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Acquisition of Sign Language by Autistic Children. III: Generalized Descriptive Phrases[1]

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Sign language training has emerged as a viable alternative to speech for those autistic children who remain nonverbal in spite of remediation efforts. Yet the variables responsible for the acquisition of specific signing skills have not been fully investigated. The present study was undertaken to validate experimentally a portion of a general language intervention program developed by the authors. Specifically, we focused on descriptive signing that involved action-object phrases. Four autistic children were successfully taught such phrases following an intervention composed of prompting, fading, stimulus rotation, and differential reinforcement. After being trained on a small number of action-object phrases, the children displayed skill generalization to new situations. The results were discussed with respect to the likely need for added incidental teaching to bring about communicative use of the skills taught.

Language deficit is a cardinal feature of autism (Rutter, 1978), and for that reason considerable research has been undertaken to remediate the problem (Carr, 1985a; Lovaas, 1977; Hemsley et al., 1978). Although remedial procedures have been successful in teaching many children to speak, a significant number remain mute (Mack, Webster, & Gokcen, 1980). Sign training

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has emerged as a viable alternative to speech (Goodman, Wilson, & Bornstein, 1978). Indeed, there is a growing experimental research literature in this area (Kiernan, 1977; Konstantareas, Oxman, & Webster, 1977; Layton & Baker, 1981; Lloyd, 1980). However, a majority of studies are of a nonexperimental nature (Carr, 1979). This fact prompted us to embark on a program of systematic experimentation designed to isolate and identify those variables that contribute to the effectiveness of specific skills acquisition.

Initially, we explored the variables responsible for the acquisition of expressive and receptive sign labels (Carr, Binkoff, Kologinsky, & Eddy, 1978; Carr, & Dores, 1981; Carr, Pridal, & Dores, 1984). Then, we examined the factors responsible for inducing children to use such labels in order to communicate (Carr & Kologinsky, 1983). This research plus related clinical work formed the basis for developing an initial sign training program for autistic children (Carr, 1982a, 1982b). The experimental validation of our program has, to date, focused exclusively on the factors responsible for the performance of single signs. Yet the literature is clear in demonstrating that autistic children are capable of multisign performances as well (Bonvillian & Nelson, 1976; Salvin, Routh, Foster, & Lovejoy, 1977). However, the specific variables necessary for such behavior have not been examined experimentally. In light of this fact, we sought, in the present study, to identify experimentally the factors that facilitate one type of multisign performance.

In addressing the above issue, it is necessary to decide first whether one generic type of multisign performance would be more worth concentrating on than another. The literature on language development in normal children may serve as a guide (Schopler, Reichler, & Lansing, 1980). This literature suggests that one of the earliest and most prevalent multiword utterances involves verb-noun combinations, particularly those that are described in case grammar terminology as action-object phrases (Bloom & Lahey, 1978; Brown, 1973). Indeed, action-object phrases are so common in the language of young children that recent programs designed to treat language delay in otherwise normal children have stressed teaching such phrases after single-word utterances have been mastered (Zelazo, Kearsley, & Ungerer, 1984). In view of the literature just cited, we targeted action-object phrases as the focus of remediation efforts as well as experimental analysis.

It is worth emphasizing that the present study was intended to be not a self-contained teaching program but rather an experimental validation of part of a language intervention package. The skill taught is seen as useful partly because it is developmentally appropriate. In addition, it can be used to extend a child's capacity for conversational exchange. Specifically, the child who may initially be able to answer only those questions requiring a label (i.e., "What is this?") or a request (i.e., "What do you want?") is made capable of answering a question requiring description (i.e., "What am I doing?").

In short, our intent was to expand the child's repertoire of language forms so that such forms would be available for subsequent instructional programs that focused on language use.

METHOD

Experimental Design

Two types of experimental sessions were conducted: training sessions and test sessions. During the first set of training sessions, each child was taught to combine an action sign (i.e., "move") with an object sign (e.g., "chair") in order to describe a particular action-object sequence demonstrated by the experimenter (e.g., the experimenter would move a toy chair from one location to another and the child would sign the action-object phrase "move chair"). When the child had mastered an action-object phrase with the first action sign, he was given a test session to see if he could generalize the skill to new situations. If the child failed to generalize, he was provided training on an additional object. Training and test sessions alternated in this manner until the child generalized to new situations. At this point, a second action (i.e., "point to") was introduced and the procedure was repeated. When the child demonstrated generalized responding on the second action, a third action (i.e., "hold") was introduced and the procedure was repeated. The experiment ended when the child showed generalized responding with respect to all three actions. The sequence of test sessions conformed to a multiple baseline design across the three actions (Baer, Wolf, & Risley, 1968).

The three actions designated were chosen because (a) they represented common words and might therefore be communicatively useful to the child as remediation efforts progressed; (b) the signs for the actions as well as the actions themselves were highly discriminable and could therefore potentially facilitate skill acquisition; and (c) the actions could be paired with a number of objects in order to produce a variety of meaningful phrases.

Subjects and Setting

Four males participated. Three of them, Ron (age 15 years), Dave (age 16 years), and Rick (age 11 years) were residents of a local psychiatric facility. They had all been diagnosed autistic by a psychologist and pediatrician using the criteria established by Rutter (1978). The fourth child, Jim (age 13.5 years) resided at home and attended a day school for the developmentally disabled. He was diagnosed by two psychiatrists as having organic brain syndrome manifested by severe bilateral hearing loss, motor discoordination,

and autistic features. On the Vineland Social Maturity Scale, the children received social age scores as follows: Ron, 2.1 years; Dave 2.2 years; Rick, 2.9 years; and Jim, 4.5 years. Only Jim was testable on standard intelligence measures; specifically, he received a mental age score of 7 years 3 months on the Leiter.

The children were chosen for this study because they were nonverbal, their vocal productions being limited to occasional incomprehensible babbling. They could respond to simple verbal requests such as "stand up" and "sit down." A series of speech therapists had been unsuccessful in teaching the children to imitate phonemes. Jim was somewhat more advanced than the other children in that he could make simple sign requests for desired objects and respond to a small number of signed requests. None of the children, however, could produce constructions consisting of more than one sign except for the rote phrase "I want_____." All children lacked appropriate toy play, rarely initiated contact with adults or peers, and engaged in frequent self-stimulatory behaviors such as body rocking and finger flicking.

All sessions were conducted in small therapy rooms that measured 6 × 5 m. The experimenters were four undergraduates and one graduate student, all of whom were experienced with sign training and were familiar with the children.

All children had previously been taught to produce the 20 sign labels that were to be used in the present study. In addition, an adult who was not subsequently involved in the experimental training procedures rehearsed the 20 sign labels with each child every 3rd day. This periodic rehearsal was undertaken to ensure retention of the labels.

Procedure

Pretraining Test Sessions (Baseline). All test sessions included trials involving training objects as well as test objects. To begin, 15 common objects (e.g., a toy chair, a ball) were selected for use in subsequent training sessions and 5 common objects (e.g., candy, apple) were selected for use exclusively in test sessions (i.e., the test objects were not included in any aspect of the subsequent training intervention). Each of the 5 test objects was paired with each of 3 actions (i.e., "move," "point to," and "hold") to produce 15 action-object phrases (e.g., "move apple," "point to candy"). Likewise, each of the 15 training objects was paired with the 3 actions to produce 45 action-object phrases. In each test session, all 15 of the action-object test items were presented. Also, 15 of the action-object training items were randomly selected from the pool of 45. In each test session, a different set of 15 training items was selected without replacement until the pool was exhausted. At that point, the random selection process began anew from the pool of 45. The 15 test

items and the 15 training items were randomly intermixed in order to generate 30 trials per test session.

In each session, the child and adult sat facing each other. A table that was 1.8 m long was positioned alongside the two individuals. Trials were begun only when the child was sitting quietly and attending to the adult. The adult verbally controlled inattentiveness and self-stimulatory behaviors by issuing specific commands (e.g., "sit up," "hands down"). This general procedure was also followed during the training sessions described below.

Each trial was conducted as follows. First, the adult signed "look." When the child attended, the adult demonstrated one of the action-object sequences (described later in detail for the training sessions). Following this demonstration, the adult signed "what do?" a telegraphic version of the question, "What am I doing?" (The rationale for the use of telegraphic questions is also outlined below.) The child was given 5 sec in which to respond by signing the correct action-object phrase (e.g., "hold ball" if the adult had just demonstrated the action of holding a ball). If the child failed to respond or made an incorrect response, the next trial was presented. Correct responses involving (future) training objects were to have been reinforced with praise and edibles; however, no correct responses occurred to any of the stimuli presented during the baseline test sessions.

Training Sessions. These sessions were conducted 3 to 5 days per week for an average of 45 min per session.

The initial action-object phrase (i.e., "move chair") was taught in two steps. In Step 1, the adult taught the sign for the action only (i.e., "move"). In Step 2, the adult taught the child to combine the action sign (i.e., "move") with the object sign (i.e., "chair") in order to produce the complete phrase (i.e., "move chair").

Pilot data collected prior to this study indicated that, at first, children would typically not attend to the adult's actions when objects were present. In Step 1 therefore, we decided to begin by teaching the action in isolation (i.e., the objects were removed from the table). The basic strategy employed was to have the adult pantomime the action of interest. In the case of the action, "move," the following procedure was used. First, the adult signed "Look" and directed the child's attention to the adult's right hand, which was resting on the tabletop. The adult then moved his/her own hand across the tabletop with the fingertips pointing downward and lightly touching the table surface. The movement began at a point directly next to the adult and ended at a point .9 m away, directly next to the child. The action was presented in this accentuated manner as a further means of ensuring the child's attention. Immediately following the pantomime, the adult signed a telegraphic version of the question "What am I doing?" (i.e., "what do?"). Again, pilot data had suggested that the child was more attentive to the adult's signs when these signs were presented telegraphically rather than in full

sentences. After signing the question, the adult waited 5 sec for the child to make the correct response. If the child failed to respond, the adult used manual prompts in order to get the child to make the sign for "move." Specifically, the adult molded the child's hands into the standard "0" sign with both palms down and moved the child's hands from left to right (i.e., the sign for "move" described by Bornstein, Hamilton, Saulnier, & Roy, 1975, p. 161). Following this prompt, the adult rewarded the child with a combination of praise and edibles. After 5 sec had elapsed, the next trial began and the procedure just described was repeated. Over a number of trials, the manual prompt was faded. Step 1 was considered complete when the child was able to make the sign for "move" (without prompts) on 5 consecutive trials in response to the question "what do?" At this point, Step 2 was initiated.

In Step 2, the adult introduced the object (i.e., a toy chair). The chair was placed on the table and the adult signed "look" as before. The action was then carried out in the manner described above except, of course, that the chair was now involved in the action sequence. Once the action was demonstrated, the adult signed "what do?" Typically, at this point, the child would sign "move" rather than the correct phrase, "move chair." To remedy this problem, the adult manually prompted the sign for "chair" 1 to 2 sec after the child had completed the sign for "move." The child was then rewarded with praise and edibles. After 5 sec had elapsed, the next trial began and the procedure just described was repeated. During the first 1 to 3 training trials for each child, the adult manually prompted the phrase "move chair" an extra 4 to 6 times on each trial, rewarding the child on each occasion. This massed practice at the end of a trial was carried out in order to help the child gain facility in making the two signs quickly one after another. As training progressed, the manual prompts were gradually faded. On later trials, the child would occasionally fail to respond to the query "what do?" within the 5-sec time limit. When this occurred, the adult signed "no" and presented a new trial, prompting "move" and then "chair." On rare occasions, the child responded by making the sign for "chair" only. The adult dealt with this situation by signing "No" and presenting a new trial, prompting "move" and then "chair." If the child failed to respond or responded incorrectly after all prompts for the action-object phrase had been faded, the adult signed "no" and presented a new trial, reinstating the prompt-fade procedures described above for one or both signs as necessary. At this stage, prompted signs were reinforced with praise but not edibles. Step 2 was considered complete when the child was able to sign "move chair" (without prompts) on five consecutive trials in response to the question "what do?" At this point, a test session was conducted.

If a child did not reach criterion during the test sessions (described below), he was given additional training. Specifically, Step 2 was repeated

with a new object (i.e., "move ball"). During this stage of training, trials involving the old phrase ("move chair") were intermixed with trials involving the new phrase ("move ball") in a ratio of 1 to 3. This method of stimulus rotation was undertaken as a means of practicing the old phrase and facilitating the discrimination between the two phrases. When the child attained the mastery criterion of five consecutive correct trials on both items, another test session was conducted. Training sessions alternated with test sessions in the manner outlined above until the child reached criterion in the test session. At this point, training sessions were resumed and a second action (i.e., "point to") was introduced.

The second action, "point to," consisted of the adult's touching the middle of the child's forehead with the tip of the outstretched index finger and then describing a small arc (with the finger) from the area in front of the child's face to the area on the table normally occupied by the object. Again, an accentuated movement was used at first to ensure that the child attended to the action. The two-step procedure described above for the phrase "move chair" was used to teach the phrase "point to chair." As before, Step 2 included a stimulus rotation procedure involving the old and new phrases. The mastery criterion was five correct responses involving each of the two adult actions in a random sequence of trials. At this point a test session was conducted. If the child failed to reach criterion on the test, training sessions were reintroduced with the second object ("point to ball") and Step 2 was repeated. Training sessions incorporating new objects alternated with test sessions until the child reached criterion in the test sessions. When this occurred, the final action ("hold") was introduced.

The third action, "hold," consisted of the adult's extending his/her left hand, chest level, palm up, fingers pointed toward the child, and with the object in question placed on the outstretched palm. The procedure used to train the action-object sequence involving "point to" was repeated for the new action "hold." Training sessions alternated with test sessions until the child reached criterion on the test. At this point, the experiment was terminated.

Posttraining Test Sessions. A test session occurred whenever a child reached criterion in a training session. Each test session consisted of 30 trials (i.e., 15 training phrases and 15 test phrases). Test sessions were conducted in the same manner as baseline sessions with the following exceptions. Trials involving training phrases were evenly distributed among only those phrases that had been mastered prior to the test session. The test and training items were randomly intermixed from session to session, with the constraint that no more than two test items were presented consecutively.

On trials involving trained phrases, the experimenter dealt with correct responses, incorrect responses, and nonresponding in the same manner as

in the training sessions. If the child missed a trained phrase, the next trial was not given until the child signed correctly on two consecutive presentations of the missed item. On trials involving test items, the experimenter did not prompt or reinforce any responses.

For each action, the mastery criterion was 100% correct for two consecutive sessions on all test phrases involving the particular action. The experiment itself ended when the child achieved 100% correct for four consecutive sessions on all test phrases involving each of the three actions.

Scoring of Responses and Reliability

Reliability was assessed in 75 of the 89 test sessions conducted. During each assessment, an undergraduate assistant, randomly drawn from a pool of eight assistants, was designated as the reliability observer.

Immediately before a reliability session, the observer was shown the signs for the 3 actions and 20 objects as they appeared in a standard sign-language dictionary (Bornstein et al., 1975). A response was scored as correct if it met three criteria. First, the signs making up the response had to match the signs depicted in the dictionary. Second, the signs had to describe the action-object sequence presented. Third, the signs had to be performed in the correct order (e.g., "move chair" and not "chair move"). Poorly articulated signs, single signs, inappropriate signs, signs made in the wrong order, and no signs were therefore all scored as incorrect. The responses that the observer recorded on each trial were compared to those recorded by the experimenter. The reliability index was the number of agreements on occurrences and nonoccurrences, on both test and training items, divided by the number of agreements plus disagreements. The mean interobserver reliability across the four children was 98.5% (range: 80 to 100%). Since correct responses on training items were reinforced, it could be argued that the presence of such reinforcement aided the reliability observer's judgment and produced inflated reliability estimates. To address this issue, we also computed reliability separately for the test items, responses to which were never reinforced. The mean interobserver reliability was 99% (range: 80 to 100%). Thus, it is clear that the overall reliability estimate was not spuriously high.

RESULTS

Figure 1 presents the test session data for each of the four children. The figure is divided into quadrants, each quadrant representing the data for one child. Each quadrant in turn is divided into three frames, each frame representing the test trial data related to a specific action. The abscissa denotes

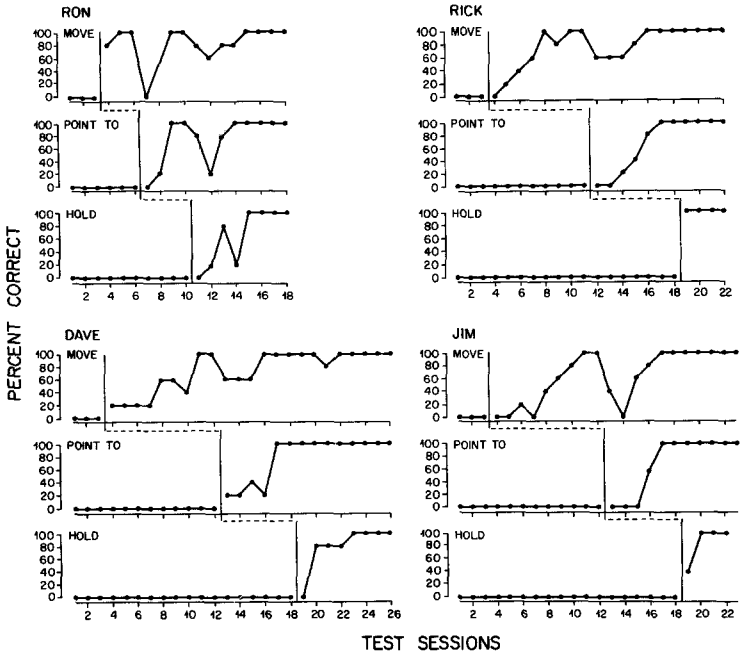

Fig. 1. Percent correct of action-object sign phrases made by each of four autistic children on test trials involving three different actions.

test sessions and the ordinate shows percent correct on the various action-object test phrases. In each frame, data to the left of the solid vertical line represent pretraining test sessions (baseline); data to the right represent post-training test sessions.

Consider the data for Ron, plotted in the upper left quadrant. The top frame shows that during baseline on test trials involving the action "move," Ron scored 0% correct. Typically, he would imitate the experimenter's signed question or self-stimulate. The first data point to the right of the vertical line was taken after Ron had mastered his first action-object phrase (i.e., "move chair"). Already, at this point, his test session responding had increased to 80% correct. Following training on a second action-object phrase (i.e., "move ball"), he reached test criterion (i.e., two test sessions in a row of 100% correct responding). Thus, Ron required training on only two objects paired with the action "move" before generalizing to untrained stimuli. The data for the other three children parallel those for Ron in that baseline scores were 0% correct and improvement on test trials did not occur until training began. To reach test criterion for the action "move," Rick (upper right quadrant) required training on seven objects; Dave (lower left quadrant), on eight objects; and Jim (lower right quadrant), on eight objects.

The test data for the actions "point to" and "hold" are presented in the middle and bottom frames, respectively. These data parallel those just described for the action "move."

As noted previously, during test sessions, trained items were interspersed among the test items. All children maintained high levels of correct responding on the training phrases. Specifically, the mean percentage correct on these phrases was 93.8, 97.9, 98.6, and 98.0 for Ron, Rick, Dave, and Jim, respectively.

Figure 1 also shows a consistent relationship among the trained actions—namely, that all children displayed losses in generalized responding with respect to old actions following the introduction of training on new actions. Consider Ron's data. Ron's responding on "move" was 100% correct on test session 6. However, on test session 7, which followed the introduction of training on a new action, "point to," his performance on the old action, "move," decreased to 0% correct. Similarly, following training on the new action, "hold," performance on both "move" and "point to" decreased. In all cases, however, responding in test sessions recovered to high levels as additional training on a particular action was carried out. Similar patterns are seen for the other three children.

The total number of training trails required in order to produce generalized responding across all the action-object test phrases was 1,208 for Jim, 3,922 for Ron, 7,566 for Rick, and 11,155 for Dave.

An additional generalization assessment was carried out with Ron. He was given four more test sessions after completion of the experiment, using 10 objects from the original training pool that had not been needed during the training portion of the study. These 10 objects were paired with the 3 actions to produce a new set of test items. The results of the additional test sessions were that Ron scored 95% correct. Thus, it was demonstrated that generalization was not limited to the set of 5 test objects used in the study.

DISCUSSION

Descriptive sign sentences involving action-object phrases can be taught using a combination of prompting, fading, stimulus rotation, and differential reinforcement. Further, it appears that following training on a small number of action-object phrases, children generalized their skills to new situations, producing phrases that were not explicitly taught. The multiple baseline design demonstrated that these gains were the result of treatment intervention rather than chance factors; specifically, no child made gains until the intervention began.

Our teaching strategy involved the use of massed practice, a specialized treatment setting, and instructional episodes initiated by the adult. This

strategy is sometimes referred to as the discrete-trial method (Koegel, Russo, & Rincover, 1977). Although this method has proven beneficial in teaching language forms, it has proven problematic in teaching language use—that is, communication (Carr, 1985b; Goetz, Schuler, & Sailor, 1983). In particular, there is no guarantee that, following discrete-trial training, each child will spontaneously use the action-object phrases taught in order to communicate with an adult. This possible outcome is a clear limitation of the present study, and we offer a suggestion for extending the language training outlined. Specifically, in our clinical work on this problem, we have been able to combine descriptive skills with other skills previously acquired in order to produce functional conversations (Carr, 1982b). For example, an adult might pour some milk in a glass and ask a thirsty child, "What am I doing?" When the child responds with the appropriate action-object phrase ("pour milk"), the adult praises the child and asks, "What do you want?" When the child responds with the request "want milk," the child is given the milk. The chaining together of descriptive phrases and request phrases may be one way of making the former phrases a part of the child's functional, communicative repertoire.

In essence, what we are suggesting is that maximal communicative utility will likely be obtained from the procedures reported on in this study only when they are combined with incidental teaching methods. Incidental teaching is a procedure that stresses language instruction within the natural context—that is, a context in which the child's shifting momentary interests become the teacher's cue for initiating instructional episodes (Hart & Risley, 1982). Thus, the chaining together of descriptive and request phrases with respect to a potential reinforcer such as milk would best be achieved when the nonverbal child indicates (e.g., by pointing, grabbing, or staring at the milk) that he or she is at that time interested in the milk. Instruction at this time would teach the child that he or she can employ language to influence others in useful ways.

There is an emerging consensus in the field that incidental and discrete-trial procedures are both needed to enhance language skills. The two procedures have different goals (Carr, 1985a; Carr & Kologinsky, 1983; Hubell, 1977). Discrete-trial training may be seen as the method of choice for teaching an initial repertoire of language forms; incidental teaching might be seen as the method of choice for getting children to use those forms—that is, to communicate. Several investigators (Blank & Milewski, 1981; Rogers-Warren & Warren, 1981; Zelazo et al., 1984) have implied that children who have serious language delays may require discrete-trial training first in order to ensure that specific content is mastered prior to any consideration of teaching language use. Once content is mastered, it may then be fruitful to proceeed to implement procedures to teach use (Keogh & Reichle, 1985; Zelazo et al., 1984). Seen in this light, the present study may be viewed as an initial

repertoire-building stage designed to teach a potentially useful language form (action-object phrases). Once the repertoire is developed, it is likely that additional instruction via incidental teaching will be necessary to fully realize the communicative possibilities of the skill taught.

REFERENCES

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1,* 91-97.

Blank, M., & Milewski, J. (1981). Applying psycholinguistic concepts to the treatment of an autistic child. *Applied Psycholinguistics, 2,* 65-84.

Bloom, L., & Lahey, M. (1978). *Language development and language disorders.* New York: Wiley.

Bonvillian, J. D., & Nelson, K. E. (1976). Sign language acquisition in a mute autistic boy. *Journal of Speech and Hearing Disorders, 41,* 339-347.

Bornstein, H., Hamilton, L. B., Saulnier, K., & Roy, H. L. (Eds.). (1975). *The signed English dictionary for preschool and elementary levels.* Washington, D.C.: Gallaudet College Press.

Brown, R. (1973). *A first language.* Cambridge, Massachusetts: Harvard University Press.

Carr, E. G. (1979). Teaching autistic children to use sign language: Some research issues. *Journal of Autism and Developmental Disorders, 9,* 345-359.

Carr, E. G. (1982a). Sign language. In R. L. Koegel, A. Rincover, & A. L. Egel (Eds.), *Educating and understanding autistic children* (pp. 142-157). San Diego: College Hill Press.

Carr, E. G. (1982b). *How to teach sign language to developmentally disabled children.* Lawrence, Kansas: H & H Enterprises.

Carr, E. G. (1985a). Language acquisition in developmentally disabled children. In G. J. Whitehurst (Ed.), *Annals of child development* (pp. 49-76). Greenwich, Connecticut: JAI Press.

Carr, E. G. (1985b). Behavioral approaches to language and communication. In E. Schopler & G. Mesibov (Eds.), *Current issues in autism: Volume 3. Communication problems in autism* (pp. 37-57). New York: Plenum.

Carr, E. G., Binkoff, J. A., Kologinsky, E., & Eddy, M. (1978). Acquisition of sign language by autistic children. I: Expressive labeling. *Journal of Applied Behavior Analysis, 11,* 489-501.

Carr, E. G., & Dores, P. A. (1981). Patterns of language acquisition following simultaneous communication with autistic children. *Analysis and Intervention in Developmental Disabilities, 1,* 347-361.

Carr, E. G., & Kologinsky, E. (1983). Acquisition of sign language by autistic children. II: Spontaneity and generalization effects. *Journal of Applied Behavior Analysis, 16,* 297-314.

Carr, E. G., Pridal, C., & Dores, P. A. (1984). Speech versus sign comprehension in autistic children: Analysis and prediction. *Journal of Experimental Child Psychology, 37,* 587-597.

Goetz, L., Schuler, A., & Sailor, W. (1983). Motivational considerations in teaching language to severely handicapped students. In M. Hersen, V. B. VanHasselt, & J. L. Mattson (Eds.), *Behavior therapy for the developmentally and physically disabled* (pp. 57-77). New York: Academic Press.

Goodman, L., Wilson, P. S., & Bornstein, H. (1978). Results of a national survey of sign language programs in special education. *Mental Retardation, 16,* 104-106.

Hart, B. M., & Risley, T. R. (1982). *How to use incidental teaching for elaborating language.* Lawrence, Kansas: H & H Enterprises.

Hemsley, R., Howlin, P., Berger, M., Hersov, L., Holbrook, D., Rutter, M., & Yule, W. (1978). Treating autistic children in a family context. In M. Rutter & E. Schopler (Eds.), *Autism: A reappraisal of concepts and treatment* (pp. 379-411). New York: Plenum.

Hubell, R. D. (1977). On facilitating spontaneous talking in young children. *Journal of Speech and Hearing Disorders, 42,* 216-231.

Keogh, W. J., & Reichle, J. (1985). Communication intervention for the "difficult to teach" severely handicapped. In S. F. Warren & A. Rogers-Warren (Eds.), *Teaching functional language* (pp. 157-194). Baltimore: University Park Press.

Kiernan, C. (1977). Alternatives to speech: A review of research on manual and other forms of communication with the mentally handicapped and other non-communicating populations. *British Journal of Mental Subnormality, 23,* 6-28.

Koegel, R. L., Russo, D. C., & Rincover, A. (1977). Assessing and training teachers in the generalized use of behavior modification with autistic children. *Journal of Applied Behavior Analysis, 10,* 197-205.

Konstantareas, M. M., Oxman, J., & Webster, C. D. (1977). Simultaneous communication with autistic and other severely dysfunctional children. *Journal of Communication Disorders, 10,* 267-282.

Layton, T. L., & Baker, P. S. (1981). Description of semantic-syntactic relations in an autistic child. *Journal of Autism and Developmental Disorders, 11,* 385-399.

Lloyd, L. L. (1980). Unaided nonspeech communication for severely handicapped individuals: An extensive bibliography. *Education and Training of the Mentally Retarded, 15*(2), 15-34.

Lovaas, O. I. (1977). *The autistic child.* New York: Irvington.

Mack, J. E., Webster, C. D., & Gokcen, I. (1980). Where are they now and how are they faring? Follow-up of 51 severely handicapped speech-deficient children, four years after an operant-based program. In C. D. Webster, M. M. Konstantareas, J. Oxman, & J. E. Mack (Eds.), *Autism: New directions in research and education* (pp. 93-106). New York: Pergamon Press.

Rogers-Warren, A., & Warren, S. F. (1981). Form and function in language learning and generalization. *Analysis and Intervention in Developmental Disabilities, 1,* 389-404.

Rutter, M. (1978). Diagnosis and definition. In M. Rutter & E. Schopler (Eds.), *Autism: A reappraisal of concepts and treatment* (pp. 1-25). New York: Plenum.

Salvin, A., Routh, D. K., Foster, R. E., & Lovejoy, K. M. (1977). Acquisition of modified American sign language by a mute autistic child. *Journal of Autism and Childhood Schizophrenia, 7,* 359-371.

Schopler, E., Reichler, R. J., & Lansing, M. (1980). *Individualized assessment and treatment for autistic and developmentally disabled children* (Vol. 2). Baltimore: University Park Press.

Zelazo, P. R., Kearsley, R. B., & Ungerer, J. A. (1984). *Learning to speak: A manual for parents.* Hillsdale, New Jersey: Erlbaum.