

ON THE ACQUISITION OF SEGMENTAL DURATION IN NORMAL AND ARTICULATION DISORDERED 4-YEAR-OLDS

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ABSTRACT

Aspects of sound duration were longitudinally investigated in the speech of two groups of preschoolers, children with normal speech/language development and children with articulation disorders. Results included increased longitudinal dissimilarities between the groups.

1. INTRODUCTION

The importance of suprasegmentals within the speech/language development of children has recently been emphasized [3], [5]. This prevailing tendency revives the old question of segmental duration which has been extensively investigated for well over 100 years [6], [4].

Speech sounds not only vary in intrinsic duration, they also influence another durationally in regular ways. The possibility to establish frequently reconfirmed durational rules bears witness to this fact.

Comparable findings in speakers of many different languages suggest common physiological properties behind these relational manifestations. Vowels seem to be generally longer before voiced than before voiceless stops, for example. Durational peculiarities between languages, on the other hand, point to simultaneous language dependent learning effects.

More recently several investigators have examined consonant and vowel

duration in the speech of children with specific articulatory deficits [8], [1], [7]. These studies have shown a greater durational variability in the children with articulatory difficulties. However, certain durational contrasts such as voicing appear to be maintained by children with disordered articulation as well.

When and how do children acquire the durational standards of their native language, whether they are based on physiological maturation of articulatory timing events or on learning processes? Are there differences in the acquisition of these standards between children with and without certain speech/language deficiencies? In an attempt to procure initial results, this study was designed to investigate sound duration longitudinally in the speech of two groups of preschoolers, children with normal speech/language development and children with disordered articulation.

2. METHOD

2.1. Subjects

Twelve children (7 boys, 5 girls) between the ages of 4;0 and 4;11 served as subjects. All subjects had passed a hearing screening test and had no reported history of neurological, physical, psychological or behavioral impairment.

Standardized tests, the Test of Early Language Development (TELD) and

the Weiss Comprehensive Articulation Test (WCAT), established the two groups of subjects (N = 6/group): The NORM Group, children who achieved age appropriate scores on both, the language and the articulation tests, and the ARTICULATION DISORDERED group, children who performed within one standard deviation of the norm on the language test but at least four points below age on the articulation test.

2.2. Data Collection/Analysis

The material consisted of 42 CVC contracts with initial /p/ plus either /i/, /k/ or /u/, followed by all voiced and voiceless stops and fricatives of American English.

These stimuli were presented orally and repeated three times in three month (10-13 weeks) intervals. At each test time all stimulus items were modelled by the same person. Misarticulations of a stimulus item in any part resulted in repetition of the logatom by the investigator. After 3 incorrect responses, the child's final production represented his/her response to that particular item. The responses of the subjects were audiorecorded and later analyzed from oscillographic displays utilizing the Micro Speech Lab computer program, Kay Elemetric Corp., 1985. To ensure comparability of the measurements, certain segmentation principles were established and strictly adhered to.

3. RESULTS

For the statistical analyses, the data were organized in two ways: absolute and relative duration. The absolute duration consisted of the real time measurements of each acoustic sound representation: initial [p], medial vowel, and final consonant. The relative duration is a calculation devised to minimize rate differences between speakers and consists of the sound

length/average sound duration of the entire word [2].

Voicing Contrast: The first question addressed was: Do the two groups of subjects adhere to the durational standard that vowels preceding voiceless consonants are shorter than those preceding voiced consonants? Absolute and relative durations were analyzed by means of a two tailed t-test. An alpha level of .05 was established for significance.

For all three testing times both the Norm and the Articulation Disordered group produced significantly longer durations when the vowels preceded voiced consonants. This held true for the three vowel qualities, regardless of whether the vowel preceded stops or fricatives, and for both absolute and relative duration. Therefore, although the group of children with an articulation disorder often misarticulated the final consonant, the durational contrast of the preceding vowel was observed. This is especially interesting in light of the fact that clearly over half of the misarticulations represented devoicing of the final consonant.

Group Specific Durational Differences over Time: The second question addressed was: Do the Norm versus Articulation Disordered subjects demonstrate group specific variations in sound duration for each of the three testing times? To answer this question, a multivariate analysis of variance was used to test for interactions among group by absolute and relative duration of the 1) initial [p] (IP), 2) medial vowel (MV) and 3) final consonant (FC) for Time 1, 2, and 3 (T1, T2, T3).

As can be noted in Tables 1 and 2 there was always a statistical significance between the Norm and Articulation Disordered groups for all absolute and relative durations at T3. From these results there appears to be a change over time with the two groups

of subjects becoming more dissimilar during this testing period.

Table 1: MANOVA Results for the Absolute Durations of Initial-p (IP), Medial Vowel (MV), and Final Consonant (FC) X Group for Time 1, 2, and 3 (T1, T2, T3)

	F-Ratio	df(1,11)	p
IP-T1	7.29		.007
IP-T2	17.22		.0001
IP-T3	5.20		.02
MV-T1	2.42		.122
MV-T2	12.67		.0005
MV-T3	5.07		.027
FC-T1	2.51		.116
FC-T2	3.60		.06
FC-T3	8.93		.004

Table 2: MANOVA Results for the Relative Durations of Initial-p (IPR), Medial Vowel (MVR), and Final Consonant (FCR) X Group for Time 1, 2, and 3 (T1, T2, T3)

	F-Ratio	df(1,11)	p
IPR-T1	11.40		.001
IPR-T2	5.35		.02
IPR-T3	11.64		.001
MVR-T1	2.26		.135
MVR-T2	.16		.69
MVR-T3	6.48		.01
FCR-T1	10.00		.002
FCR-T2	3.51		.06
FCR-T3	13.26		.0005

Individual Durational Variations for Each Group: The third question addressed was how each individual child manipulated segmental duration throughout this testing period. It was also important to determine whether or not the children in both groups varied from known norms. To establish this theoretical norm, the means of the Norm group for both absolute and relative durational measures were utilized.

An overall mean for each context condition (the three vowel qualities, voiced and voiceless stops and fricatives) was calculated from the Norm group. A 95% confidence interval was set around these means. Each child's performance was then compared to this confidence interval. A percentage was determined based on how many means of the individual child were found within this 95% confidence interval. As is to be expected, the Norm group had a much higher percentage of means within the 95% confidence interval. However, individual variations could be seen, for example: Subject 3 = 37%, Subject 5 = 46%, Subject 1 = 89%. Thus, not all members of the Norm group reacted durationally in the same manner. For the group of children with articulation disorders percentage scores were lower as well as less variable (range = 39-69%). While three of the children fell clearly outside the Norm means (Subject 8 = 42%, Subject 9 = 39%, Subject 12 = 45%), the overall range of percentages was clearly reduced when compared to the Norm group.

4. DISCUSSION

This investigation supports previous findings [1], [7], [8]: even children with articulation disorders adjust the vowel duration preceding voiced consonants although they produced in fact devoiced final consonants. However, in this respect group variations were found. In addition, more incidences of significant differences could be noted between the two groups at time 3. One feasible hypothesis is that the subjects of the Norm group did develop fairly fast during the testing time interval while the Articulation Disordered group showed little or no durational maturation. According to our findings, then, it is not that the children within the Articulation Disordered group were developing durationally in a dif-

ferent direction, but rather that their pace of change was drastically different. Finally, a fair degree of individual variation was noted in both groups of subjects, although the range of variability found was wider within the Norm group.

5. REFERENCES

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This research was supported by a University of South Alabama Research Council grant.