FURTHER EXAMINATION OF THE REGRESSION HYPOTHESIS

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ABSTRACT

Common processes of sound errors were compared between nonfluent and fluent aphasics. Although both groups used some of the processes found in the speech of normally developing children, aphasics used significantly more error patterns which were peculiar to aphasics. Types of errors did not differ significantly between aphasic groups. These findings do not support the regression hypothesis. Differences between the phonological systems in children and adults are discussed.

Jakobson's regression hypothesis (1941, translated 1968) stemmed from his research concerning phonological acquisition in children. He demonstrated that children do not simply acquire individual sounds as units, but rather learn features or attributes that characterize a sound or contrast it with other sounds. Further, he showed that these features were acquired in a general order via a contrast strategy. Jakobson's observations of phonological disruptions in adult aphasics led him to hypothesize that this population "loses" features in the inverse order in which they are acquired in childhood with loss being a correlate of severity. He believed that as aphasics recovered they recapitulated the acquisition patterns seen in children.

As noted by Caramazza and Zurif (1978), the regression hypothesis, although appealing, has not borne close scrutiny. Although they admit that the regression hypothesis is at best superficial, these authors felt that further comparisons between normal developmental and acquired disordered patterns might result in further understanding of the nature of language and its breakdown.

Support or lack of support for the regression hypothesis appears to vary with the analytical techniques employed in studying phonemic errors in aphasics. Shankweiler and Harris (1966) used traditional articulatory analyses with five primarily expressive aphasics. Their results did not support the regression hypothesis since the aphasics were not consistent in their errors, showed more errors in the initial rather than medial or final word positions, and their types of errors differed from those found in children's speech.

The question of inconsistency of substitutions raised by Shankweiler and Harris is questioned by Trost and Canter (1974). Trost and Canter suggested that had Shankweiler and Harris employed a subphonemic (quasi-distinctive feature) analysis that they would have found consistency comparable to that found by Trost and Canter in their Broca's aphasics.

Distinctive feature analysis was used by Blumstein (1973) resulting in a detailed comparison of phonemic errors among Broca's, Wernicke's and conduction aphasics. She found that all groups substituted unmarked for marked phonemes more often than the reverse. This finding, along with the tendency of substituted sounds to be close to target sounds in distinctive feature distance led her to conclude that the phonological system is hierarchically organized and, regardless of aphasia type, will follow similar dissolution. Lecours and Caplan (1975) argue that this conclusion is faulty in that it ignores non-phonemic characteristics differentiating fluent and nonfluent aphasics. Actually, it would appear that Blumstein did not ignore nonphonemic characteristics since she chose separate aphasic subgroups (Broca's-nonfluent, Wernicke's and conduction-fluent) for comparison. Further, Blumstein, using a distinctive

feature phonological analysis, was only commenting on the hierarchical nature of phonology as predicting its dissolution and not on suprasegmentals or other phonetic influences affecting speech production of the sound system. That is, the limitations of the methods of analysis or the way one chooses to study the problem will lend support to broader or narrower interpretations.

The study of phonological errors in adult aphasia has used techniques which were generally adapted from developmental phonological studies. For example, Shankweiler and Harris (1966) employed articulatory analyses and reported substitutions, omissions and distortions of sounds by word position, while Blumstein (1973) and Trost and Canter (1974) used distinctive feature analysis which is designed to find rules and patterns among sound substitutions.

The present study used a technique which has evolved from developmental phonology of identifying common sound processes used by normal children acquiring language (Dale, 1976). It was hypothesized that since phonology is hierarchically organized, that some of the sound errors of adult aphasics would resemble those used by children. However, it was further hypothesized that aphasics do not lose sounds or rules of sound combinations and would, therefore, demonstrate errors more complex and different from those found in children. That is, children do not exhibit all of the error patterns of which the adult phonological system is capable since they are working from a restricted set of phonemes and rules. However, the aphasic, inefficiently working with a complete set of sounds and rules, may demonstrate more complex breakdowns than those observed in children.

Methods and Procedures

Thirty subjects, 15 fluent and 15 nonfluent aphasic adults, participated in this study. All were evaluated by professional personnel at the Boston Veterans Administration Hospital using the

Table 1.
Summary of common substitution processes occurring in normal developing children* with examples from adult aphasic errors**

1. Processes of substitution	
a. Final devoicing	five ☛ fife
b. Initial stopping	nice ☛ tice
c. Gliding	really ☛ weally
d. Fronting	hurricane ☛ hurritane
2. Processes of cluster reduction	
a. Deletion	sneak ☛ seak
b. Epenthesis	England ☛ Enguland
3. Processes of final consonant avoidance	
a. Deletion	word ☛ wor
b. Epenthesis	can ☛ cana
4. Processes of assimilation	
a. Assimilation	Howard ☛ Woward
b. Reduplication	discover ☛ discerver

*adapted from Dale (1976, p. 216)
**Examples of errors in this table are from the transcriptions of adult aphasic in this study

Boston Diagnostic Aphasia Examination (BDAE) (Goodglass and Kaplan, 1972). Seven of the fluent group had been diagnosed as Wernicke's and 8 as conduction aphasics, while all nonfluent subjects had been diagnosed as Broca's aphasics. The mean age of the fluent subjects was 54.133 years (SD 9.133) and their mean severity was 2.133 (SD 0.743). Mean age of the nonfluent group was 50.067 years (SD 11.222), while their mean severity was 1.867 (SD 0.915). t-Tests for independent means (Bruning and Kintz, 1977) indicated that the fluent group was significantly older than the nonfluent group (t 4.072, df 28, $p \leq .001$) and significantly less severe than the nonfluent group (t 3.270, df 28, $p \leq .01$).

The data used in this study were taken from transcriptions of taped recordings of the conversational and expository speech sections of the BDAE. These transcriptions were made by two trained speech pathologists. The criterion for acceptance of transcription was 100% agreement between the two transcribers. Two hundred and fifty words from each conversation were analyzed. Phonological errors were identified and classified using a summary of common substitution processes which occur in normally developing children (Dale, 1976, p. 216). Table 1 summarizes these processes.

Since aphasics demonstrated phonological errors which could not be accounted for by normal developmental classifications, further categories were devised. These "aphasic" categories are summarized in Table 2.

Table 2.
Summary of aphasic phonological processes with examples of resulting adult aphasic errors

1. Processes of substitution*	
a. Vowel	laquered ☛ licquered
b. Consonant	three ☛ sree
2. Processes of addition	
a. Consonant	nine ☛ ninet
b. Singleton to blend	boy ☛ bwoy
3. Processes of deletion	
a. Consonant	window ☛ winow
b. Syllable	company ☛ comp
4. Metathesis	split ☛ spilt
5. Complex	contractor ☛ cranitreka

*Other than those summarized in Processes of substitution in Table 1

Results

Percentages of types of phonological errors made by subject groups are summarized in Table 3. A two-factor factorial design (Bruning and Kintz, 1977) was used to analyze differences in frequency of errors between aphasic groups and frequency of types of errors (developmental or aphasic) made by each group. As shown in Table 4, the fluent and nonfluent groups did not significantly differ in the number of phonological errors they made. However, for both groups, aphasic errors occurred significantly more frequently than did developmental errors. The interaction between aphasic groups and types of errors was not significant.

Table 3.
Percentages of types of phonological errors made by fluent and nonfluent groups

Types of errors	Fluent	Nonfluent
A. Developmental errors total	14.8	25.0
1. Processes of substitution		
a. Final devoicing	0.7	0.7
b. Initial stopping	1.5	
c. Gliding		2.0
d. Fronting	2.9	4.7
2. Processes of cluster reduction		
a. Deletion	4.4	7.4
b. Epenthesis	2.2	
3. Processes final consonant avoidance		
a. Deletion	1.5	2.0
b. Epenthesis	0.7	
4. Processes of assimilation		
a. Assimilation		7.4
b. Reduplication	0.7	0.7
B. Aphasic errors total	85.2	74.3
1. Processes of substitution		
a. Vowel	5.9	10.8
b. Consonant	15.5	18.2
2. Processes of addition		
a. Consonant	2.9	1.4
b. Singleton to blend	6.7	4.7
3. Processes of deletion		
a. Consonant	3.7	2.7
b. Syllable	5.2	3.4
4. Metathesis	2.2	
5. Complex	42.9	33.2

Table 4
ANOVA of frequency of error types made by fluent and nonfluent aphasics

Source	SS	df	ms	F	p
Total	1527.334	59	—	—	—
Groups	3.267	1	3.267	0.173	NS
Error types	459.267	1	459.267	24.306	$\leq .001$
Groups x Error types	6.667	1	6.667	0.353	NS
Error	1058.135	56	18.895	—	—

Nonfluent aphasics made significantly more developmental errors than did fluent aphasics (t 3.011, df 28, $p \leq .01$). Further, the percentages of types of developmental errors differed between groups. Most to least frequent for fluent aphasics were cluster reduction, substitu-

tion, final consonant avoidance and assimilation processes. For the nonfluent group, assimilation occurred most frequently, while substitution and cluster reduction were used equally as often and final consonant avoidance occurred least frequently. Within each process category, particular subdivisions were unequally represented for each group. For example, fronting was the most frequent and final devoicing the least frequent substitution error for both groups. Initial stopping did occur although no gliding occurred in the fluent group. The reverse was observed in the nonfluent group. Deletion was the most frequent method of cluster reduction for both groups while epenthesis occurred only in the fluent group. The most frequent method of final consonant avoidance in both groups was deletion with epenthesis occurring only in the fluent group. Fluent aphasics used only reduplication while nonfluents most frequently used assimilation.

Frequencies of aphasic errors did not significantly differ between the two groups (t 0.214, df 28). Most- to least-frequency of aphasic error types for both groups were complex, substitution, addition, deletion and metathesis. No example of a metathesis error alone occurred in the nonfluent group. However, metathesis in conjunction with other errors did occur in this group. Within category comparisons showed that consonant substitutions were more frequent than vowel substitutions for both groups. Additions resulting in singleton to consonant cluster changes accounted for the most addition errors, while consonant additions occurred less often for both groups. Neither group demonstrated vowel or syllable additions. Consonant deletion errors were observed in both groups while vowel deletion was not observed in either group. For both groups syllable deletion occurred more frequently than consonant deletion. As can be seen in Table 3, complex errors accounted for the majority of errors made by both groups, indicating that most aphasic errors cannot be accounted for by the simple processes of substitution, addition or deletion found in the speech of normally developing children.

Discussion

As was expected, some of the phonological errors made by both aphasic subgroups were similar to the common substitution processes observed in normally developing children. This finding probably reflects the restricted and hierarchial structure of phonology and phonotactics rather than similarity between normal children and adult aphasics. That is, a system composed of a restricted set of distinctive features with a restricted set of phonotactic rules should share some common breakdown patterns among varied populations of misusers. Although this point seems obvious and simplistic, it does demonstrate the limitations of using only a pure structural or linguistic analysis for studying disordered populations. As Lecours and Caplan (1975) noted, there are nonphonological differences among aphasic subgroups which are important for differential diagnosis. In this study, we had speculated that some common phonological errors would occur between normally developing children and adult aphasics due to the restrictions of the phonological system.

However, as we had predicted, the overwhelming number of sound errors made by aphasics were peculiar to aphasics. Primarily, these findings fail to support the regression hypothesis. The patterns of errors made by the aphasics indicated that they were not working from a reduced store of sound units or rules, but were inefficiently using a complete sound and rule system. For example, aphasics both reduced and created clusters with consonant deletion and addition. Further, consonant substitutions did not always follow the more complex to simple direction of those found in children. Finally, complex errors which involved combinations of other errors often resulted in more complicated structures than found in the target words.

These findings indicate that aphasics do not need to be "taught" developmental phonology. They do not talk as children talk and should not be taught as children are taught. The complexity of sound errors made by aphasics reflects the inefficienty of a damaged nervous system which appears to be failing to inhibit or uninhibit sound retrieval. As aphasiological clinicians have observed, improvement of sound errors in this population involves a process of teaching self-monitoring skills rather than teaching sounds.

It is for these clinical implications that notions such as the regression hypothesis should be re-examined. Although appealing, as Caramazza and Zurif (1978) have noted, the regression hypothesis has not been supported by research. Consequently, the regression hypothesis offers no logical direction for clinical intervention.

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