*THE APPLICATION OF NATURALISTIC
CONVERSATION TRAINING TO SPEECH PRODUCTION IN
CHILDREN WITH SPEECH DISABILITIES*

STEPHEN CAMARATA

VANDERBILT UNIVERSITY

The purpose of this experiment was to test the effectiveness of including speech production into naturalistic conversation training for 2 children with speech production disabilities. A multiple baseline design across behaviors (target phonemes) and across subjects (for the same phoneme) indicated that naturalistic conversation training resulted in improved spontaneous speech production. The implications of these findings are discussed relative to existing models of speech production training and other aspects of communication disorders.

DESCRIPTORS: articulation disorders, language, naturalistic conversation training, phonological training, children

Research indicates that communication training in contexts that parallel natural conversation conditions is more likely to be effective in improving the communication skills of individuals with communication disorders (cf. Camarata & Nelson, 1992; Warren, 1988). A remarkable aspect of these findings has been the diverse nature of targets, ranging from individual vocabulary items (Koegel, O'Dell, & Dunlap, 1988) to complex sentence structures (Camarata & Nelson, 1992), and the diverse nature of the populations, including children with autism (Koegel, O'Dell, & Koegel, 1987), hearing impairments (Prinz & Masin, 1985), developmental delays (Dattilo & Camarata, 1991; Guess, Keogh, & Sailor, 1978; Warren, McQuarterm, & Rogers-Warren, 1984), and language learning disabilities (Camarata & Nelson, 1992), within which these kinds of naturalistic procedures have been effective.

This effectiveness stands in sharp contrast to analogue procedures that rely upon extensive out-of-context imitation and drill. Although analogue approaches can be effective in producing gains within limited training settings, none have shown strong evidence of increasing spontaneous production (e.g., Siegel & Spradlin, 1985). Furthermore, some studies indicate that these imitation-and-drill procedures are likely to have adverse side effects, including resistance to training and increased disruptive behavior (Koegel, Koegel, & Surratt, 1992; Koegel et al., 1987). Moreover, the literature is replete with studies demonstrating the advantages of applying naturalistic conversation training across populations, settings, and target behaviors.

Interestingly, one important aspect of communication disorders—speech production—has not been included in these studies of naturalistic conversation training. A potential reason for this exclusion is that speech sound production disability has long been viewed as a motor task that requires direct analogue practice. A related assumption is that this motor practice requirement precludes effective application of naturalistic conversation training to improve speech production skills (Bernthal & Bankson, 1988). However, these assumptions have not been tested directly.

Several aspects of speech production disability are consistent with the characteristics of other types of communication behavior and are thus likely to be consistent with the procedures and positive out-

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Correspondence should be addressed to Stephen Camarata, Scottish Rite Child Language Disorders Center, Division of Hearing and Speech Sciences, Vanderbilt University, Nashville, Tennessee 37232-8700.

comes seen when applying naturalistic conversation training to communication disorders. For example, training for many communicative behaviors is directly predicated upon mastery of speech sounds. Consider the morphological domain of language, which includes specific word endings for past tense, plural, and copula and auxiliary verbs (Brown, 1973). These structures are often the focus of communication training, yet each requires accurate speech production by the child (e.g., the final "s" sound for plural, possessive, and third-person singular forms as well as for contracted versions of the copula and auxiliary). Clearly, training on morphological targets is less likely to succeed with a child who is unable to produce an accurate "s" (Camarata, 1990; Camarata & Erwin, 1988). In addition, studies of language acquisition and data from studies of mother-child interaction reveal that speech production skills systematically improve without extensive analogue practice; instead, mothers present accurate models of words and sentences (including accurate speech sound models) within natural conversational interactions (e.g., Cross, 1978; Malsheen, 1980). These data indicate that speech production is an integral part of communication behavior and is thus likely to be learned in a manner consistent with other effective communication training procedures (i.e., naturalistic conversation training).

Another rationale for applying conversation-based training to speech production disabilities can be derived from the literature on analogue training for these behaviors. Although there have been a number of recent shifts in the theoretical perspectives for selection of target behaviors (e.g., phonological process analysis, Elbert, Dinnsen, & Powell, 1984; Hodson & Paden, 1981; generative phonology, Gierut, 1989, 1990; or phonological contrasts, Weiner, 1981), all are based upon analogue drill activities conducted within a very limited interactive context. As with other types of communication behavior, analogue training often produces increases in speech production accuracy in the training context, but there is no evidence that these changes in speech behavior generalize to spontaneous speech (Elbert, Dinnsen, Swartzlander, & Chin, 1990).

Such an outcome should not be unexpected, because this same lack of generalization has long been observed in analogue training of communicative behaviors conducted without reference to naturalistic conversational contexts (Hart & Risley, 1980; Koegel et al. 1987; Siegel & Spradlin, 1985; Warren & Kaiser, 1986).

Finally, several studies provide evidence that naturalistic conversation training is likely to be effective for speech production. For example, Koegel et al. (1988) followed unintelligible vocalizations of children with autism with naturalistic conversation reinforcers and reported advances in vocabulary acquisition and in overall levels of speech intelligibility. Although Koegel et al. did not directly target speech production, the intervention included accurate models for speech production. Similarly, Hoffman, Norris, and Monjre (1990) reported gains in speech production following conversation-based activities such as story reading and free-play "language enrichment." However, because their training model was based on "whole language," details of the interaction procedures and the specific characteristics of the speech targets were not described.

The purpose of the present study was to test directly the effect of naturalistic conversation training on speech production accuracy. A multiple baseline design across subjects and behaviors included systematic monitoring of speech production within spontaneous conversation contexts. Because of this monitoring, the design enabled assessment of target acquisition to production within spontaneous speech.

METHOD

Subjects

The subjects were 2 children with speech impairments. The determination of impairment was made by a speech-language pathologist using a standardized assessment instrument (the Goldman-Fristoe Test of Articulation, Goldman & Fristoe, 1986) and spontaneous sampling procedures. Both subjects fell below expected levels on these instruments, and neither had mastered speech sound production within spontaneous conversation at the lev-

els reported for normal children (Shriberg & Kwiatkowski, 1980). In addition, both subjects passed an audiometric screening (25 dB at 500, 1000, 2000, and 4000 Hz) and an oral motor screening exam (St. Louis & Ruscello, 1981), and had a negative history for any type of neurological impairments. Thus, both subjects met the standard criteria for phonological disorders of unknown origin provided by Shriberg, Kwiatkowski, Best, Hengst, and Terslic-Weber (1986).

Subject BH, a boy who was 3 years 10 months old at the onset of the study, had been enrolled in an analogue speech sound training program for approximately 1 year. Subject RM, a girl who was 4 years 3 months old, had also undergone previous analogue training for approximately 6 months. The current study did not include speech targets in word positions that had been trained previously.

Procedure

Setting. The standardized testing, spontaneous sampling, and training sessions were completed in a quiet room in the Scottish Rite Child Language Disorders Center at the Bill Wilkerson Hearing and Speech Clinic at Vanderbilt University. All sessions were completed in a room (4 m by 5 m) with tables and chairs appropriate for use with preschool children. The materials included picture books and toys. The toys included Fisher-Price® town, airport, farm, school, and house; Color-forms®; Legos®; Playdoh®; Lincoln Logs®; and assorted animals, vehicles, dolls, and figurines. Sampling and training activities were completed at the table and, when appropriate to the training task, on the floor.

Sampling procedures. Baseline levels of speech sound production were determined using conventional speech sampling procedures. Spontaneous conversation samples were gathered using the play format suggested by Miller (1981) to ensure representative sampling of communication behavior. The play activities included toys and games appropriate for each child's age (e.g., animals, building blocks, simple board games) conducted with the trainer. These sessions were recorded using a Panasonic® AG-180 VHS video recorder. Sound

quality was enhanced by using a Realistic® 33-1083 electret microphone attached to the child's collar approximately 5 cm below the mouth. This microphone was routed to the video recorder via the external microphone jack and thus bypassed the recorder's existing microphone. Sound quality was further enhanced using a Sony® SVO-140 video playback unit with Realistic® headphones. Detailed transcripts of the samples were prepared from the videotapes using the revised broad phonetic transcription guidelines and symbols of the International Phonetic Association (IPA) (1981). The baseline sampling and transcription procedures were replicated throughout the study.

Speech target selection. The target selection was based upon the results of the standardized assessment (Goldman & Fristoe, 1986) and the results of the spontaneous speech sample. In order to be assigned as a speech target, the speech sound (phoneme) had to meet the following criteria: (a) The production accuracy for the phoneme had to be at 0% in the initial sample and in at least three baseline samples, and (b) the phoneme must have been at or below the age level of customary use according to the Sander (1972) data base for normal children. This latter criterion was adopted to ensure that production targets did not exceed the expectations for the child's chronological age.

Targets meeting these criteria were /l/, /r/, /sp/ blends, and /z/ in word final position for BH and /k/, /g/, /r/, and /l/ for RM. Sound substitution patterns at the onset of training included w/r and w/l for both subjects and deletion of /s/ in all blends and deletion of word-final /z/ for BH. RM produced both /k/ and /g/ with an incorrect glossal placement on the alveolar ridge (t/k, d/g). In those sounds that were produced incorrectly in word-initial and word-final positions, training was completed on the word-initial form. This selection was based upon data suggesting more rapid acquisition of word-initial forms for these types of targets (Elbert et al., 1984; Gierut, 1989).

Baseline assessment. The speech targets were sampled in 30-min spontaneous conversations, similar to the procedures used in the initial assessment.

In the baseline condition, the trainer made no effort to correct or highlight error patterns. The speech sampling and training procedures were completed twice per week throughout the baseline and training periods.

Naturalistic conversation training. The procedures used by Camarata and Nelson (1992) to train grammatical morphemes and complex sentences were adapted to phonological targets. A basic element in this training procedure is the feedback (Nelson, 1989). The only feedback provided in this paradigm was a correct model delivered immediately following the child's incorrect productions of the designated language target. Correct productions were reinforced only with semantic affirmations (e.g., "yes," "you're right, it is"). For the purposes of this study, feedback was provided exclusively for the speech targets; no changes or additions were provided for grammatical errors or omissions. A critical element of naturalistic conversation training is that the clinician maintains the integrity of the interaction while providing the model. For example, if the child said [hI ð wop] for "here's a rope" (a w/r substitution) during training of word-initial /r/, the clinician would respond "yes, a rope." This type of model, with an affirmation for the initial production followed by a correct model of the target, enabled the child to continue the naturalistic conversation. No direct requests for imitation were delivered. Although both children often imitated the clinician's model without prompting, they were not required to do so. To ensure that there were numerous opportunities for feedback, the clinician preselected the materials so that a large number of items containing the speech targets were available for inclusion in the training activities. For example, if the target for a session included /l/, the toys and books for selection could include lions, Legos®, logs, lights, lamps, toy lips, and so forth, to ensure ample opportunities for the child to attempt the target behavior. The 45-min sessions were conducted twice weekly. To facilitate accurate tracking of speech targets, the sessions were divided into equal time intervals wherein training focused on one of the speech behaviors. For example, if a child had reached a point

in training at which three targets were being trained simultaneously (e.g., /z/, /l/, and /r/), 15 min of the session would be completed with /z/, 15 min with /l/, and 15 min with /r/. Data were collected on all spontaneous utterances during all sessions. This included any attempts of target sounds, even if that sound was not currently being targeted during that session's activities. A verbalization was considered spontaneous if (a) it did not include all or parts of phrases from an immediately preceding clinician production, and (b) it did not follow a directive to verbalize.

Training of Clinicians

Because the training procedures were relatively straightforward, a 30-min session was sufficient to establish the training paradigm with the clinicians. Training included verbal instruction by the author and models of simulated child productions and correct clinician responses. Often, the clinician's first responses during this practice session included overemphasis of the target, with unnaturally high levels of intensity, duration, and intonation of the target sound (e.g., "yes, a rope" in response to the child production of "here's a wope"). When such an overemphasis was produced, the clinician was instructed to respond in a natural manner without specific emphasis on the error. This facilitated more natural delivery of the targets during the actual training sessions.

Twenty-five percent of the training sessions were monitored directly by the investigator each week to ensure continual treatment fidelity. This monitoring consisted of direct observation, through a one-way mirror, of the clinician and child engaging in the training activities. Feedback was provided to the clinician in two ways: (a) A written record was kept of the number of opportunities for delivering a target model, and (b) any departures from the procedures were noted. The treatment fidelity observer delivered these records to the clinician immediately following the session. These records revealed that over 95% of attempts by the child were followed by an appropriate clinician model, with the errors consisting of missed opportunities (the child used the target incorrectly, but the clinician

continued the activity without delivering a correct model). Also, there were two departures from the procedures during one session. One of these departures consisted of using an inappropriate amount of stress when the model was delivered (i.e., over-emphasis on the sound produced incorrectly within the model). The other consisted of a clinician requesting an imitation (i.e., "can you say that?"). In both cases, feedback was sufficient to return the clinician to the procedures described, and no further departures were noted.

Dependent Measure

All sessions were transcribed using the broad version of the IPA. The dependent measure was the percentage of correct productions for the individual targets (see Shriberg & Kwiatkowski, 1980). This was determined by comparing the target attempt to the adult version of the word and tallying the number of correct and incorrect productions of the target sound within the spontaneous speech produced during each session. Percentage of correct productions was calculated by dividing the number of correct productions by the total number of attempts (correct plus incorrect) and multiplying by 100%.

Interobserver Agreement

Interobserver agreement was assessed by having an independent judge retranscribe 20 of the sessions (5 with RM and 15 with BH). These independent transcripts were compared to the originals on a point-by-point basis for each of the target phonemes. An agreement was noted when both judges identified the production as correct or incorrect. A disagreement was noted when one scored a target sound as correct and the second judge scored it as incorrect. The percentage agreement was calculated by dividing the total number of agreements by the sum of the agreements and disagreements and multiplying by 100%. Interobserver agreement was 92% for /s/, 88% for /z/ (many of the disagreements were for voicing rather than place errors), 84% for /l/ (BH), 87% for /l/ (RM), and 83% for /r/.

Generalization and Social Validity

Generalization to untrained settings was measured by sampling spontaneous production of speech in the child's home while he or she interacted with the mother and a clinician who had not participated in the training sessions. The home sample was gathered within 2 weeks following training and was transcribed and analyzed using procedures identical to those used in the training sessions. Social validity was examined by directly interviewing the mother immediately following the home sample. She was asked whether any changes were noted in the child's speech patterns and whether any other individuals interacting with the child had reported any changes in speech production. In addition, the generalization and social validity assessments were repeated at a 9-month follow-up.

RESULTS

Figure 1 includes session-by-session results on the percentage of correct target production across three targets for BH (/sp/, /z/, and /r/). Figure 2 shows the results of a multiple baseline across the 2 subjects for the target /l/. Only one target is presented for RM because she dropped out of the program after 14 sessions. Her data for /l/ were included because production of this sound had stabilized at high levels and because it provided a between-subjects comparison with BH. The baseline production levels were consistently at 0% for all targets. Note that some of these baselines extended over a relatively long period of time (e.g., 5 months for /r/: 3 months following the initial assessment plus 2 months in the baseline phase). For BH, 100% correct production was reached after 4 sessions for /sp/, 9 sessions for /z/, and 17 sessions for /r/. In the between-subjects comparison for /l/, 100% correct production occurred after 7 sessions for RM and after 16 sessions for BH. All targets, both within and between subjects, were continually produced with a high level of accuracy after reaching 100%. The number of individual target attempts these percentages are based

Figure 1. Percentage of correct consonant production within spontaneous speech production across behaviors for BH.

Figure 2. Percentage of correct /l/ production within spontaneous speech production for both subjects.

upon ranged from 8 to 69 per session, with a mean of 23.9. Similarly, the frequency of models also ranged from 8 to 69 per session, but the mean number of models per target per session was 22.6, because the clinicians occasionally failed to deliver a model in response to an attempt.

The results of the generalization samples for BH are presented in Figures 1 and 2. With the exception of one distorted /r/ in the generalization sample, BH produced all targets correctly in both the generalization sample and the 9-month follow-up sample. The actual number of productions the per-

centages are based upon include 9 for /l/, 3 for /sp/, 22 for /z/, and 9 for /r/ in the generalization sample and 12 for /l/, 7 for /sp/, 28 for /z/, and 14 for /r/ in the 9-month follow-up.

In the social validity interview, BH's mother reported that (a) his speech was much easier to understand, (b) errors on any of the target sounds were rare in any setting, and (c) two relatives reported that they had noticed a positive change in BH's speech. The social validity interview at the 9-month follow-up replicated these findings: BH's mother reported that his speech continued to be

much more understandable than it was before training; she also reported that she had "never noticed" any speech errors during the past few months. In addition, since BH was discharged from training, no additional training or treatment has been required or recommended. Because he entered kindergarten following training, this continued lack of report for speech production disabilities provides further evidence that the training was effective.

DISCUSSION

The results for speech production training are very similar to the reports for other types of communication behavior: Naturalistic conversation training is likely to be very effective and results in production during spontaneous conversation (Koegel et al., 1987; Warren, 1988). All speech sounds were acquired and produced in conversational contexts and in generalized settings. These productions extended to spontaneous interactions in the home with the mother and with an unfamiliar adult. Further, parent report indicated that the improvements observed in the training setting were associated with socially valid improvements in other settings and extended to overall speech production in terms of improved intelligibility (reported as more "understandable" by the mother).

It should be noted that neither child had a history of neurological or motor impairments or any other documented medical or physical etiology to account for the speech production disabilities. The results suggest that children with this type of negative history (e.g., functional misarticulators, Dinnsen, Chin, Elbert, & Powell, 1990; or developmental phonological disabilities of unknown etiology, Shriberg et al., 1986) may not require motor practice or other forms of analogue training to improve speech production. Numerous studies have documented the efficacy of communication training in naturalistic contexts; it is evident that many children with communication disorders simply require an increased number of relevant models, compared to the number available in the ambient communicative environment, to learn (Camarata & Nelson, 1992; Nelson, 1989; Warren & Kaiser, 1986).

The results of the present investigation indicate that this general finding for conversation-based training paradigms can be effective in training speech sounds as well.

There are several issues that could be examined in more detail in future studies. The present investigation included only 2 children and was conducted at a single site. Thus, more comprehensive studies, including larger subject pools and replications across sites, should be conducted. Similarly, the results of Miller et al. (1990) suggest that improvements in speech production are related to increased production accuracy in related language behaviors that have been limited or restricted because of low intelligibility. Because of this, one might also expect improvements in social behavior as the communication improves (Carr & Durand, 1985). To isolate the effects of training on speech behavior, both subjects in this study were free of any other communication or behavior disorders. Future studies should include subjects whose speech impairments occur with other communication or social problems to determine the impact of training on these potentially associated behavior domains. Similarly, to isolate the effects of conversation-based training, the procedures used here did not include any direct imitation prompts. However, because Camarata and Nelson (1992) reported that imitation may be effective for some communication behaviors, a larger study could directly compare imitation and conversation-based procedures (cf. Koegel et al., 1992).

Another aspect of the training that could be investigated further is the structure of the clinician's response. The present study included conversational affirmations and modeling of correct production of the speech sounds. It remains to be determined whether changes in the structure of the clinician's response to include additional semantic, morphological, and syntactic behaviors will result in a decrease in effectiveness as the child attends to these other behaviors. Perhaps such simultaneous modification will result in broader advances in communication skill rather than reductions in treatment efficacy. Finally, a sound-by-sound approach to training was used here because this direct method

was more conducive to the monitoring of production and more closely paralleled the naturalistic learning conditions for speech. However, because current speech production theory includes across-class error analysis (e.g., final consonant deletion, Shriberg & Kwiatkowski, 1980), our training procedures could be replicated using pattern analysis to determine whether these theories translate to improved training procedures for naturalistic conversation training.

This study illustrates the utility of applied behavior analysis in monitoring specific speech targets. In contrast to less detailed training and monitoring procedures (e.g., whole language programs, Hoffman et al., 1990), training and progress were measured and monitored directly. Indeed, the results of this study indicate that the kinds of experimental data analysis and target monitoring developed for other communication goals (e.g., Hart & Risley, 1980; Koegel et al., 1988) can be applied to speech as well. Further, the results indicate that researchers and clinicians should reconsider the assumption that speech is a unique form of communication and must always be trained using direct motor practice.

REFERENCES

- Bernthal, J., & Bankson, N. (1988). *Articulation disorders*. Englewood Cliffs, NJ: Prentice-Hall.
- Brown, R. (1973). *A first language: The early stages*. Cambridge, MA: Harvard University Press.
- Camarata, S. (1990). Semantic iconicity in plural acquisition: Extending the argument to include normal children. *Clinical Linguistics and Phonetics*, 4, 319-325.
- Camarata, S., & Erwin, L. (1988). Rule invention in the acquisition of morphology revisited: A case of transparent semantic mapping. *Journal of Speech and Hearing Research*, 31, 425-431.
- Camarata, S., & Nelson, K. (1992). Treatment efficiency as a function of target selection in the remediation of child language disorders. *Clinical Linguistics and Phonetics*, 6, 167-178.
- Carr, E., & Durand, V. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, 18, 111-126.
- Cross, T. (1978). Mother's speech and its association with rate of linguistic development in young children. In N. Waterson & C. Snow (Eds.), *The development of communication* (pp. 199-216). New York: Wiley.
- Dattilo, J., & Camarata, S. (1991). Facilitating conversation through self-initiated augmentative communication treatment. *Journal of Applied Behavior Analysis*, 24, 369-378.
- Dinnsen, D., Chin, S., Elbert, M., & Powell, T. (1990). Some constraints on functionally disordered phonologies: Phonetic inventories and phonotactics. *Journal of Speech and Hearing Research*, 33, 28-37.
- Elbert, M., Dinnsen, D., & Powell, T. (1984). On the prediction of phonological generalization learning patterns. *Journal of Speech and Hearing Disorders*, 49, 309-317.
- Elbert, M., Dinnsen, D., Swartzlander, P., & Chin, S. (1990). Generalization to conversational speech. *Journal of Speech and Hearing Disorders*, 55, 694-699.
- Gierut, J. (1989). Maximal opposition approach to phonological treatment. *Journal of Speech and Hearing Disorders*, 54, 9-19.
- Gierut, J. (1990). Differential learning of phonological oppositions. *Journal of Speech and Hearing Research*, 33, 540-549.
- Goldman, R., & Fristoe, M. (1986). *The Goldman-Fristoe test of articulation*. Circle Pine, MN: American Guidance Service.
- Guess, D., Keogh, W., & Sailor, W. (1978). Generalization of speech and language behavior. In R. Schiefelbusch (Ed.), *Bases of language intervention* (pp. 373-396). Baltimore: University Park Press.
- Hart, B., & Risley, T. (1980). In vivo language intervention: Unanticipated general effects. *Journal of Applied Behavior Analysis*, 11, 407-432.
- Hodson, B., & Paden, E. (1981). Phonological processes which characterize unintelligible and intelligible speech in early childhood. *Journal of Speech and Hearing Disorders*, 46, 369-373.
- Hoffman, P., Norris, J., & Monjure, J. (1990). Comparison of process targeting and whole language treatments for phonologically delayed preschool children. *Language, Speech, and Hearing Services in Schools*, 21, 102-109.
- International Phonetic Association. (1981). *Principles of the International Phonetic Association*. London: University College.
- Koegel, R., Koegel, L., & Surratt, A. (1992). Language intervention and disruptive behavior in preschool children with autism. *Journal of Autism and Developmental Disorders*, 22, 140-153.
- Koegel, R., O'Dell, M., & Dunlap, G. (1988). Producing speech use in nonverbal autistic children by reinforcing attempts. *Journal of Autism and Developmental Disorders*, 18, 525-538.
- Koegel, R., O'Dell, M., & Koegel, L. (1987). A natural language paradigm for teaching nonverbal autistic children. *Journal of Autism and Developmental Disorders*, 17, 187-199.
- Malsheen, B. (1980). Two hypotheses for phonetic clarification in the speech of mothers to children. In G. Yeni-Komshian, J. Kavanagh, & C. Ferguson (Eds.), *Child phonology: Vol. 2. Perception* (pp. 173-184). New York: Academic Press.
- Miller, J. (1981). *Assessing language production in children*. Austin, TX: Pro-Ed.

- Miller, J., Miolo, G., Murray-Branch, J., Pierce, K., Rosin, M., Sedey, A., & Swift, E. (1990). *Facilitating speech and language development in children with Down syndrome*. Paper presented at the annual conference of the American Speech-Language-Hearing Association, Seattle, WA.
- Nelson, K. (1989). Strategies for first language teaching. In M. Rice & R. Schiefelbusch (Eds.), *The teachability of language* (pp. 263-310). Baltimore: Paul H. Brookes.
- Prinz, P., & Masin, L. (1985). Lending a helping hand: Linguistic input and sign language acquisition in deaf children. *Applied Psycholinguistics*, 6, 357-370.
- Sander, E. (1972). When are speech sounds learned? *Journal of Speech and Hearing Disorders*, 37, 55-63.
- Shriberg, L., & Kwiatkowski, J. (1980). *Natural process analysis*. New York: Wiley.
- Shriberg, L., Kwiatkowski, J., Best, S., Hengst, J., & Terslic-Weber, B. (1986). Characteristics of children with phonological disorders of unknown origin. *Journal of Speech and Hearing Disorders*, 51, 140-161.
- Siegel, G., & Spradlin, J. (1985). Therapy and research. *Journal of Speech and Hearing Disorders*, 50, 226-230.
- St. Louis, K., & Ruscello, D. (1981). *The oral mechanism screening examination*. Baltimore: University Park Press.
- Warren, S. (1988). A behavioral approach to generalization. *Language, Speech, and Hearing Services in Schools*, 19, 292-303.
- Warren, S., & Kaiser, A. (1986). Incidental language teaching: A critical review. *Journal of Speech and Hearing Disorders*, 51, 291-299.
- Warren, S., McQuarter, R., & Rogers-Warren, A. (1984). The effects of mands and models on the speech of unresponsive language delayed preschool children. *Journal of Speech and Hearing Disorders*, 49, 43-52.
- Weiner, F. (1981). Treatment of phonological disability using the method of meaningful minimal contrast: Two case studies. *Journal of Speech and Hearing Disorders*, 46, 97-103.

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