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INTRODUCTION

The construct of contrastive oppositions in phonological intervention has been shown to be effective in remediating speech disorders in children for the past several decades (cf., Weiner, 1981; Gierut, 1989; 1992). Although derivations of contrastive oppositions have been examined, particularly with the nature of the comparison sound contrasted with the target sound (i.e., known ~ unknown; unknown ~ unknown), all variations have incorporated a singular contrast. Frequently, however, children with severe speech disorders collapse multiple ambient sounds to a single phoneme in their sound system (Williams, 2000). The purpose of this investigation was to examine phonological restructuring when contrastive oppositions were constructed to include larger treatment sets that confronted the child with multiple sound targets selected from an entire rule set.

PARTICIPANTS

Fourteen children with moderate to severe phonological impairments served as participants in this study. Five girls and nine boys who ranged in age from 4 years to 6 years (mean age = 4 years; 9 months) met the following criteria to be included in the project: (1) exclusion of at least six sounds across three manner categories of sound production, as determined by performance on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986); (2) normal hearing; (3) no known history of organic or motor disorders; (4) non-verbal cognitive abilities within normal limits; (5) between the ages of 42 and 78 months; and (6) reside in a monolingual English-speaking family. Table 1 describes the participants with regard to age, PPVT-R standard score, and pre- and post-treatment percent correct underlying representations (PCUR).

METHODS

Independent and relational phonological descriptions were completed on each child prior to and following intervention. Two samples were collected and served as the basis for the phonological analyses. One sample was a 20-30 minute conversational sample. An extensive single-word elicited sample was also obtained in order to ensure a representative sample of the child's speech. Each child's sound system was described in terms of phonetic and phonemic inventories, distribution, phonotactic constraints, phonological rules, and phoneme collapses (Williams, 1993). Three to four target sounds were selected from each of two different phoneme collapses.

METHODS (Cont.)

A combined single-subject design of multiple baseline across subjects and across behaviors was used to investigate the efficacy of the multiple opposition approach. Two error patterns were selected for intervention for each child. Half of the children received treatment on the first pattern while the other half of the children remained in an extended baseline until treatment was completed on the first pattern with the first group of children. After 21 treatment sessions, or 90% generalization to the target behaviors in the untrained items was achieved, treatment switched to the second pattern for the first group of children and the second group of children began treatment on their first error pattern. Treatment consisted of five contrastive multiple oppositions for each error pattern which resulted in a total of 20-25 stimuli per pattern trained.

Narrow and broad measures of generalization were used. Generalization probes were constructed for each child to assess learning of target sounds to untrained words as well as to provide a baseline level of performance on targeted sounds prior to the initiation of intervention. If the generalization criterion of 90% accuracy on the target sound in untrained words was met, a short conversational sample was collected to check the child's use of the targeted sound in connected speech. If the child produced the sound with at least 50% accuracy, treatment for that sound was terminated, as suggested by Fey (1986).

Data analysis: For each target, the end of treatment mean was compared with the baseline mean with the t-test. The pre-post comparison of means for phonological knowledge was tested with the paired t-test. A probability level of 0.05 or smaller was used to indicate statistical significance.

Table 1. Description of Participants

Participant	Age	PPVT-III (SS)	P-CUR (pre)	P-CUR (post)
Mariah	5;1	105	63%	76%
Britany	6;0	90	34%	97%
Allen*	5;2	92	12%	20%
Catherine	5;0	95	51%	63%
Cameron	5;6	74	34%	71%
Cody	4;7	114	58%	90%
Bobby	5;0	99	31%	35%
Josh T.	6;0	111	43%	66%
Juliana	4;4	110	71%	83%
Tyler	4;1	101	24%	52%
Heather	5;2	103	13%	24%
Josh S.	4;10	102	28%	41%
Stephen	4;0	108	34%	51%
Fred	4;4	123	19%	64%
mean	4;9	101.9	36.7%	59.5%

*did not complete treatment on Behavior 2.

RESULTS

Table 2 lists the mean baseline and final treatment performance for each target trained within the two behavior patterns (i.e., B1 and B2) for each of the 14 children. The statistical significance between these two scores is also indicated, as well as the child's response level on each target at the end of treatment (i.e., imitation or spontaneous).

Table 3 summarizes the results for each of the two behaviors treated in terms of number of sounds that demonstrated significant improvement and the number of sounds that reached the spontaneous level of production by the end of treatment. As indicated in this table, the majority of sounds showed significant improvement in 21 treatment sessions or less. Specifically, 77% (37/48) of the sounds treated within Behavior 1 achieved statistical significance. In Behavior 2, 97% (38/39) of the sounds demonstrated improvement that was statistically significant. Further, the majority of target sounds reached the spontaneous level of production by the end of treatment. For Behavior 1, 58% of the sounds were at the spontaneous level and 90% of the sounds in Behavior 2 were at the spontaneous level.

System-wide phonological change in terms of productive phonological knowledge is summarized for all children in Figure 1. Productive phonological knowledge significantly increased from a mean of 38.7% (pre-treatment) to a mean of 62.5% (post-treatment). An increase was observed for each study participant.

Table 2. Baseline and End Treatment Mean Performance for Target Sounds Across Participants.

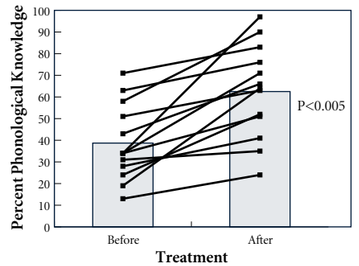
	B1 (first error pattern)					B2 (second error pattern)				
Participant	Target	Baseline	End of Treatment		Response Level	Target	Baseline	End of Treatment		Response Level
1	z/#__	0	70	*	I	t/#__	38	83	*	S
	s	10	80	*	I	g	0	90	*	I
	k	0	100	*	I	st	0	72	*	S
	tʃ	0	90	*	I					
2	z/#__	0	100	*	S	g/__#	4	100	*	S
	ʃ	0	100	*	S	k	17	100	*	S
						d_3	6	100	*	S
3	k/#__	0	100	*	S	d_3/__#	40	100	*	S
	s	0	95	*	S	ʃ	10	90	*	S
	ʃ	0	80	*	S					
4	z/V_V	5	92	*	S	s/__#	40	95	*	S
	k	70	83	ns	S	g	19	90	*	S
	w	45	73	*	S	d_3	1	22	*	I
5	d/#__	0	63	*	S	k/__#	0	83	*	S
	f	0	97	*	S	z	0	87	*	S
	d_3	0	37	ns	I	ʃ	0	87	*	S
	st	0	83	*	S					
6	g/#__	17	80	*	S	f/__#	0	90	*	S
	d_3	0	80	*	S	s	0	70	*	S
	gl	0	100	*	S	ʃ	0	97	*	S
7	k/#__	0	23	*	I	z/__#	17	88	*	S
	s	0	87	*	S	ʃ	0	85	*	S
	gl	0	30	*	I	tʃ	0	85	*	S
8	θ/#__	7	57	*	S	f/#__	0	98	*	S
	ʃ	40	83	*	S	tʃ	0	75	*	S
	tʃ	0	77	*	S					
9	g/__#	10	10	ns	I	z/#__	0	70	*	S
	f	0	77	*	S	n	0	93	*	S
	ʃ	0	77	*	S	sl	0	57	*	S
	tʃ	0	53	*	S					
10	s/#__	0	97	*	S	θ/__#	53	82	ns	S
	ʃ	0	93	*	S	ʃ	0	83	*	S
	tʃ	0	3	ns	I					
	tr	0	3	ns	I					
11	k/#__	0	78	*	S	f/__#	0	88	*	S
	s	0	0	ns	I	z	0	40	*	I
	tʃ	0	45	*	I	m	0	93	*	S
	tr	0	0	ns	I					
12	t/#__	0	10	ns	I	z/__#	0	98	*	S
	s	10	87	*	S	ʃ	0	73	*	S
	tʃ	3	23	ns	I					
	kl	0	0	ns	I	d_3	0	95	*	S
13	f/#__	0	98	*	S	s/V__V	0	90	*	S
	z	0	93	*	S	ʃ	0	60	*	S
	k	0	100	*	S	tʃ	0	68	*	S
14	ʃ/#__	0	63	*	I	m/__#	5	37	*	S
	s	0	63	*	I	z	0	77	*	I
	d_3	0	0	ns	I	g	0	50	*	S
	f	3	68	*	I					

Note: * = significantly different from baseline mean (P<0.05); "ns" indicates no statistical significance.

Table 3. Summary of Significant/Non-Significant Treatment Changes and Ending Response Level for Behaviors 1 and 2.

	Behavior 1	%	Behavior 2	%
No. of Significant Changes	37	77%	37	95%
No. of Non-Significant Changes	11	23%	2	5%
Ending Response Level: Imitative	20	42%	4	10%
Ending Response Level: Spontaneous	28	58%	35	90%

Figure 1. Percent Phonological Knowledge (PPK) Before and After Multiple Oppositions Treatment.



DISCUSSION

These results indicated that the multiple opposition treatment model resulted in significant changes on trained as well as untrained aspects of the children's sound systems. These changes occurred in a relatively short time period of 21 to 42 treatment sessions.

The construct of multiple oppositions has implications for the part/whole learning theory and therefore poses an interesting learnability question. Specifically, is phonologic learning enhanced by focused input that involves smaller, fragmented treatment sets (singular oppositions) or from focused input involving larger, integrated treatment sets (multiple oppositions). Although singular and multiple contrastive approaches address homonymy through the use of contrastive oppositions, they approach phonological change from different theoretical perspectives that address learnability in different ways.

Models of singular oppositions are based on the premise that the target contrast is generalizable to other phonetically similar sounds that are affected by the child's error pattern. Although the child has only a single new contrast to learn, it is fragmented from a larger, more diverse rule pattern and therefore may be more difficult to integrate into a new rule set. Conversely, multiple oppositions presents the child with the range and diversity of the new contrasts, which appears to facilitate rule discovery and increase generalization. Thus, learnability of multiple sound contrasts may be easier for a child to systematically reorganize his/her sound system than when intervention is provided on a single contrast that is isolated from the child's rule set.

The theoretical perspective of singular contrastive approaches, such as minimal pairs, focuses on the level of the *sound* for both the description and intervention of phonological disorders as it addresses learning from the "parts of the whole". The linguistic construct of oppositions, whether they involve minimal or maximal distinctions, is the focus of phonologic learning and change. According to Gierut (1990), it is the nature of the opposition that is deemed essential in shaping the course of phonological learning. Conversely, it is the level of the *system* that is important for the multiple opposition approach as learning is approached from a broader "holistic" perspective. By addressing the child's phonologic strategies, the larger treatment sets of multiple oppositions are explicitly directed at inducing change across an entire rule rather than by one contrast at a time. This theoretical perspective assumes that the greatest amount of change will occur in the shortest amount of time with the least amount of effort when intervention is focused on disruption across a rule set.

Future research is planned to directly examine the role of learning theory in manipulating the "part" versus "whole" aspects of the treatment input presented to the learner.

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