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# Experimental Methods and Insights from Speech Remediation

Speech-language pathologists and linguists have shared a common interest for many years — the study of phonological acquisition in children. Linguists are interested in this area for a variety of reasons — not the least of which is what it contributes to our understanding of the nature of language and the mechanisms of acquisition which render language learnable. Speech-language pathologists utilize information about normal acquisition in order to understand the disordered child. A comparison between normal and disordered speech behavior allows us to form opinions about whether the disordered child is delayed (like the normal child but at a less advanced stage) or deviant (unlike the normal child) and allows us to compare stages in the acquisition of phonology as it occurs in the environment with the acquisition that occurs during clinical training.

Recently there has been information suggesting that similarities exist between the speech of young children and older children with functional articulation problems. According to the evidence, articulation errors are not random, but are instead systematic and rule governed (Compton, 1970, 1975; Oller, 1973; Ingram, 1976; Panagos, 1974; Haas, 1963). This evidence has led to the suggestion that articulation errors be characterized in part as phonological disorders within a phonological system.

If similarities exist between the speech of normal children and misarticulating children, there should be value in exploring the acquisition process as it occurs in individuals in both of these groups. Information obtained on individuals in one group should be of value to understanding the other. Speech-language pathologists have looked toward diary studies carried out by linguists to obtain information on acquisition. We would like to suggest in this paper that information on misarticulating children may provide a window for the study of normal phonological development and that there may be methodological advantages in studying the disordered child.

Some of the difficulties that are encountered in collecting data on very young children in naturalistic studies can be controlled in a clinic setting with older children. It is possible to obtain session by session data from older misarticulating children during the course of articulation training that reflect the variations in children's productions during acquisition of sounds.

It is also possible in a clinic setting to structure a set of test words which can be administered to children regularly so that changes in the production of particular words can be observed over time. This type of information on the change within specific words by a single child or across children has been scarce in diary studies.

The limited information which is available concerning change over time in lexical items has provided valuable information on two aspects of phonological acquisition. One aspect concerns the variability within the production of a single word during acquisition and a second aspect concerns the variability among individual children in terms of the strategies employed in acquiring sounds.

Based on this information from normal acquisition, the following study was designed to examine in detail the changes in production of misarticulating children as they were learning to produce /s/ in training. Session by session data were explored for evidence of 1) shifts in production of single items across sessions, 2) strategies used by the children in learning the target sound in syllables and 3) individual variability among the children in the time required to complete the training program.

## METHOD

**Subjects.** The data in this study are derived from five misarticulating children in the process of receiving training for /s/ misarticulation. Four children who misarticulated several phonemes in addition to /s/, and one child whose only misarticulation was /s/ (Subject 5) were selected as subjects. The ages of the five children ranged from five years, six months to six years, five months and their mental ages as derived from the Peabody Picture Vocabulary Test (Dunn, 1965)

Table: Thirty-seven test items.

| Syllables | | | | | /s/ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CV | 1. | /si/ | 2. | /sæ/ | 3. | /su/ | 4. | /sa/ | 5. | /sʌ/* |
| VCV | 6. | /isi/ | 7. | /æsæ/ | 8. | /usu/ | 9. | /asa/ | 10. | /ʌsʌ/* |
| VC | 11. | /is/ | 12. | /æs/ | 13. | /us/ | 14. | /as/ | 15. | /ʌs/* |
| CCV | 16. | /sti/ | 17. | /stæ/ | 18. | /sku/ | 19. | /ska/ | | |
| VCC | 20. | /ist/ | 21. | /æst/ | 22. | /usk/ | 23. | /ask/ | | |
| VCCV | 24. | /isti/ | 25. | /æstæ/ | 26. | /usku/ | 27. | /aska/ | | |
| Words (Spontaneous) | | | | | | Words (Imitated) | | | | |
| | 28. | I. | suit | | | | 33. | I. | seek | |
| | 29. | | soap | | | | 34. | | sub | |
| | 30. | M. | glasses | | | | 35. | M. | masking | |
| | 31. | F. | goose | | | | 36. | F. | moose | |
| | 32. | | bus | | | | 37. | | mice | |
| Totals: 37 | | | | | | | | | | |

* Training syllables

ranged from four years, three months to ten years, ten months. All subjects had normal hearing and were diagnosed by the experimenter as having a functional (non-organic) misarticulation problem.

**Items for Acquisition Testing.** The data base for this study was the subjects' imitated and spontaneous responses to 37 /s/ items (untrained nonsense syllables and words) presented on three occasions prior to training correct /s/ production and at every session throughout training. These items were never trained, only tested and the children were given no information about the correctness of their responses to these items at any time.

The untrained items shown in the Table consisted of syllables and words. The twenty-seven syllable items were constructed to examine contextual effects and syllable structure. Ten words with /s/ in the initial, medial and final positions were also tested. All of the syllables and five of the words were elicited through imitation. The remaining five words were elicited spontaneously by asking the children to name pictures. These items were tape recorded and randomized for presentation to the subjects during the course of training.

**Training Syllables and Training Procedures.** Three of the syllables from the test list were selected for training. Correct production of /s/ was first trained in the syllable /sʌ/, then /ʌs/ and finally /ʌsʌ/. In training, the experimenter modeled the syllable and the subject imitated the model. Subject responses were immediately followed by verbal feedback from the experimenter. This shaping procedure was used until correct production of each syllable was obtained. At the end of each session the test items were presented to determine what form the child would use as the child was changing production on the training items. Subjects were administered training on the three training syllables until at least 50% of the untrained test items were produced correctly.

All training consisted of 30-minute individual sessions three or four times a week. The experimenter and an observer were present at each session to transcribe all responses phonetically. The subject responses to the test items from each session during training provided information on the forms produced by the children as they learned to produce /s/ on the training items.

## RESULTS AND DISCUSSION

**Variations from Correct to Incorrect.** Normal acquisition literature suggest that children vary: 1) in the time it takes to learn correct sound production; and 2) in shifting from correct to incorrect production after the sound has been produced correctly. The data obtained in this study show these aspects of variation in the children's productions. Space limitations preclude presentation of the full set of data showing the variability of responses over time. However, the following data is an example of one child (Subject 1) and his generalization pattern. In the first three test sessions that occurred before training he produced all incorrect responses to the 37 test items. After training on /s/ was initiated, correct responses began to occur on many of the untrained items. For instance, on the syllable /si/ Subject 1 continued for four sessions to produce [θi] as a response, however, beginning at session four he began to produce variant responses, which included a combination of sounds [θˢi], an addition of a sound [θid] and a dentalized /s/. In session eight he produced /si/ correctly and maintained the response for several sessions. On the thirteenth session he again produced [θi], but at sessions 14 through 17 he produced /si/ correctly. This variability between correct and incorrect production continued until the twenty-sixth session when training was completed. The same variability was seen on the other test items whether they were words or syllables, imitated or spontaneous. Similar shifting responses were observed across the five subjects on the complete set of test items. The fact that this shifting occurred for all children studied suggests that it is a common pattern during acquisition of the correct sound in training. It is also a pattern reported for children learning phonology normally.

Moskowitz (1973) uses the term *progressive idiom* to describe early correct productions followed by less correct forms. Ferguson (1976) has compared this type of phonological variability to a child's extensions and overgeneralizations in other aspects of language. For instance, this phonological shifting has been compared to the development of past-tense forms in which a child begins to use the word *comed* when he had previously used *came*. An often cited example of this phenomenon in phonological acquisition comes from Hildegard (Leopold, 1947) where the word *pretty* was produced correctly for several months, changed to [pɪti] and later to [bɪdi] during the course of development. A shifting in forms may be an indication of the application of a new rule that affects a number of words and may represent a step forward in development.

The correct-incorrect variation in productions within items did not seem related to context because it occurred in many different phonetic contexts (Elbert and McReynolds, 1978). Instead it might be attributed to competing rules operating during the early stages of acquisition similar to the rules proposed to be operating during morphological acquisition.

**Strategies Children Use.** The data from the study were also explored to determine if children use different strategies, individual strategies, as they learn to produce sounds.

Two patterns, or strategies emerged from the children's performance on consonant cluster generalization. In one pattern, Subjects 3, 4, and 5 began to replace the substituted consonant in the cluster with correct /s/ and then alternated between correct and incorrect productions. In the other pattern, or strategy, Subjects 1 and 2 first marked the presence of another consonant in some way before producing the correct /s/. A general rule may have been operating in acquisition of /s/ in clusters, the rule that the consonant has to be marked either with a substitution or with some other form before it is produced correctly in a cluster. In accomplishing the operation children use individual strategies which are dependent on the form of their original error pattern.

These data contribute some support to the proposed stages of development (of consonant clusters) in normal phonological acquisition. Ingram (1976) lists the four general stages of cluster development as: (1) deletion of entire cluster; (2) reduction of cluster to one member; (3) use of cluster with substitution for one of the members; and (4) correct articulation. According to these proposed stages, Subjects 3, 4, and 5 would have been at stage three during baseline testing because they were using a substitution for one of the cluster members. They would have progressed to stage four, correct articulation, during training. Subjects 1 und 2 used a substitution in some clusters during baseline but reduced other clusters by deleting one of the consonants. Reduction of a cluster to one member corresponds to stage two in development. In no instance did a subject begin to produce /s/ correctly in a cluster until he had first substituted /θ/ for /s/ within the utterance. It is recognized that these data are preliminary in nature and were obtained on a small number of children; exceptions may be found as more children are studied.

In summary, the children's performance in training corresponded to some extent to the performance of younger children developing phonology normally. Both groups of children evidence shifts from correct to incorrect before the correct form is stabilized. Individual variability is displayed by the children in regard to the length of time required to reach acquisition and the strategies used to approach complex forms in production.

Given the demonstrated parallels between normal acquisition and acquisition through clinical intervention, the study of children with functional articulation problems constitutes another area for experimental phonologists to test hypotheses and discover other aspects of acquisition. The results of investigations of both types of acquisition show promise of complementing one another. There may even be advantages to the clinical investigations since development can be accelerated allowing a full range of developmental stages to be evidenced in a relatively short time frame. Observing comparable stages of development in normal acquisition would entail longitudinal studies complicated by necessarily longer time frames. Also, the experimental controls available in the clinical studies are at least as rigorous as those found in current psycholinguistic experimental research and otherwise constitute enormous advances over earlier diary studies.

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