

TRANSFER OF ARTICULATION TRAINING ACROSS MORPHOLOGICAL CONTEXTS: A BRIEF REPORT

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ABSTRACT

Three children with /s/ and /z/ misarticulations were trained to correctly produce /s/ or /z/ in the final position of a sequence of nonsense word nouns. A probe was administered each time training criterion was reached for a given noun. The probe assessed transfer of articulation training to English noun and nonsense plural, possessive and third person singular present verb tense contexts for /s/ and /z/. One subject showed transfer across phonemes and all contexts. A second subject showed transfer across all context for the trained phoneme only. His transfer across phonemes appeared to be restricted by co-articulation effects. The third subject showed no transfer. The results are discussed in regard to efficiency of training /s/ and /z/ phonemes.

Research in transfer of articulation training has been reviewed extensively by Mowrer (1971). Transfer of training has been investigated at all major articulation skill acquisition steps (e.g. words, sentences). The prevailing issue is efficiency of training. That is, how can the greatest articulation gains be obtained from the least amount of training? Mowrer describes transfer as involving "carry over" and generalization. Transfer of training is a unified concept under any broad definition indicating that past learning experiences influence subsequent performance. Training one skill may **facilitate** the training of a second skill as in the case of providing speech discrimination training prior to speech production training (Winitz and Priesler, 1965; Mann and Baer, 1971). Moreover, training one skill may result in the spontaneous **emergence** of a skill never directly trained. Elbert, Shelton and Arndt (1967) demonstrated transfer of training from /s/ production training to correct production of /z/.

The possibility of transfer between articulation and language training has been suggested by McReynolds (1973) in view of the frequency of language deficits in children with articulation errors (Menyuk, 1964; Shriner, Holloway and Daniloff, 1969). That issue is especially salient for /s/ and /z/ because each phoneme also represents a surface manifestation for varying linguistic concepts. That is, both /s/ and /z/ appear in the language as plural, possessive and third person singular verb tense allomorphs.

Recently, Rosen and Schiavetti (1975) compared normal and articulation impaired children in their knowledge of morphological inflections. No significant differences occurred between the two groups. Children who misarticulated /s/ and /z/ used the same misarticulation in responding to test items. The extent to which trained articulation

responses will transfer across distinctively different uses in language contexts is, however, an empirical question. The purpose of the present study was to explore such patterns of transfer of /s/ and /z/ articulation training. Specifically, subjects were provided with **either /s/ or /z/** production training in the final position of nouns. Transfer of articulation training to nouns as well as plural, possessive and third person singular present verb tense contexts was assessed for both /s/ and /z/.

METHOD

Subjects

One girl and two boys served as subjects. They ranged from six to eight years of age. All subjects were screened for normal hearing at 20 dB (ISO standards) for the frequencies 250, 500, 1000, 2000, 4000 and 8000 Hz. They each consistently misarticulated the /s/ and /z/ phonemes in at least the final or arresting position on the McDonald Deep Test of Articulation (McDonald, 1964). One subject substituted θ /s and ζ /z both in the releasing and arresting positions. The other subjects omitted both phonemes in the arresting position.

Stimulus Materials

Five monosyllabic nonsense words were contrived for training and testing each phoneme (see Table 1). Each word appeared as a response across the four contexts: 1) final position of nouns; 2) plural form; 3) possessive form; and, 4) verb tense form. Therefore, the articulation response topography was held constant across all contexts. Response elicitation procedures were adapted from Berko (1958). Each context for a word was

TABLE 1. Nonsense word stimuli for /s/ and /z/ phonemes.

Phoneme	Nouns	Plural	Possessive	Tense
/s/	woks	woks	wok's	woks
	dæks	dæks	dæk's	dæks
	paks	paks	pak's	paks
	guks	guks	guk's	guks
	miks	miks	mik's	miks
/z/	woz	woz	wo'z	woz
	dæz	dæz	dæ'z	dæz
	paz	paz	pa'z	paz
	guz	guz	gu'z	guz
	miz	miz	mi'z	miz

illustrated by a separate black and white hand drawn picture. Animated nonsense figures were used to illustrate each noun label (e.g. woz). A different nonsense figure was used to illustrate the singular form of each nonsense word (e.g. wo). The figure appeared in singular and paired forms on one picture. The accompanying verbal stimulus to elicit the plural form was "This is (wo). Here are two (**woz**)". The same nonsense figure was pictured with a common object (e.g. hat). The verbal stimulus to elicit the possessive form was "This is (wo). This is his (hat). Whose (hat) is it, it's (**wo'z**)". Verb tense pictures contained novel actions not readily identified by any English verb (e.g. man with teapot on head). The verbal stimulus was "Here is a man who knows how to (**wo**). He does it everyday. What does he do, he (**woz**)." Five English nouns were also selected for each phoneme (/z/ - cheese, hose, fuzz, nose, rose; /s/ - dress, juice, face, bus, mouse). These were illustrated in pictures taken from the Peabody Language Development Kit. Subjects were asked "What do you see?" to elicit noun labels. English nouns were necessary to assess transfer within the noun class simply because subjects could not spontaneously name the nonsense nouns without prior articulation training.

Probe Lists

The nonsense word nouns were used for articulation **training** only. The English nouns and nonsense plural, possessive and verb tense forms were organized into two probe lists, one for /s/ and one for /z/. Each list contained the five nonsense words in each of the three morphological contexts and the five English nouns for a total of 20 items. Each successive sequence of four items contained one English noun and a plural, possessive and verb tense item. The nonsense words were rotated through the list until each had been tested in all three morphological contexts. The probe lists were presented to two normal speaking children within the same age range of the subjects. Both children performed at a 90% level of accuracy.

Imitation Pre-Test

The nonsense words for /s/ and /z/ were organized into two separate lists with each word included twice. Subjects were required to imitate the words on each list at a 25% or better level of correct imitation for each list. This requirement was to insure the subjects' phonetic capacity for the articulatory responses trained and probed.

Experimental Procedures

Setting: All sessions were conducted in the Speech and Language Research Laboratory at the University of Kansas Medical Center. Subjects were seen individually in an experimental room containing a child size table and chairs. The trainer sat facing the child and an observer could sit to the right but slightly behind the trainer to record responses.

Baseline: The probe lists for /s/ and /z/ were presented to each subject three times to insure a zero level of correct articulation responses prior to training. The list for the phoneme to be trained was presented last. No consequence was provided for responses during the baseline.

Training: All subjects received articulation training with nonsense nouns. Two subjects were trained in /z/ production and one subject was trained in /s/ production. Subjects were seen individually for four training sessions per week. A session consisted of 120 trials organized into six sets of 20 trials. Nonsense nouns were trained in the order of listing in Table 1. Each noun was trained individually to criterion before another noun was trained. Reinforcers for correct responses consisted of marbles dropped into a plexiglass container. Marbles were exchangeable for plastic tokens used to purchase candy and small toys.

Initially, each subject was trained to correctly imitate the phoneme in the noun ("Say_____") while trainer held up nonsense picture). Training later shifted to spontaneous production. The trainer presented the picture and asked "What is this?". Reinforcement was shifted from a fixed-ratio 1 schedule to a fixed-ratio 3 schedule (from every correct response to every three consecutive correct responses) during both imitative and spontaneous training. (i.e. FR1-Im, FR3-Im, FR1-Sp, FR3-Sp). Criterion for terminating each training step was 90% or better performance¹ on three consecutive sets of 20 trials.

The /s/ and /z/ probes were administered when criterion (90%, FR3-Sp) for a given noun was achieved. The probe of the phoneme being trained was administered first. The criterion for terminating additional noun training was correct production of the trained phoneme (e.g. /z/) in at least four of the five items for each context (English nouns, nonsense plural, possessive and tense forms). If probe criterion was not met another noun was trained. Training continued until probe criterion was met or all five nonsense nouns had been trained. Training sets were arranged to provide four review trials for previously trained nouns and 16 trials for each additional noun.

Reliability

Reliability measures for judgements of correct articulation were obtained for baseline and probes for each subject. Observer scoring of responses was compared item by item with the trainer's scoring. There was 100% agreement for baseline measures of all subjects and both phonemes. Percentage of agreement on probes ranged from 85% to 100%.

RESULTS

Repeated presentations of the /s/ and /z/ probes provided an indication of articulation transfer occurring during training. Table 2 contains the probe results for the three subjects. The results are expressed as the number of correct items out of the total of five for each phoneme across the four contexts.

TABLE 2. Articulation probe results for the three subjects.

Subject	Phoneme Trained	Contexts	BASELINE		N1		N2		N3		N4		N5		
			S	Z	S	Z	S	Z	S	Z	S	Z	S	Z	
1	/z/	English nouns	0	0	1	5	1	4	—	—	—	—	—	—	—
		Plural	0	0	1	4	2	5	—	—	—	—	—	—	—
		Possessive	0	0	2	3	2	4	—	—	—	—	—	—	—
		Tense	0	0	2	4	4	5	—	—	—	—	—	—	—
2	/z/	English nouns	0	0	0	1	0	1	3	3	3	4	—	—	—
		Plural	0	0	0	0	0	0	0	4	0	4	—	—	—
		Possessive	0	0	0	0	0	2	0	5	0	4	—	—	—
		Tense	0	0	0	0	0	1	0	5	0	4	—	—	—
3	/s/	English nouns	0	0	1	0	0	0	0	0	0	0	0	0	0
		Plural	0	0	0	0	1	0	0	0	0	0	0	0	0
		Possessive	0	0	0	0	0	0	0	0	0	0	0	0	0
		Tense	0	0	0	0	0	0	0	0	0	0	0	0	0

¹Both trainer and independent observer had to agree that the level had been reached before shifting to the next step.

Subject 1 received /z/ production training. She consistently substituted z /z and Θ /s during administration of the baseline. Subject 1 reached probe criterion for /z/ after training on two nonsense nouns. Improvement in /s/ articulation across all contexts occurred during /z/ training but to a lesser degree than for /z/. The most improvement in /s/ articulation occurred in the Tense context where four of the five items were scored as correct.

Subject 2 also received /z/ production training. He omitted /s/ and /z/ during the baseline. Probe criterion for /z/ was reached after training four nonsense nouns. Improvement in /s/ production occurred only for the English noun context. Subject 2 produced /s/ correctly in three of the five English nouns.

Subject 3 received /s/ production training. He omitted /s/ and /z/ during the baseline with the exception of an occasional Θ /s substitution primarily on English nouns. All five nonsense nouns were trained and probe criterion was not obtained. Essentially no improvement occurred on /s/ or /z/ probe items during training. Subject 3 continued to omit both phonemes on the probes except for an occasional Θ /s substitution usually on English nouns.

DISCUSSION

The results provide a simple demonstration of transfer of 'articulatory' responses across distinctively different uses in language contexts. Transfer across phonemes was less explicit. Subject 1 showed some transfer across all contexts for /s/ and /z/ during /z/ production training. A lag existed between /s/ and /z/ probe performance such that additional training on one or the other phoneme would probably be necessary for eventual criterion /s/ production performance.

Subject 2 showed transfer across all contexts for the trained phoneme /z/. A lag in /s/ production occurred again. Subject 2 produced /s/ correctly only in some English nouns. The latter result appears to highlight co-articulation as a variable in transfer of /s/ articulation across morphological functions. Nonsense words for /s/ (e.g. woks) ended in a consonant cluster. All /z/ words (e.g. woz) and /s/ English nouns (e.g. bus) were CVC in nature. Subject 2 may have transferred simply on the basis of the similar and easier co-articulation. Subject 1 was already producing a substitution in all contexts so was more advanced in development of the different co-articulations (McDonald, 1964). The co-articulation effect could be assessed by probing English nouns ending in the /ks/ cluster (e.g. box).

Subject 3 showed no transfer on either the /s/ or /z/ probe despite reaching training criterion for all five nouns. The discrepancy between training and probe performance suggests apparent individual differences in the amount of training required to generate transfer of articulation responses.

The above results provide implications for efficiency in training correct articulation of /s/ and /z/. As McReynolds (1973) suggests, training /s/ or /z/ in the final position from the outset may be the most optimal approach. Subject 1 misarticulated both phonemes in the releasing and arresting word position at the outset of training. The McDonald Deep Test and the Goldman-Fristoe Test of Articulation were administered to her at the end of the study. She had transferred correct articulation of /s/ and /z/ to all positions in test items as well as to the other tested contexts on the probes. Training articulation in the final position

may then be more efficient for at least /s/ and /z/ than the more typical approach of training each word position starting with the initial position.

An additional consideration is the use of morphological contexts to directly train articulation of /s/ and /z/. Transfer of articulation training from morphological contexts was not included in the present procedure. Nonetheless, a morpheme (e.g. plural /s/) may be more highly discriminative to a child for correct articulation because of its generality in the language than a series of individual vocabulary items containing the trained phoneme. Consequently, training articulation in a morphological context might enhance "carry over" of articulation responses to more natural speaking situations.

In summary, assessment of children's articulation across morphological contexts broadens the available sample of articulation performance and progress. Moreover, they may also serve as avenues for articulation training. The above discussion is speculative in nature. It should, however, provide some basis for an empirical approach to articulation training involving at least the two phonemes in question.

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