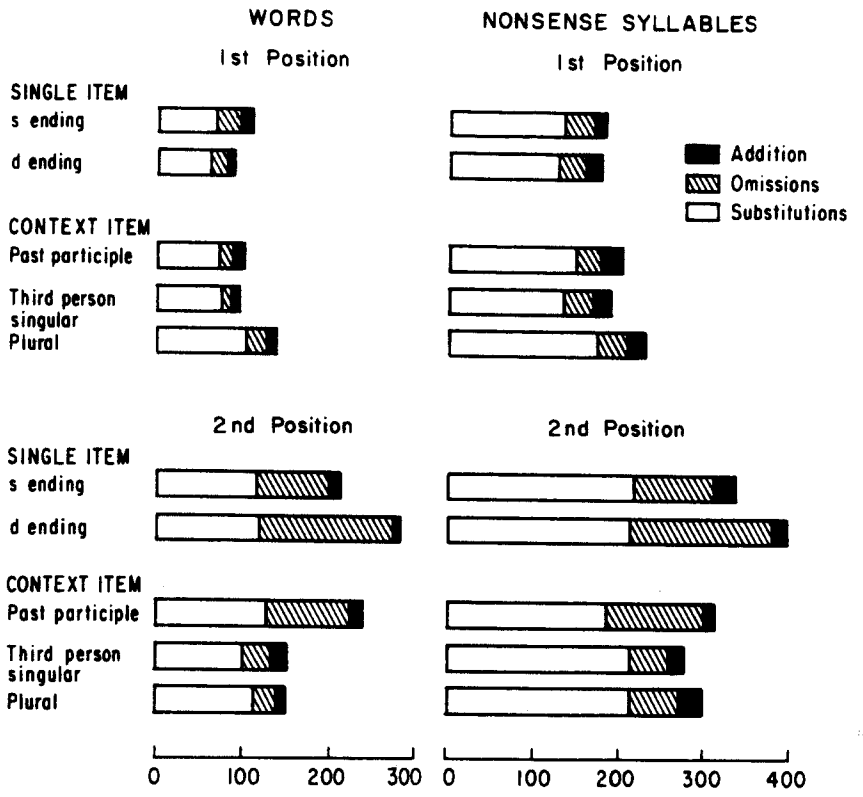

Figure 2. Incidence of addition, omission, and substitution errors in words and nonsense syllables for single and context items according to position.

Single Items. As expected, substitution and omission errors occurred more frequently in the second position than in the first for both words (substitution T=2; omission T=0) and nonsense syllables (substitution T=2, omissions T=0). This was found to be significant beyond the .005 level in all cases. This duplicated the findings of Martin et al. (1975) for the repetition of single CCVCC words which contained an inflection

Context Items. While the tendency for substitution and omission errors to occur more often in the second position persisted in context items, this, as hypothesized, was not found to be significant except in one instance. The greater number of omission errors in the second position within nonsense syllables was found to be significant beyond the .005 level (T=2) (see Figure 2).

Substitution and Addition of Inflections. It was observed during the analysis of the data that there were often substitutions of inflections in the responses (see Figure 3). There a subject might say "slipt" for "slips" or apparently add an inflection, as in "slipst." There did not appear to be any particular pattern of occurrence with the types of stimuli (see Figure 3)

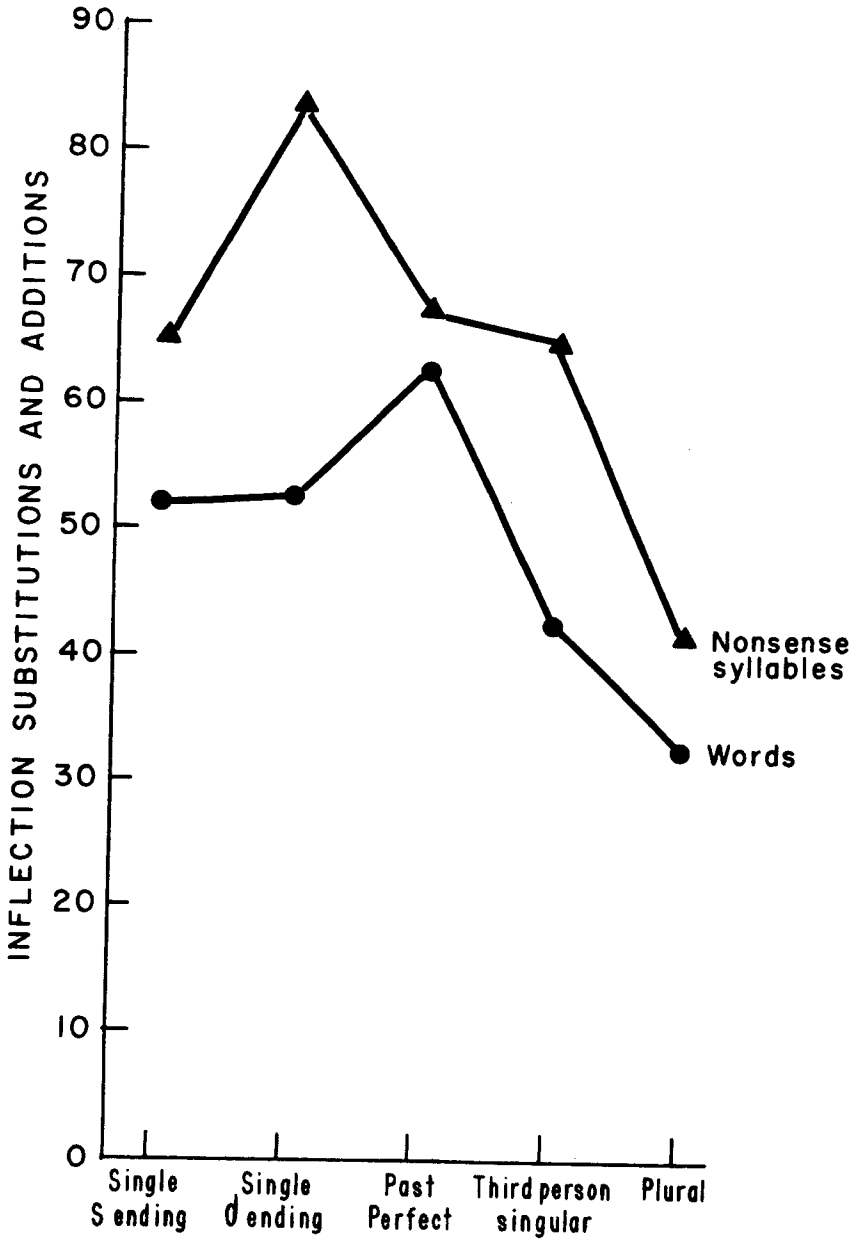

Figure 3. Incidence of inflection substitutions and additions in words and nonsense syllables for single and context items.

Discussion. The results support the hypothesis that context has a highly specific effect upon performance, primarily in terms of incidence and type of error within the second cluster position. The significantly greater occurrence of errors in the second cluster position for single items confirmed the earlier findings of Martin et al. (1975). They proposed that

this disparity in the processing of two consonant clusters within the same word was partially the result of increased difficulty in the processing of an inflection bearing consonant cluster. Within this framework, the introduction of context made the two clusters more equivalent, at least in terms of difficulty.

The results can and should be discussed in terms of the process model proposed in the earlier study. Time limitations in this presentation preclude any detailed discussion. However, some points can be highlighted. In the earlier study we suggested that the predominance of omission errors in a particular position for a particular type of cluster reflected the action of a grammatically dependent segmentation process. The results of this study offer further support for this suggestion. The serendipitous finding that, while omission errors decreased significantly in the presence of context, there was an increase in the substitution of one inflection for another, indicated that context may have affected the basic nature of the demands made upon the interacting decision and prelminary analysis components also proposed in the earlier paper, and the segmentation process which they initiate.

Gibson and Guinet (1971) had a similar result in the reading of inflected words and nonsense syllables by children and adults. They interpreted the tendency to substitute one inflection for another as an indication that inflections are separate features, processed separately from the base word. Murrell and Morton (1974) had made similar proposals. Taft and Forster (1975) also offered evidence for the analysis of a stimulus into its constituent morphemes during processing. We would suggest that the segmentation process allows a differential as well as separate processing whereby factors other than the preliminary analysis and the decision component can affect error performance. For example, decay within short term memory could operate to produce omission errors. It would appear to be only logical that if an inflected word has been divided into its two units, the word and the inflection, and if the aphasic person has difficulty in maintaining numbers of units in short term store, the major unit would be the one to be maintained. The significant decrease of omission errors with context would further indicate that the presence of more information or of heightened expectancy aids in the maintenance of the separated unit. It is important to note again, however, that this substitution of one inflection for another mirrors behaviors found in normals. This would lend support to arguments by other authors that aphasic performance is basically a reduction in the efficiency of operation of the language supporting system rather than a loss of elements of that system. (Schuell, Jenkins, Jiminez-Pabon, 1965). The question still is, however, how does this system operate in its reduced state? As stated earlier (Martin et al., 1975), the preliminary analysis component furnishes a feature matrix which has been derived from the acoustic signal. At this point we now have information which has been coded for entry into short term store. It is upon this coded information that the other systems operate to produce the desired or necessary process (Powers, 1973). The output of this particular decision, then, must be either whether or not there is an inflection, and perhaps, if the answer is yes, which inflection. This reorganization runs the risk of failing to record aspects that might be considered to be important at a later stage in the processing. If the primary emphasis is upon the recoding "inflection"

by the decision component, you might have the substitution of one inflection by another as a result of faulty retrieval. If the coding is in terms of the phonetic feature representation of the particular inflection, separate from the feature representation of the rest of the signal, the substitution of one inflection by another may be the result of faulty feature identification, or reduced storage capacity in short term memory, as just two possible examples. Feedback processes become important here, as well, since self recognition of error depends upon these systems. If, however, the coding of the inflection in short term memory is not in terms of features, but a classification as a particular linguistic unit, i.e., inflection, the substitution of one inflection for another would not necessarily indicate an error during the ongoing cybernetic process of comparison.

The significantly greater incidence of omission errors in the "d" inflections adds support to the findings of Goodglass and Berko (1960) that the "past" morpheme is more difficult than the plural morpheme. The relatively small differences between the plural and third person inflections, however, raise questions as to whether the "...difficulty of various inflectional endings follows a definite order which is based on grammatical function, not phonological similarity" (Goodlgass and Berko, 1960, p.266). Rather, it would seem to support the idea that the difficulty may lie in the phonetic or acoustic nature of the particular inflection. This would be reasonable, since stop consonants are much more highly encoded in the speech signal than the phoneme /s/, therefore more of the surrounding signal needs to be examined in the perception of the stop consonant (Foss and Swinney, 1973).

The relatively small difference between the plural and third person inflections appeared to contradict the findings of Goodglass and Hunt (1958), that there was a hierarchy of difficulty, with the third person singular being more difficult than the plural.

Overall, the results demonstrate again that the proposed process model is a viable means to generate and test hypotheses concerning repetition performance by aphasics. They also appear to demonstrate the intricacy and complexity of the interactions of cognitive processes even in a relatively simple task such as repetition. Simple linear and loss models of aphasia are inadequate to demonstrate such complexity. It is apparent, however, that even in areas covered in this study, more detailed research is needed. For example, the question of semantic strategies interacting with grammatic context is of prime importance. The role played by the aphasic individual's speech itself is also an area of great interest; for example, what would be the effect of context when used by the aphasic individual?

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DISCUSSION

Q. Could you tell us a little more about the subjects in terms of type of aphasia, hemiparesis, etc.

A. First, let me state that type of aphasia was not a criterion for participation in the study. However, four of the subjects were fluent, 6 were non-fluent, two were hemiplegic. Severity, in terms of performance on the task appeared to be related to type of aphasia., that is, the closer the patient got to being classified as a fluent, the more errors he made. Non-fluent subjects handled the task the best. There did not appear to be any qualitative difference between the two types.

Q. I'm afraid I find myself in the same position as your students. Could you explain how the data could be applied to therapy?

A. These are not just errors on an articulatory level, therefore you would not necessarily treat them with articulation therapy. Let me go back a bit. One of the goals of the therapy situation is to place the patient in a situation where he can use the processes which support language. I discussed this briefly in my paper. We hypothesize that there are certain "phonological processes" which are necessary to produce speech. Therefore, every time we can get them to talk, we are getting them to utilize phonological processes. Everytime

we can get them to do it as well as they can, we are getting them to utilize these processes to the maximum. Again, I am stressing that these are not specific level errors to be treated, as in the medical model of treatment, in isolation or as a specific.

To maximize performance, therefore, I would recognize that there are several levels operating in any task and I would attempt to conciously use these levels. (Conciously on the part of the clinician.) For example, rather than use nonsense syllables in rapid movement, I would use meaningful material 99% of the time. I would tend to use context since, as has been demonstrated in this study, context appears to aid somewhat in performance, and so on. The major thrust is to utilize the interaction of processes to maximize performance.

Q. I don't see why people using different models would not come up with the same thing.

A. I chose as my example what I view to be an extreme example of therapy arising from a medical model. I did not use the writings of Jay Rosenbek, for example, because there are many points in his therapy with which I agree wholeheartedly. However, there would be points of divergence because we are using dissimilar models as a basis for therapy. I might utilize certain of the techniques that Dabul and Boller report, but, because I am operating from a different model, I would use them for entirely different reasons, and would evaluate my results entirely differently. Therapy is not just a particular technique that is applied. It is the outgrowth of a theory and must be evaluated from that standpoint. I can't think of any other way to say it.

Q. The important question is, does it work? Do you have any comparative data that you can present?

A. Yes it does work. I have videotapes of patients who can say nothing who are producing by the end of the session. I have shown these tapes at national meetings. I don't think they can be compared to what has been published by others. Also, as I stated earlier in this meeting, I have strong reservations as to whether we have the technology or the means to effectively evaluate the effectiveness of particular therapy approaches.

Q. One point you left out is the supportiveness of your approach. I have observed you doing therapy quite often, and as in our clinic, the aphasic person does not make errors. That is, we concentrate on his performance and pay very little overt attention to errors. This is very supportive and very effective and I think is an absolute essential of your approach. There is little corrective action taken.

Q. Do you think there could be a congruence between the motor based view of apraxia of speech and the linguistic based view proposed by you?

A. If I had the chance to revise that article (Some objections to the term apraxia of speech), I would begin with the title and go on. I did not feel I was saying it is a linguistically based disorder, although that is how it has been taken. I have no difficulty with the concept of difficulty with the programming of the movements for speech.

My difficulty arises from the view of that difficulty. I am coming from the concept or principle of equifinality, that different causes can have the same effect, and vice versa. Therefore, you could have difficulty with the programming of the movements for speech for a variety of reasons within the same patient at different times. My objection lies in the concept of the specificity of the impairment at some particular point within the organism or the process. If a patient makes an articulatory error based upon frequency of occurrence, or lack of context, or strain on the auditory retention system, or whatever, that is not an impairment of the motor programmer, it is not a motor disorder.

Q. Did you find that as in children's language, the omissions found in the study followed any particular rules, any particular phonological rules?

A. We did not look at that.