DOCUMENT RESUME

ED 295 400 EC 202 839

AUTHOR	Egel, Andrew L.; Shafer, Michael S.
TITLE	The Use of Explicitly Trained Peers To Facilitate the Social Behavior of Autistic Children. Final Report.
INSTITUTION	Maryland Univ., College Park.
SPONS AGENCY	Office of Special Education and Rehabilitative Services (ED), Washington, DC. Div. of Innovation and Development.
PUB DATE	Oct 83
GRANT	G008201138
NOTE	67p.
PUB TYPE	Information Analyses (070) -- Reports - Evaluative/Feasibility (142)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Autism; Interaction Process Analysis; *Interpersonal Competence; Intervention; *Mild Disabilities; *Peer Relationship; *Peer Teaching; Primary Education; Training Methods

ABSTRACT

The paper reviews the literature on the training of social behavior in autistic children and reports on a project which developed and evaluated a program which explicitly trained mildly handicapped peers to facilitate the social behavior of autistic children. The extensive literature review looks at the etiology of social deficits in autistic children and treatment of social deficits, specifically peer mediated intervention. In the study, three non-autistic but mildly handicapped subjects (ages 5.7 to 8.7 years) with good social skills were given explicit training in sharing with and praising one of three autistic subjects (ages 5.5 to 6.5 years) using modeling, practice with feedback, and training probe techniques. Results indicated that modeling plus direct prompting of interactions between a peer-trainer and an autistic student was an effective strategy; that this training increased both the frequency and duration of interactions; that these increases generalized to a play group with untrained peers present; and that for two of the autistic students, peer-training resulted in increased interactions with untrained peers. Seven pages of references are provided. (DR)

THE USE OF EXPLICITLY TRAINED PEERS TO FACILITATE THE SOCIAL BEHAVIOR OF AUTISTIC CHILDREN

Final Report
(G00-82-01138)

Andrew L. Egel
Principal Investigator

Michael S. Shafer
Student Investigator

University of Maryland
College Park

INTRODUCTION AND STATEMENT OF PROBLEM

Autism is a seriously debilitating disorder which greatly affects the lives of the children, their parents, siblings, and peers. Approximately 1 out of every 2,500 children are diagnosed autistic (Lotter, 1967; Wing, Yates, Brierley, & Gould, 1976), representing a rather heterogeneous population characterized by a variety of behavioral deficits and excesses.

One of the more serious excesses displayed by autistic children is the occurrence of frequent and often unprovoked, tantrums and other oppositional behavior. This behavior may take the form of aggression, property destruction, and self-injurious behavior. A second and equally serious behavioral excess is high rate self-stimulatory responding. This behavior is considered to be one of the most defining characteristics of autistic children (Rimland. 1964) and one of the most formidable obstacles to educating them (Koegel, Egel, & Dunlap, 1980).

In addition to excessive oppositional and self-stimulatory behaviors, autistic children are also characterized by a variety of equally serious behavioral deficits. These include deficits in appropriate speech and language. For example, these children may be mute or echolalic, parroting phrases heard previously, but unable to use them in a meaningful context. Additionally, deficient or inappropriate play, social behavior, and affect may also be encountered with autistic children. Typically, children identified as autistic do not exhibit all of these excesses and deficits. However, the more commonly employed diagnostic criteria require that a majority of these characteristics be exhibited (Newsom & Rincover, 1979; Ritvo & Freeman, 1978).

In the past decade and one-half, a great deal of progress has

been made in the treatment of autistic children (c.f., DeMyer, Hingtgen, & Jackson, 1981; Egel, Koegel, & Schreibman, 1980; Koegel, et al., 1980). During this time, researchers have developed an effective technology for treating these children which is based upon behavioral principles (c.f., Newsom, Carr, & Lovaas, 1979). This technology has resulted in the proliferation of strategies for teaching these children a variety of skills including: speech and language (Carr, Schreibman, & Lovaas, 1975; Lovaas, 1977); self-care skills (Fox & Azrin, 1973a; Plummer, Baer, & LeBlanc, 1977); appropriate toy play (Koegel, Firestone, Kramme, & Dunlap, 1974); and academic skills (Rosenbaum & Breiling, 1976). Similarly, the application of behavioral principles in the treatment of autistic children have produced decreases in self-stimulatory behavior (Fox & Azrin, 1973b; Koegel, et al., 1974), tantrums (Solnick, Rincover, & Peterson, 1977), and self-injurious behavior (Carr, Newsom, & Binkoff, 1976). The effective treatment of these behaviors has allowed researchers to focus a greater deal of attention on other behavioral domains which are equally important but, until recently, have not been adequately assessed. One domain that deserves particular attention is that of social behavior which is typically nonexistent among autistic children and like self-stimulatory behavior, represents a defining characteristic of these children (DeMyer, et al., 1981; Rutter, 1978).

In normally developing children, social behavior encompasses a wide array of responses including cooperative play, greeting and initiating skills, conversation skills, and role modeling (Brophy, 1977). These responses and their by product of interactions provide an important function in the development of essential skills later in life.

Reese and Lipsitt (1970) noted that childhood social interactions allow children to practice motor, language, and social skills essential for adaptive adult functioning.

Typically, deficits in childhood social behavior have been assessed in correlational studies in which some later indicator of adult functioning is used as a dependent variable. For example, the lack of childhood social behavior has been linked t adult schizophrenia (Bower, Shellhamer & Daily, 1960), deficient adult social behavior (Moreno, 1934), poor school achievement (Bonney, 1971), and sensory-motor and cognitive deficiencies (Hartup, 1970). These investigations have indicated that deficient childhood social behavior not only retards development, but also darkens prognostic indicators of later functioning.

In summary, childhood social interactions provide an important function by which normally developing children incidentally acquire a variety of critical skills. The lack of social behaviors among autistic children seriously restricts their opportunities to acquire these critical skills and further impedes the process of normalization.

Etiology of Social Deficits in Autistic Children

A variety of theoretical orientations have attempted to explain the social deficits characteristic of autistic children. Traditional psychoanalysts such as Bettleheim (1967), for example, speculated that autism is the result of a child experiencing frustration during the early months of life, typically at the hands of its mother. In an attempt to avoid this frustration, the child may respond with inward rage, a feeling of helplessness, and complete social withdrawal. This withdrawal is viewed as the child's means of adapting to a frustrating

and threatening reality. These therorists suggest that social behavior as well as other forms of appropriate behavior, will spontaneously increase once these frustrating and threatening experiences are eliminated. Unfortunately, the etiological considerations as well as the treatment procedures advocated by these theorists have not stood up to the rigors of scientific research (c.f., Egel, et al., 1980).

An alternative explanation for the severe social deficits of autistic children may be extrapolated from the work of DesLauriers and Carlson (1969) who contend that this disorder is the result of a neurophysiological imbalance. Specifically, these researchers speculated that sensory experiences which are processed through the ascending reticular formation, dominate or suppress the functions of the midbrain limbic system which attaches affective, pleasurable, or painful qualities to sensory experiences. Thus, the child, while capable of attending and responding to social stimuli, is unable to establish any meaningful or affective qualities to these stimuli. In other words, these children are simply unable to derive pleasure from social interactions. Although DesLauriers and Carlson's (1969) clinical observations of autistic children may lend support to this interpretation (as evidenced by self-stimulation and social withdrawal), empirical verification of the hypothesized neurophysiological imbalance as well as the treatment procedures has yet to be provided.

Finally, a third interpretation of the severe social deficits of autistic children may be drawn from the research in the area of applied behavior analysis. Researchers in this area have identified a number of variables which may mitigate the development of social behavior with these children. Given the severe language deficits of

autistic children, corresponding deficits in appropriate social behavior would not be surprising. Considering the communicative effect which social behavior plays, the lack of an appropriate communication system such as speech would naturally result in a restricted social repertoire.

Evidence has been provided which also implicates overselective responding as a variable interfering with the development of social repertoires in autistic children. The term overselectivity refers to the selective nature of attending exhibited by these children in which they may respond on the basis of a limited number of typically irrelevant cues (Lovaas, Schreibman, Koegel, & Rehm, 1971). In a recent review of the research on overselectivity, Lovaas, Koegel, and Schreibman (1979), have speculated that the social deficits of autistic children may be due in part, to the complexity of normally occurring interactions.

In an analog study by Schreibman and Lovaas (1973), designed to assess the impact which overselectivity may have on responding to social stimuli, normal and autistic children were taught to discriminate male and female dolls. Various assessments were conducted after the discriminations were acquired in which particular characteristics of the dolls were systematically varied (i.e., shoes, eyeglasses, jewelry, etc). While the normal children maintained the discrimination by attending to the cues around the head area (i.e., length of hair, presence of facial hair, jewelry, etc), the autistic children responded on the basis of highly idiosyncratic and typically irrelevant cues such as a belt, shoes, or eyeglasses. Although applied research of this phenomenon is lacking, anecdotal reports have been

provided, illustrating the detrimental role overselectivity plays in social behavior (Schreibman & Lovaas, 1973).

The occurrence of high-rate inappropriate behavior such as self-stimulation has also been shown to interfere with appropriate social responding. Previous investigators have documented the debilitating effects which self-stimulation has upon learning (Koegel & Covert, 1972), eye contact (Risley, 1968), response latencies (Lovaas, Litrowinik, & Mann, 1971), observational learning (Varni, Lovaas, Koegel, & Everett, 1979), and appropriate play (Epstein, Doke, Sajwaj, Sorrell, & Rimmer, 1974; Koegel, Firestone, Kramme, & Dunlap, 1974; Rincover, Cook, Peoples, & Packard, 1979). In each of these investigations, high rates of self-stimulation were accompanied by extremely low rates of appropriate behavior. However, following the implementation of a variety of interventions aimed at reducing self-stimulatory responding, each investigation reported dramatic, and often spontaneous increases in appropriate responding.

Additional evidence of the detrimental effects of self-stimulatory behavior has recently been provided by investigators seeking to facilitate social behavior with autistic children (Ragland, Kerr & Strain, 1978; Strain, 1981; Strain, Kerr, & Ragland, 1979). In each of these investigations, a direct relationship was evidenced between initial baseline performance and the effectiveness of treatment. Specifically, those children exhibiting lower baseline levels of positive social behavior were less responsive to a social-initiation treatment program than were children with relatively higher baseline performances. However, such a relationship was not replicated with children exhibiting extremely high rates of self-stimulation. These

children were quite divergent in their responsiveness to treatment, showing no relationship between baseline and treatment levels of performance. In reviewing these results, Strain (1981) suggested that self-stimulatory behavior may compete with or mask children's existing social repertoire. This recent evidence further demonstrates that in many cases, self-stimulatory responding may interfere, not only with the acquisition of new responses (Koegel & Covert, 1972), but also with the maintenance and generalization of existing social repertoires (Ragland, et al.,1978; Strain, et al., 1979).

Summary. The severe social deficits encountered by autistic children represents a serious deficiency which may be maintained by a number of variables including accompanying language deficits, overselectivity, and functionally incompatible responses such as self-stimulation. In view of the seriousness of the social deficits typically encountered with these children, it is incumbent upon researchers to develop and assess effective strategies for facilitating social behavior. Much of the literature to date on this subject has focused on strategies for promoting social interactions among socially deficient, but non-autistic children. In view of the wide array of behavioral characteristics encountered with autistic children, a technology which incorporates these variables into a treatment program for facilitating social behavior is certainly desired. Such a technology has been evidenced in recent investigations with autistic children in which social responding has been a dependent variable. This research has drawn heavily upon similar research conducted with other populations and will be reviewed on the following pages. In addition to reviewing this developing technology, discussion will also focus on potential areas

where additional research is needed which could facilitate the social behavior of autistic children.

Treatment of Social Deficits

Functional analyses of the treatment of social deficits with autistic children have only recently been addressed. Much of this research has drawn upon similar investigations conducted with other populations. The techniques assessed in these investigations have been typically mediated either by adults or by peers.

Adult Mediated Intervention. Adult mediated treatment strategies have been characterized by the presence of an adult to prompt, praise, or otherwise evoke social behavior from socially deficient children (Strain, 1980). Strain and Timm (1974), in an often cited study of social skill training, assessed the social interactions of a behaviorally disordered preschooler and her classroom peers during two conditions of adult attention. Following a baseline phase during which no contingencies were in effect, adult verbal praise and physical contact were directed at the subject's peers for appropriately interacting with her. After a subsequent return to baseline, adult attention was then directed at the subject for interacting with her peers. Results indicated that both the subject's and the peers' number of appropriate social responses rapidly increased during both phases. These results were quite dramatic as increases occurred with both the peers and the subjects, regardless of who was receiving adult attention.

The phenomenon documented by Strain & Timm (1974) was termed "spillover" by Strain, Shores, & Kerr (1976) who assessed its effect using a teacher prompting and reinforcement procedure. In this investigation, a combined reversal and multiple baseline design was

employed to assess the "spillover" effects with three behaviorally handicapped preschoolers. In addition to the delivery of teacher mediated social reinforcement contingent on the occurrence of positive social behavior, these subjects were also prompted by the teacher to engage in social behavior. These prompts were delivered whenever a subject was not interacting with his peers and when there was no prospect of an interaction occurring. Specifically, the teacher prompting and reinforcement procedure was first implemented with one subject and, following a return to baseline, was subsequently implemented with two subjects simultaneously. This application was then repeated again in a reversed order, interspersed with baseline conditions such that teacher reinforcement and prompting was once again implemented with two subjects and following a return to baseline, implemented with only one subject. The resulting effects of this procedure were similar to that obtained by Strain and Timm (1974), producing smaller but consistent increases in the social behavior of non-target children in addition to those observed in the target subject. Furthermore, the spillover effects observed when the two subjects were reinforced were superior to that obtained when only one subject received reinforcement. These results indicated that maximal treatment effects will be obtained with maximal manipulation of the environment; that is, the greater number of individuals receiving training, the greater likelihood that other individuals will directly or indirectly be affected by this treatment.

Cooke and Apolloni (1976), in adding to the spillover literature, presented evidence suggesting that spillover effects may be response specific. Employing a multiple baseline design across behaviors, an

adult-mediated treatment package consisting of instructions, modeling and social praise, was systematically implemented to accelerate four target social responses (smiling, sharing, positive physical contacting, and verbal complimenting). Four learning-disabled students were simultaneously trained, each responding with accelerated levels of three of the target responses in the training setting as well as in the generalization setting with three untrained peers. The untrained peers also exhibited increases similar to those reported for the four target subjects. The effect was quite consistent with behavioral increases for both sets of children typically accompanying the intervention. The last target behavior, verbal complimenting, showed minimal generalization across settings and no spillover to the nontarget subjects, leading the investigators to speculate that verbal complimenting may not be a natural occurring response in the repertoire of young children.

The structural differences of the play group employed by Cooke and Apolloni (1976), may account in part for the generalization which was attained. That is, in support of the results of Strain, et al. (1976), spillover and generalization effects appear to be correlated with the number of individuals receiving treatment; as the number increases so does the likelihood of spillover.

The spillover effects reported by Cooke and Apolloni (1976) among children not present during intervention session adds a new dimension to this growing body of information. Typically, spillover effects have been atttributed by operant psychologists to be a function of vicarious reinforcement, a process involving both reinforcement and modeling (see Kazdin, 1981, for a thorough review of this literature). The results from Cooke and Apolloni (1976), however, indicated that additional

variables may also account for spillover. Since the nontarget children were not able to observe the delivery of contingencies to the target children, it is unlikely that the improvements in their behavior could be a function of vicarious reinforcement. It appears likely that a "trapping effect" may have occurred, as the increased social behavior of the target subjects may have been directed, in part, to the nontarget children, providing additional opportunities for social interactions with these children as well. Additional research in this area is certainly desirable, since the specific characteristics of both highly responsive target and nontarget children needs identification, as does the process by which spillover effects can be attained with individuals not exposed to intervention.

Although recent research of adult-mediated intervention has produced promising effects, especially in regard to the spillover effects across children, a number of considerations which may limit these strategies need to be addressed. Walker, Greenwood, Hops, and Todd (1979), for example, presented evidence suggesting that adult reinforcement produces a pattern of frequent, but brief social interactions, bearing little resemblance to normal patterns of childhood interaction. In addition, the presence of an adult to facilitate interactions among children may be inappropriate since it is impractical to assume that adults will be present in all play situations. Thus, the effects of adult-mediated interventions would unexpectantly produce limited results, specific to those environments in which adults are present.

In summary, the use of adult-mediated interventions to increase the social behavior of isolate children has proven to be a highly effective

strategy, producing behavior change in both target and non-target children. However, the reliance upon adult presence to facilitate interactions may be impractical as they are typically not present in all play situations. In addition, the disruptive effect which adult delivered reinforcement has upon ongoing interactions may also limit the effectiveness of these procedures.

Peer-Mediated Intervention. The use of normal peers as trained intervention agents to promote social behavior has been well documented with subjects characterized as behavior disordered, learning disabled, or language delayed (see Strain, 1981, for a thorough review of these procedures). Although the utilization of trained peers was first employed with socially withdrawn preschoolers, a growing body of literature suggests that similar procedures may be effectively employed to alter the social behavior of more severely disabled children.

Strain (1977), in an initial investigation of the use of peers as intervention agents, trained a normal preschooler to initiate social interactions with three age-matched subjects who displayed autistic like behavior. Four 20-minute training sessions were conducted with the nonhandicapped peer during which he learned and rehearsed verbal and motoric initiating behavior. First, the peer was taught to initiate play with the target subjects by saying things such as "Come play", or "Let's play ball". Subsequently, he was taught to engage in motor responses which would normally accompany his verbalizations such as rolling a ball or extending a toy toward the subject. This training consisted of the experimenter and the peer role-playing play interactions with the target subject. During these sessions, the peer was given 10 opportunities to initiate an interaction with the

experimenter who was assuming the role of the subject. For five of these "trials", the experimenter responded positively to the peer's initiation. The remaining five trials, however, consisted of the experimenter ignoring the peer's initiation for 10 seconds before feedback was provided. This feedback consisted of stressing to the peer to cortinue his initiations even if his initial attempts were ignored.

Employing a withdrawal of treatment design, this strategy was found to produce a five-fold increase in the positive social behavior for two of the target subjects and a smaller increase for the third subject. In addition, increases for the first two subjects generalized to a novel classroom setting while the third subject, who displayed minimal effects in the treatment setting, also showed minimal changes in the generalization setting. In discussing the differential results which were obtained, Strain (1977), speculated that the effectiveness of a peer-mediated strategy may be limited by the entry level behavior of the target subjects. For example, the subject who displayed limited responsiveness to the peer-intervention in both settings also displayed the fewest positive social behaviors during baseline. Strain goes on to speculate that for such children, direct adult shaping and reinforcement procedures may be required before attempting a peer-mediated intervention. Additional variables which may affect the responsiveness of subjects to peer interventions have also been identified. Specifically, peer strategies have been most effective for subjects displaying some expressive language (Strain, 1977), imitative skills (Guralnick, 1976), and appropriate toy play (Apolloni & Cooke, 1978; Strain, et al., 1981). These identified variables have provided important information regarding the selection of target subjects most

appropriate for peer-mediated interventions.

Adding to this information, Ragland, et al., (1978) examined the effectiveness of peer training with three autistic children who exhibited high rates of inappropriate behavior such as self-stimulation, aggression, and echolalia. The peer trainer was a ten-year old boy enrolled in a class for learning and behavior problems who, although displaying exceptional social skills, had a long history of academic failure and disruptive classroom behavior. The peer intervention strategy was similar to that previously described (Strain, 1977) with one minor distinction. The adult trainer, while ignoring some of the peer's initiations during the training sessions, also modeled some of the aberrant behaviors typical of the target subjects. Within a multiple baseline design across subjects, the peer-trainer was instructed to intervene with only one subject at a time. In addition to noting increases in positive social responding for all of the subjects with the onset of peer intervention, increases in negative interactions for two of the subjects were also noted. That is, initiations made by the peer trainer often resulted in these children engaging in some of the behaviors previously modeled by the experimenter during the training sessions. Although no generalization assessment was conducted in this investigation, the acceleration of negative social behavior on the part of the subjects may serve to punish the peer-trainer's initiations, accounting in part, for the limited maintenance and generalization which have typically plagued peer-mediated interventions. As such, the occurrence of high rate inappropriate behavior, as has been previously discussed, could be added to the list of variables affecting the responsiveness of particular subjects to peer-mediated interventions.

In addition to subject charateristics, peer-trainer behaviors may also affect the maintenance and generalization of these strategies. The two previous investigations had trained peers only to initiate interactions with the target subjects with no provision made for alternative strategies in the event of the peer's initiation being responded to negatively, or for the development of skills necessary for the continuation of interactions. Strain, et al., (1979), in noting this deficiency, compared the effectiveness of peer initiation training with peer prompting plus reinforcement training to facilitate generalized social behavior with 9 and 10 year-old autistic subjects. In this study, an 11-year old boy with behavior and learning problems served as the peer trainer. The first half of this training was identical to that previously described (Ragland, et al., 1978); in addition, the peer was instructed during role-play training sessions, to rehearse prompting statements such as "Give the wagon to Nancy" or "Roll the ball to Andy", and later, praise statements including "Way to catch the ball, Joanne", or "Nice jump, Jacque." In contrast to the peer initiation training, no instructions were provided for motor responses which would accompany these prompting and praising statements.

A withdrawal of treatment design was employed such that the peer trainer was instructed to initiate interactions with two of the subjects while prompting and reinforcing interactions with two other subjects. After a return to baseline phase, the procedure was reversed so that the peer prompted and reinforced interactions with the first two subjects while initiating interactions with the latter two subjects. Data were collected on the subjects' and peer's frequency of positive and negative social responses in free-play sessions with the trained peer present or

absent (generalization probe).

The resulting data indicated that both procedures were equally effective in accelerating the subjects' positive social behavior and neither procedure was effective in producing behavior change during the generalization probes. The lack of differential results which were obtained suggests that these strategies may be functionally equivalent. In other words, although each procedure consists of a distinct set of cues and strategies, the functional effect upon the target subjects' behavior is quite the same: a dramatic increase in the number of positive social responses is observed. If the two peer strategies were functionally distinct, then an increase in the duration as well as the frequency of positive interactions would appear to be associated with the peer prompting plus reinforcement procedure. The rationale behind such an assessment is clear; peer initiations result in an increased number of interactions with the subject which may be responded to positively, resulting in a continuation of the interaction, or negatively, in which case the peer is likely to terminate his interaction with the subject. In comparison, the implementation of peer prompting plus reinforcement should facilitate continued responses from the trained peer, even in the event of initial negative responses from the subject. This procedure should then result in longer interactions with the subject as the peer attempts prompting and/or reinforcement strategies. However, the typical data from peer-mediated socialization studies have been time sample or frequency measures; to date, no information has been provided on the duration dimension of peer-subject interactions. If duration measures from peer intervention studies indicate a pattern of frequent but brief interactions, then the same

criticisms discussed for adult-mediated interventions could also be applied to peer-mediated interventions (c.f., Walker, et al., 1973).

The lack of generalization reported by Strain, et al., (1979), may be attributed in part, to the subject and peer-trainer behaviors previously discussed. In addition, the manner in which the generalization probes were conducted may also contribute to limited generalized effects. Strain, et al., (1979), for example, conducted generalization assessments approximately 21 hours following each training session by removing the peer-trainer from a play group of four autistic subjects. For all four of these subjects, significant decreases in appropriate social behavior were evidenced in this setting. Not only is this situation a stringent test of generalization and maintenance, it may also be an inappropriate assessment technique. An assessment of generalized improvements in the social interactions among previously identified withdrawn subjects would expectantly produce conservative results since these subjects would be unlikely to engage in behaviors which would reinforce social behavior.

A more relevant indicator of stimulus generalization could involve assessing improvements in the social interactions between target subjects and other socially competent, but untrained peers. However, investigations which have assessed generalization with other socially competent peers (including the peer-trainer), have failed to differentiate the social interactions between the subjects and trained or untrained peers (Strain, 1977; Strain, et al., 1979). Information provided by such an assessment would serve a dual function. First, this information could determine the extent to which the training of one peer produces "spillover" effects with other socially competent peers. The

question to be addressed here is: will other socially competent peers spontaneously exhibit the newly acquired behaviors of a trained peer? This assessment would also indicate the extent to which improvements in the subjects' interactions with the peer-trainer result in similar improvements in the interactions with other untrained peers. This information would be quite useful, given the current practice of mainstreaming small numbers of handicapped children into larger groups of less handicapped children.

A second characteristic of peer training strategies which deserves special attention is the use of easily discriminable contingencies to reinforce the peer-trainer. This reinforcement has included praise (Strain, 1977; Strain, et al., 1979) weekly hamburgers (Ragland, Kerr, & Strain, 1978), and other edibles (Young & Kerr, 1979), typically delivered during, or immediately following training sessions, thereby establishing a characterization not associated with the generalization sessions. Drawing upon Stokes and Baer's (1977) seminal review of generalization strategies, the use of extrinsic rewards could be expected to produce limited generalization since artifical reinforcement may restrict the newly trained behaviors of the peer from coming under the control of naturally occurring contingencies (i. e., the subject's behavior). In the absence of these naturally occurring contingencies, behaviors which are under the control of other, extrinsic contingencies would expectantly not generalize to free-play situations. For example, evidence has been provided indicating the preference of trained peers to interact with other socially competent peers rather than their withdrawn playmates (Peck, Apolloni, Cooke, & Cooke, 1976). Expanding upon this point, Strain and Fox (1981) noted that this continued isolation of

target subjects is not necessarily the result of overt rejection by the trained peers, but a preference for interactions with other peers which are maintained by more natural contingencies. The contingencies which appear to maintain normal patterns of interactions are the play and social behaviors which typify normal child-child exchanges and may best be described as reciprocating relationships.

Reciprocity may be considered as "dyadic relationships in which persons A and B reinforce each other at an equitable rate" (Patterson & Reid, 1970, p. 133), thereby increasing the probability of future interactions. The spillover effects which were obtained from adult mediated interventions serve as a good example of reciprocity (c.f., Strain, et al., 1976). In each of these investigations, improved social behavior was obtained with both target and non-target children, suggesting that the improvements in the former group served a reinforcing function for the behavior of the latter children. As applied to the interactions of peer-trainers and autistic subjects, the concept of reciprocity would suggest that the peer-trainer's lack of maintained behavioral change may be a function of insufficient reinforcement from the subject.

Based upon the preceeding discussion, a primary concern for the maintenance and generalization of peer-trainer skills would be the development of reciprocating relationships between the peer-trainer's and subject's behavior. However, given the paucity of social behavior from most withdrawn subjects, such a strategy would provide an extremely sparse schedule of reinforcement. What is required of this strategy is some method of "priming " the subject to engage in appropriate play and social responses during the initial phases of peer intervention. These

responses, according to the concept of social reciprocity, would increase the probability of future interactions between the peer-trainer and the subjects. The concept of sensory reinforcement (Rincover, et al., 1979), provides a strategy, which by altering the environmental arrangement to provide this reinforcement, could accelerate the play and social behavior of withdrawn children. The results of Rincover, et al., (1979), suggested that toys which provide a great deal of subject-preferred sensory reinforcement may be used to redirect self-stimulatory behavior into more appropriate play and possibly, social behavior. As such, the use of sensory reinforcing toys would appear to be one means of facilitating subject's social behavior which could serve a reciprocating function for the behavior of the target subject, thereby minimizing the necessity of extrinsic and unnatural contingencies.

A final characteristic of peer-mediated interventions which deserves particular attention is the manner in which most peers have been trained. Strain and his colleagues (Strain, 1977; Strain, et al., 1979; Strain & Timm, 1974), for example, have typically conducted peer training by role-playing situations with the peer-trainer as the experimenter modeled the behavior of target subjects. These training sessions were continued until the peer-trainer reliably engaged in the target skills with the experimenter. This strategy assumed that the stimulus control developed by the experimenter-modeled behavior during training sessions would transfer to the subjects's behavior. If this stimulus control does not transfer, then limited generalization of the peer-trainer's behavior would be expected.

A few notable exceptions to this strategy have recently been employed. Bream and Cohen (Note 1) trained three developmentally delayed

peers to reinforce the positive social behavior of three autistic children. In this investigation, five training sessions were conducted; one introductory session, two sessions involving procedures similar to those previously described, and two final sessions during which the peer-trainer practiced with a "confederate" lower functioning developmentally delayed child. This strategy was found to be an effective method for producing skills in the peer-trainers which generalized to a number of subjects. However, a number of methodological considerations such as the behavioral measures and training procedures which were employed restrict the generality of these findings.

Similarly, Dy, Strain, Fullerton, and Stowitschek, (1981), employed a direct prompting procedure to train a peer-trainer. During these training sessions, the peer-trainer practiced directly with the target subjects while receiving verbal and if necessary, physical prompts from the experimenter. This procedure was found to be more effective than other training procedures which were employed with this peer-trainer. The other training procedures utilized the experimenter, an observer, and the peer-trainer, but not the target subjects. The lack of consistent behavior change which was obtained with these procedures indicate the limiting effects which peer training without the subjects may produce. Although additional research is needed to assess more closely the effects of training procedures conducted with the subjects directly, such a strategy appears to provide a closer match between training and free-play situations, thereby facilitating the generalization of peer-trainer behavior.

II. Project Objectives

The purpose of this investigation was to examine a number of variables relevant to training peers to modify the social behavior of autistic children. The specific objectives addressed by this research were:

1) Development and empirical validation of a training program for increasing mildly handicapped students use of specific social behaviors (e.g., sharing and praising).
2) Empirical validation of the effects of increased sharing and praising responses by trained peers on the social behavior of autistic children.
3) Assessment of the extent to which nontrained peers will share with and praise autistic children as a result of observing an explicitly trained peer.
4) Assessment of generalization of increased social behavior from structured play setting to more naturalistic environments.

Each of these objectives were met within the timeline originally stated in the proposal.

III. Methodology, Results, and Implications

Subjects

Target subjects were two boys and one girl enrolled in a classroom for autistic children at Carl Sandburg Learning Center in Rockville, Maryland. Each of these children, ranging in age from 5.5 to 6.5 years (mean = 5.8 years), had been diagnosed autistic or autistic-like by agencies not affiliated with this investigation and in accordance with the diagnostic criteria established by the National Society for Autistic Children (Ritvo & Freeman, 1978). These subjects were selected because they all evidenced severe deficits in peer social interactions as reported by the subjects' teachers and substantiated by informal pre-baseline observations.

Subject 1, a 5.5 year old boy, displayed limited language skills, as evidenced by 3-4 word utterances which were often used spontaneously.

This subject had recently shown dramatic improvements in this area, as the frequency and complexity of his sentences had increased. Common characteristics of this subject's language included pronoun reversals, perseveration on the same topic, and limited preposition use. In addition, this child exhibited immediate and delayed echolalia. A variety of self-stimulatory responses were evidenced, composed primarily of object spinning and a profound interest in fans or other objects which contained electrical motors. This latter catagory often constituted the content of his verbal behavior as well as his play behavior, preferring to spin objects repeatedly as opposed to playing with them appropriately or with other children. Finally, this subject displayed some oppositional and tantrum behaviors which were typically preceeded by a teacher command or the denial of the subject's request. These behaviors consisted primarily of crying, foot stomping, and repetitious noises.

Subject 2, a 5.6 year old girl, also exhibited language deficits, displaying a functional vocabulary of approximately 150 words. This child was also echolalic, mimicking nursery rhymes, songs, and a variety of patterned phrases. Self-stimulatory behavior consisted of hand flapping, body spinning or rocking, and object spinning. Excessive oppositional behavior was also evidenced, consisting primarily of noncompliance, aggression, and occasional tantrums.

Subject 3, a 6.5 year old male, displayed language deficits which exceeded those of the previous two subjects. This child demonstrated a functional vocabulary of 100 words or less which was most evidenced by his restricted expressive skills. Although this subject would repeatedly say "hi" inappropriately throughout the day, appropriate responses to

social initiations had to be prompted consistently. This subject also displayed a variety of self-stimulatory behaviors which included mouthing objects, holding his hands out in contorted positions, and staring for extended periods of time. These behaviors were most noticable during free-time as the child rarely played with the toys which were available or interacted with his classmates. In addition, oppositional behaviors such as noncompliance, aggression, and head banging were exhibited.

Classroom curriculum for these children consisted of a variety of academic tasks which included Distar Language, Reading, and Math. These tasks areas were presented on a daily basis to groups of 2 - 6 autistic students in a group. Specific tasks included letter and sound discrimination (reading), appropriate pronoun use, complete sentence structure, and preposition use (language), number recognition, rote and rational counting (math). Additionally, these children were learning a variety of self-care skills including toothbrushing, zipping, buttoning, shoe tying, and face washing.

Test scores for all of the subjects had been obtained from their files and, due to the tests employed, do not necessarily provide an appropriate indicator of intellectual functioning. Most recent test scores on the Peabody Picture Vocabulary Test (Form A) yielded a mental age of 38 months for Subject 1. Subject 2 had attained a mental age of 27 months on the Merrill Palmer Scale of Mental Tests. Finally, results from the Vineland Social Maturity Scale had provided a score of 26 months for Subject 3.

Peers

Nine non-autistic peers, ranging in age from 5.7 to 8.7 (mean = 7.1

years), were grouped into three triads. Each triad was formed to match the sex and (approximately) the age of each of the autistic students. Variation among the age within each triad was the result of also selecting peers with good attendance records, minimal support staff scheduling conflicts, and parental permission. These children, all students at the same school, were referred by their teachers who reported that they possessed more appropriate social repertoires than their other classmates. All of these peers exhibited delayed language development with associated handicaps including learning disabilities, mild retardation, and conduct problems.

Setting

All free-play and peer-training sessions were conducted in a 4 x 3.5 m room with a variety of toys placed throughout the otherwise barren room. Many of these toys had been identified in previous investigations to facilitate cooperative play (Quilitch, Christopherson, & Risley, 1977; Strain, et al., 1981), while other toys were selected because they were highly preferred by the autistic students. All of the toys found in this room are listed in Table 1.

Located in the closet of this room and visible during all sessions, was a Sony VO-2610 3/4" videorecording deck and camera. This equipment was in place during all free-play probes and peer-training sessions. Prior to the first baseline free-play probe, the equipments' use was explained to the children.

Toy Preference Assessment

Toy preference assessments were carried out on an individual basis for each of the three autistic students prior to conducting any baseline free-play probes. During these assessments, the experimenter

TABLE 1

Listing of Toys Found in Free-Play and Training Setting

Basketball	Puppets 2
Bean Bag Throw	Puzzles
Wooden Blocks	Tinker Toys R 1
Cars and Trucks	Toss Across R
Frisbee R	Velcro Dart Board
Jai-Lai Catch Set R	Wagon 3

R = Registered Trademark

1 = Autistic student 1's most preferred toy

2 = Autistic student 2's most preferred toy

3 = Autistic student 3's most preferred toy

individually brought each autistic student to the free-play room and instructed them to play with any of the toys present. The order in which each student then selected the toys was recorded. Students were required to select and play with no more than one toy per 30 second period. If a student began playing with another toy prior to the allotted period of time, the experimenter would prompt the student to continue playing with the original choice. After 30 consecutive seconds of playing with the toy, the student was instructed to select a new toy and the original choice was removed from the available pool of toys. Each toy preference assessment lasted approximately ten minutes, or until the student had selected five toys. These sessions were continued on a daily basis until each student exhibited stable preferences among their first three selections. These toys were then added to the selection of toys found in the free-play setting and the most preferred toy was used during the experimenter modeling phase of each peer-training session.

Free-Play Probe Procedures

Free-play probes involving three peers and an autistic student were conducted three to four days a week for each play group. The experimenter, during these probes, brought the children to the playroom and instructed them to play together. The videorecording equipment was then activated for a period of 10 minutes during which no further interactions occurred between the experimenter and the children. At the end of the 10 minute recording period, the experimenter informed the children that play time was over and returned them to their classrooms. These probes were conducted for a different number of sessions for each play group prior to the implementation of peer training. This period represented a baseline phase during which the levels of positive social

behaviors among the peers and between the peers and the autistic student were assessed. Based upon this information, the peer from each play group who had exhibited the highest level of positive interactions toward the autistic student was selected to receive training.

Peer-Trainining Procedures

Peer-training sessions began for each play group once the level of positive social interactions between the autistic student and the peer-trainer stabilized (within 20% across four baseline probes) or indicated a decreasing trend during baseline probes. During this training phase, only the selected peer-trainer and the assigned autistic student were brought to the playroom. No free-play probes with the remaining peers were conducted until peer training was terminated (see below). Each session was approximately 20 minutes in length (depending on the number of interactions modeled) and consisted of three conditions which were always presented in the following order.

Modeling. The experimenter modeled a variety of target interactions for the peer-trainer while playing with the autistic student and the most preferred toy. These interactions consisted of initiating and prompting responses by the experimenter as he attempted to interact with the autistic student. With Subject 1, for example, the experimenter extended the can of Tinker Toys and made a verbal initiation such as "Come play with me" or "Let's play Tinker Toys, Jimmy". If the autistic student failed to respond to this initiation, the experimenter modeled a sharing response by placing two Tinker Toy parts in the subject's hands and providing an explicit command such as "Put them together". The experimenter, following each demonstration, turned to the peer-trainer, described the modeled response and emphasize the importance of playing

with the subject. Approximately 3-5 modeled interactions were provided during each training session. The number of modeled responses varied from session to session, depending on how long the peer-trainer attended to the experimenter.

Practice with Feedback. After the experimenter had modeled a number of target interactions with the autistic student, the peer-trainer was instructed to play with the autistic student. For the next five minutes, the experimenter observed the peer-trainer play with the subject and provided feedback on an intermittent basis. This feedback consisted of verbal prompts such as "Put the ball in her hands" or "Show her what to do", etc. Prompts were provided following ten-second intervals during which no positive social behaviors were observed by the experimenter.

Training Probe. After five consecutive minutes of peer-trainer practice with experimenter feedback, the videorecording equipment was covertly activated and a five minute training probe was conducted. The purpose of these probes was to determine to what extent experimenter modeling and practice with feedback would facilitate the peer-trainers' interactions with the autistic student. During this time, the experimenter provided no feedback to the peer-trainer or the subject. The experimenter informed the children at the end of this probe that play time was over and praised the peer-trainer for his participation. The children were then returned to their classrooms.

These training sessions continued until the peer-trainer exhibited a level of positive social behavior toward the autistic student that was comparable to, or exceeding that directed toward the other peers during the baseline probes. Once the peer-trainer's positive social behavior

toward the autistic student had stabilized (within 20% across three training probes) at improved levels, free-play probes with the remaining two peers were resumed on the following day. These probes were conducted in the same manner as previously described. For Peer-Trainer 2, a booster training session was conducted after the first two free-play probes indicated her interactions with the autistic student were at levels comparable to baseline. This booster training session was conducted in a similar manner to the training sessions previously described, but also emphasized the importance of interacting with the autistic student even in the presence of other children.

Behavioral Measures

Both interval and duration measures were used to assess interactions between peers and between peers and the autistic students during the free-play and training probes. The interval measure was adapted from Strain, et al., (1976) and Strain (1977). This system included two broad catagories of social behavior, verbal and motor, which were further defined as positive or negative in nature according to their topographic and functional characteristics. Furthermore, temporal characteristics of each social behavior was specified as "initiated" or "responded" events in an interactional sequence. Operational definitions for each of these catagories may be found in Table 2.

Duration measures were conducted to assess all interactions between the autistic students and their peer-trainers. Each duration interval began with the first initiated response directed to or exhibited by a subject. These intervals continued until no social responses were observed to occur for at least three consecutive seconds. The observer,

TABLE 2
Behavioral Measures

Motor-Gestural: all movements that cause a child's head, arms, or feet to come into direct contact with the body of another child; or that involve waving or extending arms directly toward another child; or that involve placing of hands directly upon a material, toy or other movable apparatus that is being touched or manipulated by another child.

A. Positive: touch with hands, hug, holding hands; wave or kiss; all cooperative responses involved with sharing a toy or material.

B. Negative: hit; pinch; kick; butt with head; non-playing push or pull; grabbing object from another child; destroying construction of another child.

Vocal-Verbal: all vocalizations emitted while a child is directly facing any other child within a radius of .9 m or all vocalizations that by virtue of content (e.g., proper name, "hey you", etc.) and/or accompanying motor-gestural movements (e.g., waving or pointing, etc.) clearly indicate that the child is directing the utterance to another child within or beyond a .9 m. radius.

A. Positive: all vocalizations directed to another child excluding screams, shouts, cries, whines, or other utterances that are accompanied by gestures indicating rejecting, oppositional, or aggressive behavior.

B. Negative: screams, shouts, whines, or other utterances that are accompanied by gestures that indicate rejecting, oppositional, or aggressive behavior.

Initiation: Any response which begins an interaction between two children observed not to interact for the previous ten seconds, or involves a new activity not shared by the two children for the previous ten second period.

Response: Any behavior which follows in close contiguity (3") the initiation or response of another child and shows a direct relationship to the other child's previous response.

at the end of each interaction between the autistic student and their peer-trainer, noted the duration of the interaction and recorded it on a prepared data sheet.

Observational Procedures

Social behaviors of the autistic students and their respective peers were videotaped for ten consecutive minutes of each free-play probe. Trained observers, employing a ten-second continuous interval schedule, recorded all social responses using coded symbols and a prepared data sheet as illustrated in Figure 1.

Social responses were entered in the appropriate interval cell (10", 20", 30", etc.) corresponding to that of the individual exhibiting the behavior (S, P1, P2, P3). These responses were coded to specify topographic (motor or vocal), temporal (initiated or responded), and functional dimensions (positive or negative). Furthermore, the direction of these behaviors was noted by recording the initials of the recipient of each response. The entry in the 20 second interval of Figure 1, for example, describes a positive, vocal and motor initiation from Peer 2 to the autistic student. Subsequently, in the 30 second interval, a negative motor response was directed to Peer 2 from the autistic student. Additionally, the six second duration of this interaction is also noted. In the event that no interactions were observed for an entire interval, a diagonal slash was made, as depicted in the 50 second interval of Figure 1.

Reliability Assessment

Prior to scoring experimental free-play sessions, all observers were required to attain an inter-observer reliability score of at least 80% for three consecutive 10 minute pilot probes. Inter-observer

FIGURE 1

Sample Observation Record

	10"	20"	30"	40"	50"	60"
S			-mr=P2			
P1						
P2		+mvi=S				
P3						
Duration			6"			

m = motor i = initiation + = positive

v = vocal r = response - = negative

= = directed to

reliability assessments were carried out on 72% of all free-play and training probes throughout the investigation. For these assessments, the experimenter would randomly select and score videotaped sessions which had previously been observed by the trained observers. Subsequent comparisons between the experimenter's and the trained observers' records were made. Corresponding reliability scores were then computed for occurrence, nonoccurrence, and total reliabilities. These scores were computed by summing the number of agreements per category (occurrence or nonoccurrence), dividing that number by the summed number of agreements plus disagreements and multiplying by 100. Agreements were scored only if both records reflected the same topography (motor or vocal), temporal sequence (initiated or responded), and functional effect (positive or negative), all occuring in the same interval, with the same behaver and recipient.

Reliability coefficients for the duration measures were calculated in a similar fashion on an interval by interval basis. Each duration measure was compared by dividing the longer duration by the shorter and multiplying by 100. These scores were then summed and averaged across each session (Bailey & Bostow, 1979).

Table 3 presents the reliability scores obtained for each play group, for occurrence, nonoccurrence, total, and duration data. Reliability checks were conducted on 72% of the baseline free-play probes, 75% of the training probes, and 70% of the free-play probes following training. These checks yielded average reliability scores of 90.1% for occurrence, 94.8% for nonoccurrence, 97.3% for total, and 71.4% for duration.

TABLE 3
Inter-Observer Reliabilty Coefficients

Student	Occurrence	Nonoccurrence	Total	Duration
1	87.15	93.72	96.82	71.45
2	85.30	93.37	96.68	68.38
3	97.36	97.15	98.35	74.23
Total	90.05	94.75	97.28	71.35

Experimental Design

The present study employed a multiple-baseline design across subjects to show that trained peers could be effectively used to facilitate the social behavior of autistic children. Each subject participated in a different number of free-play probe sessions prior to peer-training. Specifically, 8, 11, and 13 baseline free-play probe sessions were conducted with autistic students 1, 2, and 3, respectively.

Functional control is demonstrated by the multiple baseline design as increases in the dependent variable occur only following treatment. In the case of the multiple-baseline across subjects, baseline data are gathered for at least one behavior across several subjects. After baseline measures stabilize across subjects, treatment is implemented for one subject, while baseline conditions are held constant for the others. With the introduction of the experimental condition for each subject, this design demonstrates whether or not the behavior of the subject changes before or after he is included in the treatment condition (Kazdin, 1973). Sidman (1960) and Kazdin and Kopel (1975) pointed out that single subject designs such as the multiple-baseline design across subjects are ideally suited for experimental and clinical research where demonstrations of experimental effects are made with a small number of subjects.

RESULTS

Peer-trainers' behavior. Figure 2 shows the results of the multiple baseline analysis with probe sessions plotted along the abscissa and the percent of intervals in which positive social behavior occurred plotted on the ordinate. Although data were collected on both the topographical

(motor or vocal) and functional (positive or negative) characteristics of social behavior, these distictions are not presented. Topographical distinctions were collapsed into one catagory of positive social behavior since the separated data for vocal and motor behavior were (approximately) equivalent. Similarly, negative social behavior was not presented due to its low occurrence.

During the baseline condition, prior to peer training, all three peers exhibited variable and/or infrequent interactions with the autistic students. Peer Trainers 1 and 2, for example, interacted with the autistic students an average of less than 5% of the intervals (range 0% to 16.7%) during baseline probes. Peer-Trainer 3 interacted with the autistic student an average of 41% of the intervals (range 0% to 96.7%) but failed to maintain these interactions throughout baseline.

The effects of the peer training procedure were quite dramatic as all three peer-trainers substantially increased the number of intervals in which they interacted with the autistic students. Three training sessions were required for Peer-Trainers 1 and 3 before their interactions with the autistic students averaged 83% (range 80% to 86.7%) and 89% (range 86.7% to 91%) of the intervals, respectively. Peer-Trainer 2 required six training sessions before her interactions with the autistic student stabilized at an average of 44.5% of the intervals (range 33.3% to 66.7%). The effects obtained from peer-training also generalized to the free-play probes following training, as the peer-trainers continued to interact with the autistic students an average of 60.4%, 18.3%, and 90% of the intervals, respectively. A booster training session was conducted with Peer Trainer 2 after the first two free-play probes following training had indicated minimal

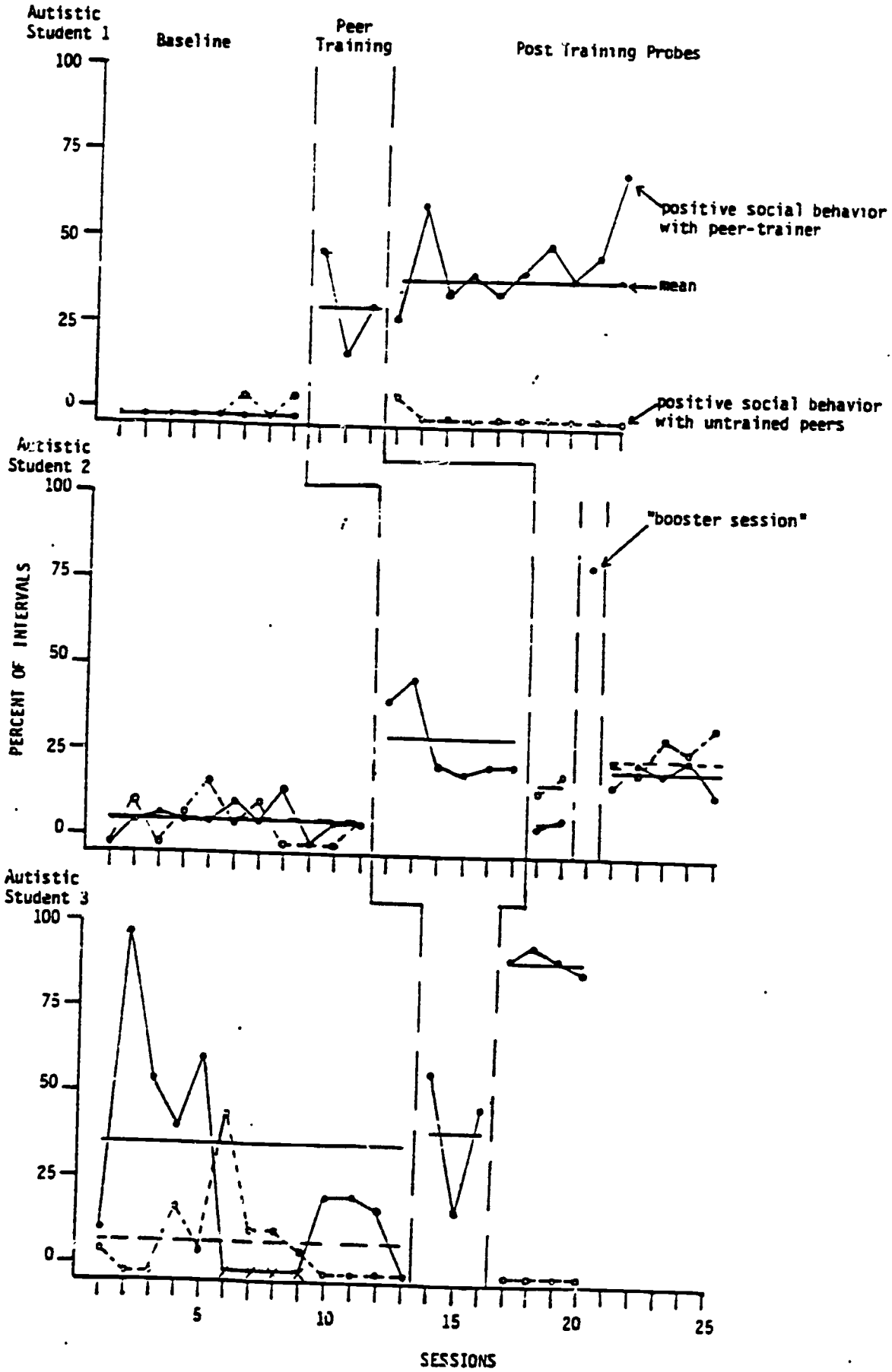
transfer of peer-training; however, interactions between this peer-trainer and autistic student continued to decrease toward baseline levels.

The effects of peer-training on the interactions of the peer-trainers and the other peers are also depicted in Figure 2. Following peer-training, Peer-Trainers 1 and 3 showed a deceleration in their interactions with the other peers; Peer-Trainer 2, however, did not show the same effect as interactions with the other peers increased slightly over baseline.

Autistic students' behavior. The effects of the peer-training procedure on the social behavior of the autistic students are depicted in Figure 3. Baseline data for the first two autistic students are quite consistent, both interacting infrequently with any of the peers (range 0% to 16.7% of the intervals). Autistic Student 3, however, showed initially higher levels of baseline social behavior with the peer-trainer and the untrained peers (range 0% to 96.7% of the intervals) which did not maintain. During peer-training probes, all three autistic students exhibited marked, but variable improvements in their social behavior, increasing to an average of 31% (range 16.7% to 46.7%), 29% (range 16.7% to 46.7%), and 39% (range 16.7% to 56.7%) for Autistic Students 1, 2, and 3, respectively. For all of the autistic students, these improvements generalized to the free-play probes following training, as the Autistic Students interacted with their peer-trainers an average of 38.7% (range 25% to 70%), 19.7% (range 13.3% to 23.3%) and 89.9% (range 86% to 93%) of the intervals observed, respectively. In addition, Autistic Student 2 showed a 20% increase in her interactions with the untrained peers, averaging 24.9% of the intervals (range 23.3%

FIGURE 3

AUTISTIC STUDENTS' POSITIVE SOCIAL BEHAVIOR



to 30%) following peer-training. In comparison, Autistic Students 1 and 3 showed no improvements in their interactions with the untrained peers.

Effects on duration of interactions. Figure 4 presents the mean duration of interactions between the autistic students and their peer-trainers during baseline free-play probes and free-play probes following training. In addition, the mean duration of interactions between the peer-trainers and the other peers during baseline free-play probes are presented for comparative purposes. These data indicate that Autistic Students 1 and 2 exhibited rather short interactions with their peer-trainers, averaging .9 and 5.3 seconds during baseline probes. Autistic Student displayed longer durations, averaging 2 minutes and 53 seconds; however, these durations were quite variable, ranging from 3 seconds to 4 minutes, 45 seconds. For all three autistic students, peer-training produced dramatic increases in the duration of their interactions with the peer-trainers, averaging 12 seconds, 26.9 seconds, and 8 minutes, 57 seconds, for Autistic Students 1, 2, and 3, during free-play probes following training. In comparison, the mean duration of interactions between the peer-trainers and the other peers during baseline probes averaged 31.7 seconds (range 1.4 seconds to 3 minutes, 11 seconds), 18.67 seconds (range 1.9 to 50.9 seconds) and 29.7 seconds (range 1.9 to 47 seconds) for Peer-Trainers 1, 2, and 3, respectively.

Spillover effects. The average percent of intervals in which the untrained peers directed positive social behavior to the autistic students are presented in Figure 5. During baseline, interactions between the untrained peers and the autistic students were infrequent, averaging 1.3% for Autistic Student 1, 4% for Autistic Student 2, and 30% for Autistic Student 3. The effects of peer training resulted in the

FIGURE 4

AVERAGE DURATION OF INTERACTIONS

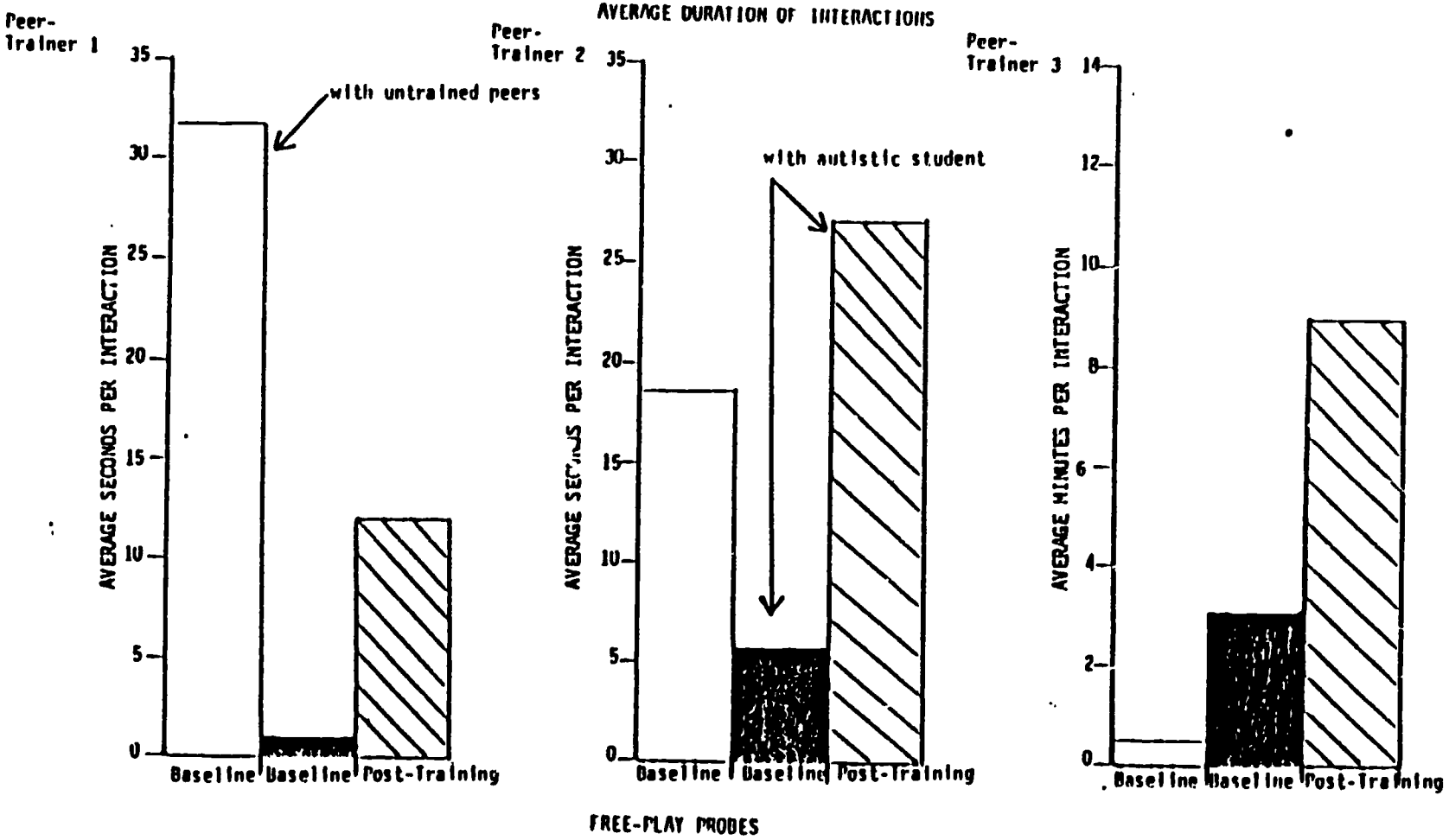
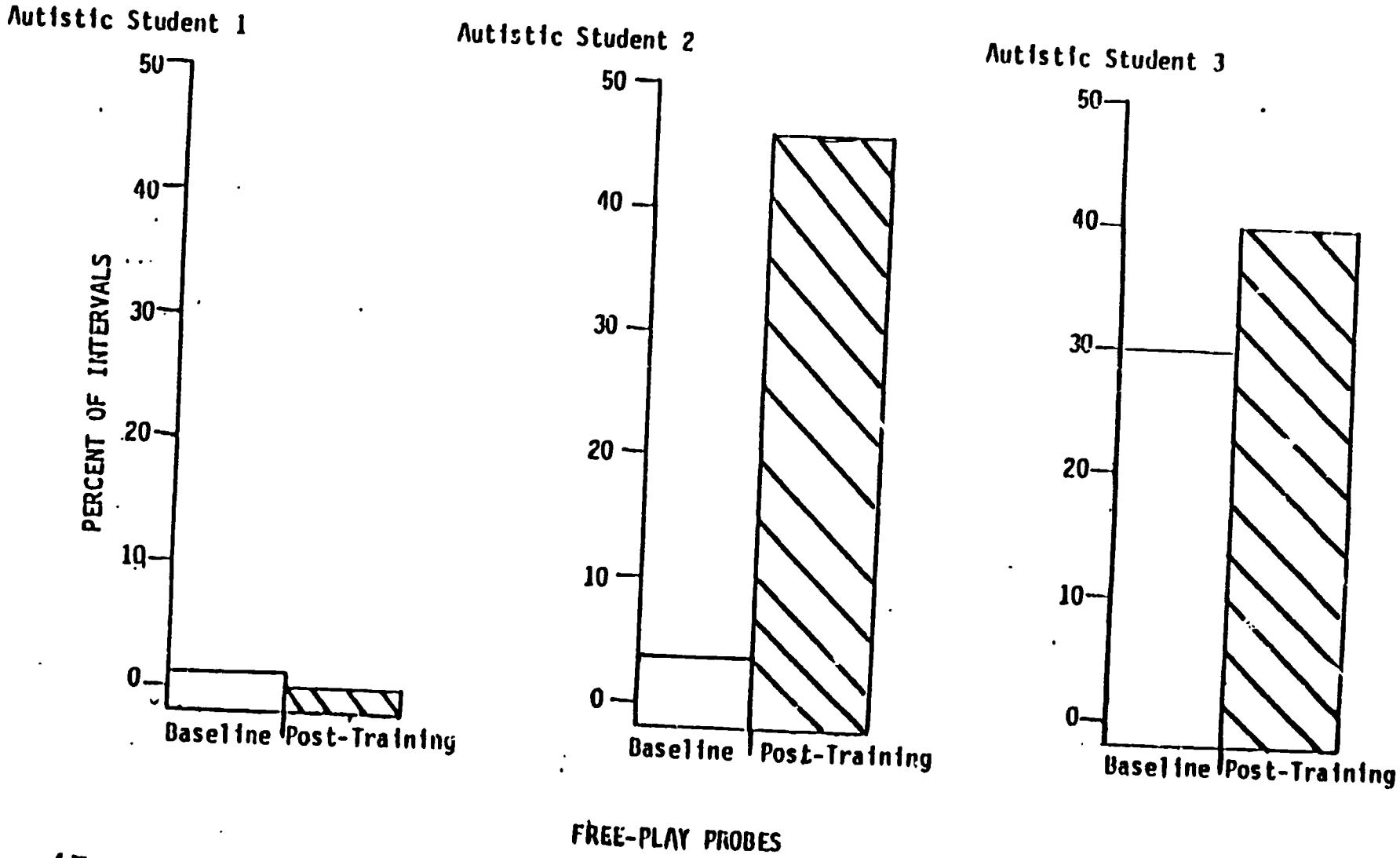


FIGURE 5

UNTRAINED PEERS' POSITIVE SOCIAL BEHAVIOR WITH AUTISTIC STUDENTS



untrained peers of Autistic Students 2 and 3 increasing their interactions with these students to an average of 46.7% and 40% of the intervals, respectively. The untrained peers for Autistic Student 1, however, failed to increase their interactions with this subject.

DISCUSSION

The results of this investigation indicate that (1) modeling plus direct prompting of interactions between a peer-trainer and an autistic student was an effective strategy for increasing dyadic interactions; (2) this training increased both the percentage of intervals in which interactions occurred and their duration; (3) these increases generalized to a play group with untrained peers present; and (4) for two of the autistic students, peer-training resulted in increased interactions with untrained peers.

Those data relevant to the training procedure expand the findings of earlier research in which peer training has been conducted (Dy, et al., 1981; Ragland, et al., 1978; Strain, et al., 1979). The present findings are consistent with the results of these earlier studies; following peer training, dramatic increases in the interactions between the peer-trainers and the autistic students occurred. In this study, these effects were obtained after three training sessions with Peer-Trainers 1 and 3, requiring 60 minutes each, and after six training sessions with Peer-Trainer 2, requiring 120 minutes. In comparison, previous investigations have typically conducted four to five training sessions, requiring 80 to 100 minutes although in these investigations, there did not appear to be a systematic method for determining the number of training sessions (Bream & Cohen, Note 1; Ragland, et al., 1978; Strain, 1977; Strain, et al., 1979). As such, the three training

sessions required for two of the peer-trainers in this study suggest that the training procedure employed may be more effective than other procedures.

A component analysis of peer training strategies by Dy, et al., (1981), suggested reasons why a direct prompting procedure, similar to that employed in this study, may be a superior training strategy. In the Dy, et al. investigation, higher levels of social interactions between peer-trainers and target subjects were obtained during direct prompting training than were associated with minimal instructions or role-playing procedures. The apparent superiority of direct prompting may be its ability to develop appropriate stimulus control over the peer-trainers' behavior. That is, with role-playing and minimal instructions, the discriminative stimuli which cue the peer-trainers' behavior is initially the modeled behavior of the experimenter and subsequently must transfer to the behavior of the target subject. In comparison, direct prompting establishes the subjects' behavior as the discriminative stimulus during training and as such, transfer is facilitated.

A second finding of this study is that once trained, the peer-trainers' interactions with the autistic students generalized to the free-play probes with other peers present. These results were obtained although no systematic procedure for facilitating generalization had been implemented. Dy, et al., (1981), for example, systematically faded the number of prompts delivered to the peer-trainer in a response dependent fashion until less than one prompt per session was required to maintain high levels of interaction between the peer-trainer and two subjects. In contrast, similar results were obtained in this study without systematically fading peer-trainer prompts.

The generalization of the peer-trainers' behavior in the absence of any prompts or systematic fading procedure, as documented by the present results, may be attributed in part, to the presence of the experimenter during the free-play probes. Since the experimenter conducted all peer-training sessions as well as supervising the free-play probes, it appears that the generalized improvements obtained in this latter setting could be a function of the discriminative control which the experimenter's presence may have exerted. However, since the experimenter remained near the video equipment and did not interact with the children during these probes, it appears that any discriminative control evidenced by the experimenter's presence would be minimal. One method of controlling for this possibility in future investigations would be to employ separate adults for conducting peer-training and free-play probes.

A second variable which may have contributed to the generalization of the peer-trainers' behavior change is the training probes conducted immediately following direct-prompting. These probes were similar to the regular free-play probes with the exception of the duration of the probe (5 minutes as compared to 10 minutes) and the participants of the probe (peer-trainer and autistic student only). Furthermore, there were a number of stimuli common to the training, training probes, and free-play probes including the setting, play materials, presence of the autistic student, and the presence of the experimenter. These common elements may have reduced the discriminability of the different conditions, thus facilitating the generalization of the peer-trainers' behavior from the training sessions to the free-play probes following training (c.f., Rincover & Koegel, 1975; Stokes & Baer, 1977).

The generalized effects obtained with the peer-trainers in this study did not maintain for Peer-Trainer 2, whose level of positive social behavior with the autistic student subsequently returned to near baseline levels. One reason for this lack of maintenance may have been the training criterion employed. In previous investigations, training has been conducted for a specified number of sessions, with little regard to any behavioral referenced indicator (c.f., Bream & Cohen, Note 1; Strain, 1977; Strain, et al., 1979). In comparison, this investigation continued peer training until the peer-trainers' level of positive social behavior with the autistic student was comparable to the levels of positive social behavior with the untrained peers during baseline free-play probes. This criterion provides a socially valid (Kazdin, 1977) indicator, based upon normative information, by which the effects of training can be determined. For Peer-Trainer 2, however, such a criterion appears to have been inadequate. That is, although training increased the peer-trainer's social behavior with the autistic student to within normative levels during training probes, this was not sufficient to maintain these improvements during subsequent free-play probes. These results suggest that peer-training had not adequately established the presence of the autistic student as a discriminative stimulus for the peer-trainer to engage in positive social behavior. A more appropriate criterion for this peer-trainer may have required levels of social behavior with the autistic student during training probes which was comparable to those obtained with the other two peer-trainers. For these peer-trainers, training resulted in much higher rates of positive social behavior with the autistic students which maintained at even higher levels during subsequent free-play probes,

suggesting that for these peers, training was effective in developing the appropriate stimulus control.

Strain, in a number of his investigations (Strain, 1977; Strain, et al., 1979), has noted a direct relationship between initial baseline performance and the effectiveness of training. In the present study, Peer-Trainers 1 and 3, who were most responsive to training also showed higher levels of positive social behavior than evidenced by Peer-Trainer 2, who was least responsive to training. The baseline data for Peer-Trainer 2 clearly documents the limited nature of this peer-trainers' social repertoire, as she displayed relatively fewer interactions with the untrained peers than evidenced by the other peer-trainers. Although this peer-trainer, like the others, was selected on the basis of her high level of interactions with the autistic student during baseline (as compared to the other peers), it appears that more weight should have been given to interactions with the other peers as well.

The increased interactions between Peer-Trainers 1 and 3 and their corresponding autistic students resulted in a suppression (relative to baseline) of interactions with the untrained peers. That is, during the subsequent free-play probes, the peer-trainers continued to interact in a dyadic fashion with the autistic students while typically not interacting with the other peers. This finding is in sharp contrast to those of previous investigations in which, following training, peer-trainers have typically continued to show higher rates of positive social behavior with their peers rather than the withdrawn subjects (c.f., Peck, et al., 1976; Strain & Fox, 1981). These investigations have noted that the continued isolation of the target subjects following peer-training may not necessarily be the result of overt rejection, but

simply a preference of the peer-trainers to interact with more reinforcing peers.

One variable in this study which may have led to the suppression of interactions between the peer-trainer and the other peers is the training procedure itself; as training consisted of prompting dyadic play between the autistic student and peer-trainer, it is not surprising to find that the trained peers continued to interact with the autistic students in a similar fashion during free-play probes. From a practical standpoint, the increased interactions between the peer-trainer and the autistic student may also have contributed to suppressing the interactions between the peer-trainer and the other peers. As the peer-trainer spent more time interacting with the autistic student, less time would naturally be available to interact with the other peers. Such an effect on the social behavior of peer-trainers toward other peers is critical, as it may ostracize not only the peer-trainer, but also the autistic student from broader social communities (e.g., other peers). One strategy which could alleviate this problem would be the systematic fading in of untrained peers into established play groups of peer-trainers and autistic students, thereby facilitating the interactions between the peer-trainer and autistic student while maintaining the interactions of the peer-trainer and untrained peers.

The dramatic and sustained increases in the positive social interactions between Peer-Trainers 1 and 3 with the matched autistic students are impressive; however, to insure long term maintenance of these increased interactions, it appears that peer-training should be conducted across a variety of materials. In this study, the peer-trainers were observed to typically interact with the autistic students

while playing only with the toy which had been used during the modeling phase of training sessions. These toys were originally selected for use during training because of their preference by the autistic students. The persistence which the peer-trainers exhibited in interacting with the autistic students and these activities indicate that some aspect of these activities was reinforcing for the peer-trainers. One source of reinforcement which may have maintained the peer-trainers' social behavior is the improved social behavior of the autistic students. That is, by handing the autistic student the Tinker Toys or pulling him in the wagon, the occassion was set for the autistic student to engage in positive social behaviors (e.g., smiling, handing the toy back to the peer-trainer, verbal responses to the peer-trainer, etc.) which may have reinforced the peer-trainers' social behavior. Such activity specific patterns of interacting may limit generalization to other settings and impede the maintenance of the peer-trainers' behavior. It appears likely that over an extended period of time, the peer-trainers would tire of playing with the same toy, eventually changing to a new activity, possibly at the expense of continued interactions with the autistic subject. As such, it would appear imperative of future research to conduct peer training with a variety of toys, thereby facilitating generalized interactions.

Accompanying the increased interactions of the peer-trainers with the autistic students was the dramatic and consistent improvements in the <u>positive social behavior</u> of all of the <u>autistic students.</u> These improvements consisted of increased levels of positive social behavior with the peer-trainers following peer-training, replicating the findings of previous peer-mediated interventions (Ragland, et al., 1978; Strain,

1977; Strain, et al., 1979). For two of the autistic students in this study, the increases evidenced during the free-play probes following training were at levels higher than during training probes.

The results obtained from the duration measures indicate that for all three of the autistic students, peer-training resulted in much longer interactions between these students and their peer-trainers. The length of these interactions were well within the range of the duration of interactions between the peer-trainers and the other peers during baseline. This dimension has not been previously assessed and may be important as future investigations determine not only the quantitative but also the qualitative effects of peer interventions. For example, one criticism of adult-mediated interventions was that these strategies produce a pattern of frequent, but brief social contacts, dissimilar to that of normal interactions. The present findings therefore, suggest that peer-mediated interventions may increase the social interactions of autistic students and in so doing, produce interactions which are more similar to that of normal patterns of interacting.

While the present results indicated that the interactions between the autistic students and trained peers increased over baseline levels, the increases for Autistic Student 2 were not as dramatic as those for the other autistic students. One variable which would naturally limit this student's increased interactions was the minimal effects obtained with her peer-trainer, who showed less improvement during the free-play probes than the other peer-trainers. Although the increased interactions of Autistic Student 2 and her peer-trainer did not maintain during the free-play probes following training, this student did show dramatic increases in her interactions with one of the untrained peers.

One variable which may have facilitated improved interactions between Autistic Student 2 and this peer appears to have been a "spillover" effect of the peer-training procedure to the untrained peer. For this autistic student, the increased social interactions with the untrained peer was not the result of her initiating more interactions with this peer, but increased initiations from the peer. Previous discussions of spillover effects (e.g., Cooke & Apolloni, 1976; Kazdin, 1981; Strain, et al., 1976) have identified vicarious reinforcement, modeling and "trapping effects" as possible explanations for this phenomenon. However, none of these explanations seem to adequately account for the present results. Vicarious reinforcement, as commonly defined, does not appear as an appropriate explanation for these results as the untrained peer was not present during training. Similarly, a "trapping effect" explanation does not address the present results since the autistic student did not increase her initiations toward the untrained peer. In comparison, modeling may have served some function in producing this spillover effect but in the absence of any extrinsic reinforcement, it appears unlikely that the untrained peer would have maintained these new social behaviors by modeling alone. One explanation that may account for these results is that the improved social behavior of the autistic student vicariously reinforced the untrained peer's initiations with the student. After observing the improved interactions of the peer-trainer and the autistic student, the untrained peer may have modeled the peer-trainer and as a result, initiated interactions with the autistic student. As these initiations were more frequently responded to positively by the autistic student following peer training, the likelihood of future initiations by the untrained peer was increased.

This appears to have been the case for Autistic Student 2, whose positive social behaviors with the untrained peer consisted primarily of responses, as opposed to initiations, and were characterized by a reciprocating relationship which had typified the interactions of the autistic students and their peer-trainers.

The generalized increases in the positive social behavior of Autistic Student 2 to the untrained peer were not replicated with either of the other autistic students although for one of these students, the untrained peers displayed some spillover effects. The lack of generalized increases in the social behavior of these students to the untrained peers may be the result of the effectiveness with which training developed and maintained high rates of positive social behavior between these students and their peer-trainers. The peer-trainers for Autistic Students 1 and 3, unlike Peer-Trainer 2, consistently engaged in high rates of social behavior with these students, thereby, allowing few contacts with the other peers. Autistic Student 3 most clearly exemplifies this situation as his level of interactions with the peer-trainer averaged 89% during free-play probes following training. Apparently, such high rates of interaction with one individual mitigated any interactions with the other peers, even though these peers were directing more positive social behavior toward the student.

The differential spillover effects obtained with the untrained peers in this study may also be explained in part, by the baseline data for these peers. Specifically, those peers who did display spillover effects in their interactions with the autistic students, also displayed relatively higher baseline levels of interaction with these students. These results are quite consistent with the training data obtained for

the peer-trainers, indicating that maximal effects will be obtained with individuals exhibiting relatively higher baseline performances.

Previous research on spillover effects has been limited to adult mediated interventions in which these effects were obtained with non-target children (c.f., Strain & Timm, 1974). As such, the present results add to the literature on spillover effects by indicating that similar results may be obtained by untrained peers interacting with peer-trainers. From a practical standpoint, identified variables which could maximize the spillover of peer-trainer skills to untrained peers could provide an effective and highly efficient strategy for programming social behavior improvements with children in mainstreamed environments.

In summary, the results of this investigation provide a number of implications for the direction of future peer-mediated interventions. The present findings suggest that direct prompting of developmentally delayed peer-trainers is an effective and highly efficient training procedure, limited only by the entry level skills of the peer-trainers. As such, this training procedure would appear to have wide applicability to most special education programs in which handicapped individuals are typically mainstreamed into larger groups of less handicapped children. The present findings with particular regard to the spillover effects, provide a strategy by which these mainstreaming efforts could be maximized.

Additional research is needed to assess a number of variables, identified in the preceeding discussion, which may affect the generality of this procedure. For example, additional delineation of the characteritics of effective peer-trainers and responsive target subjects

appears necessary. In addition, the "side-effects" on the social interactions among trained and untrained peers which may result from peer-training is an important, if not ethical concern. Further analysis of peer-strategies which facilitate social initiations as well as social responses of the target subjects is needed. Finally, an analysis of variables which may affect the generalized effects of peer-mediated strategies needs to be conducted with particular emphasis on those variables relevant to generalization across materials, settings, and individuals.

IV. Dissemination

The results of this study were presented at the Association for Behavior Analysis Convention (May, 1984), and were published in the Journal of Applied Behavior Analysis (reprint enclosed).

REFERENCE NOTES

1. Bream, L. & Cohen, E.A. The effects of play with an explicitly trained developmentally delayed peers on the social behavior of autistic children. Paper presented at Annual Meeting, Association for the Advancement of Behavior Therapy, Toronto, November 1981.

REFERENCES

Apolloni, T., & Cooke, T. P. Integrated programming at the infant, toddler and preschool levels. In M. Guralnick (Ed.), Early intervention and the integration of handicapped and nonhandicapped children. Baltimore: University Park Press, 1978.

Bailey, J.S., & Bostow, D.E. Research methods in applied behavior analysis. Talahassee: Copy Graphics, 1979.

Bettleheim, B. The empty fortress. New York: The Free Press, 1967.

Bonney, M. Assessment of efforts to aid socially isolated elementary school pupils. Journal of Educational Research, 1971, 64, 345-364.

Boower, E.M., Shellhamer, T.A. & Dailey, J.M. School characteristics of male adolescents who later become schizophrenic. American Journal of Orthopsychiatry, 1960, 30, 712-729.

Brophy, J.E. Child Development and Socialization. Palo Alto: Science Research Associates, Inc., 1977.

Carr, E.G., Newsom, C.D. & Binkoff, J.A. Stimulus control of self-destructive behavior in a psychotic child. Journal of Abnormal Child Psychology, 1976, 4, 139-153.

Carr, E.G., Schreibman, L., & Lovaas, O.I. Control of echolalic speech in psychotic children. Journal of Abnormal Psychology, 1975, 3, 331-351.

DeMyer, M.K., Hingtgen, J.K., & Jackson, R.K. Infantile autism: The decade of research. Schizophrenia Bulletin, 1981, 7, 388-451.

DesLauriers, A.M., & Carlson, C.F. Your child is asleep: Early infantile autism. Homewood, Ill.: Dorsey Press, 1969.

Dy, E.B., Strain, P.S., Fullerton, A. & Stowitscheck, J. Training institiutionalized, elderly mentally retarded persons as

intervention agents for socially isolate peers. Analysis and Intervention in Developmental Disabilities, 1981, 1, 199-215.

Egel, A.L., Koegel, R.L. & Schreibman, L. A review of educational-treatment pprocedures for autistic children. In L. Mann & D. Sabitino (Eds.), Fourth Review of Special Education. New York: Grune and Stratton, 1980.

Epstein, L.H., Doke, L.A., Sajwaj, T.E., Sorrell, S. & Rimmer, B. Generality and side-effects of overcorrection. Journal of Applied Behavior Analysis, 1974, 7, 385-390.

Foxx, R. & Azrin, N. Toilet training the retarded. Champaign, Ill.: Research Press, 1973a.

Foxx, R. & Azrin, N. The elimination of autistic self-stimulatory behavior by overcorrection. Journal of Applied Behavior Analysis, 1973b, 6, 1-14.

Guralnick, M. The value of integrating handicapped and nonhandicapped preschool children. American Journal of Othopsychiatry, 1976, 46, 236-245.

Hartup, W.W. Peer interaction and social organization. In P.H. Mussen (Ed.), Manual of Child Psychology (3rd ed.). New York: Wiley & Sons, 1970.

Kazdin, A.E. Methodological and assessment considerations in evaluating reinforcement programs in applied settings. Journal of Applied Behavior Analysis, 1973, 6, 517-531.

Kazdin, A.E. Assessing the clinical or applied importance of behavior change through social validation. Behavior Modification, 1977, 1, 427-451.

Kazdin, A.E. Vicarious reinforcement and punishment processes in the

classroom. In P.S. Strain (Ed.), The utilization of classroom peers as behavior change agents. New York: Plenum Press, 1981.

Kazdin, A.E. & Kopel, S.A. On resolving the ambiguities of the multiple baseline design: Problems and recommendations. Behavior Therapy, 1975, 6, 601-608.

Koegel, R.L. & Covert, A. The relationship of self-stimulation to learning in autistic children. Journal of Applied Behavior Analysis, 1972, 5, 381-388.

Koegel, R.L., Egel, A.L. & Dunlap, G. Learning characteristics of autistic children. In W.S. Sailor, B. Wilcox, & L.J. Brown (Eds.), Methods of instruction with severely handicapped students. Baltimore: Brookes Publishers, 1980.

Koegel, R.L., Firestone, P.B., Kramme, K.W. & Dunlap, G. Increasing spontaneous play by suppressing self-stimulation in autistic children. Journal of Applied Behavior Analysis, 1974, 7, 521-528.

Lotter, V. Epidemiology of autistic conditions in young children. II. Some characteristics of the parents and children. School Psychiatry, 1967, 1, 124-137.

Lovaas, O.I. The autistic child: Language development through behavior modification. New York: Irvington, 1977.

Lovaas, O.I., Koegel, R.L. & Schreibman, L. A behavior modification approach to the treatment of autistic children. Journal of Abnormal Child Psychology, 1974, 4, 111-129.

Lovaas, O.I., Litrowinik, A. & Mann, R. Response latencies to auditory stimuli in children engaged in self-stimulatory behavior. Behaviour Research and Therapy, 1971, 9, 934-949.

Lovaas, O.I., Schreibman, L., Koegel, R.L., & Rehm, R. Selective

responding by autistic children to multiple sensory input. Journal of Abnormal Psychology, 1971, 77, 211-222.

Newsom, C.D., Carr, E.G. & Lovaas, O.I. Experimental analysis and modification of autistic behavior. In R.S. Davidson (Ed.), Experimental analysis of clinical phenomena. New York: Sander Press, 1977.

Newsom, C.D. & Rincover, A. Behavioral assessment of autistic children. In E.J. Mash & L.G. Terdal (Eds.), Behavioral assessment of childhood disorders. New York: Guilford Press, 1979.

Patterson, G.R., & Reid, J.B. Reciprocit and coersion: Two facets of social systems. In E. Neuringer & J. Michael (Eds.), Behavior modification in clinical psychology. New York: Appleton, 1970.

Peck, C.A. Apolloni, T., Cooke, T.P. & Cooke, S.A. Teaching developmentally delayed toddlers and preschoolers to imitate the free-play behavior of nonretarded classmates: Trained and generalized effects. Journal of Special Education, 1976, 12, 195-207.

Plummer, S., Baer, D.M. & LeBlanc, J.M. Functional consideration in the use of procedural time-out and an effective alternative. Journal of Applied Behavior Analysis, 1977, 10, 689-705.

Quilitch, H.R., Christophersen, E.R., & Risley, T.R. The evaluation of children's play materials. Journal of Applied Behavior Ananlysis, 1977, 10, 501-502.

Ragland, E.U., Kerr, M.M. & Strain, P.S. Effects of peer social initiations on the behavior of withdrawn autistic children. Behavior Modification, 1978, 2, 565-578.

Reese, H.W. & Lipsitt, L.P. Experimental child psychology New York:

Academic Press, 1970.

Rimland, B. Infantile Autism New York: Appleton-Century Crofts, 1964.

Rincover, A. Cook, R., Peoples, A. & Packard, D. Using sensory extinction and sensory reinforcment principles for programming multiple adaptive behavior change. Journal of Applied Behavior Analysis, 1979, 12, 221-233.

Rincover, A. & Koegel, R.L. Setting generality and stimulus control in autistic children. Journal of Applied Behavior Analysis, 1975, 8, 235-246.

Risley, T.R. The effects and side effects of punishing the autistic behaviors of a deviant child. Journal of Applied Behavior Analysis, 1968, 1, 21-35.

Ritvo, E.R., & Freeman, B.J. National society for autistic children definition for the syndrome autism. Journal of Autism and Childhood Schizophrenia, 1978, 8, 162-167.

Rosenbaum, M.S. & Breiling, J. The development and functional control of reading comprehension behavior. Journal of Applied Behavior Analysis, 1979, 9, 323-334.

Rutter, M. Diagnosis and definition of childhood autism. Journal of Autism and Childhood Schizophrenia, 1978, 8, 139-161.

Schreibman, L. & Lovaas, O.I. Overselective responding to social stimuli by autistic children. Journal of Abnormal Child Psychology, 1973, 1, 152-168. 245.

Sidman, M. Tactics of Scientific Research. New York: Basic Books, 1960.

Solnick, J.V., Rincover, A. & Peterson, C. Some determinants of the reinforcing and punishing effects of time-out. Journal of Applied Behavior Analysis, 1977, 10, 415-424.

Stokes, T. & Baer, D.M. An implicit technology of generalization. Journal of Applied Behavior Analysis, 1977, 10, 349-368.

Strain, P.S. An experimental analysis of peer social initiations on the behavior of withdrawn preschool children: Some training and generalization effects. Journal of Abnormal Child Psychology, 1977, 5,445-455.

Strain, P.S. Social behavior programming with severely handicapped and autistic children. In B. Wilcox & A. Thompson (Eds.), Critical issues in educating autistic children and youth. Washington D.C.: U.S. Department of Education, Office of Special Education, 1980.

Strain, P.S. & Fox, J.J. Peers as behavior change agents for withdrawn classmates. In A.E. Kazdin & B.B. Lahey (Eds.), Advances in child clinical psychology. New York: Plenum Press, 1981.

Strain, P.S., Kerr, M.M. & Ragland, E.U. Effects of peer-mediated social interaction and prompting/reinforcement on the social behavior of autistic children. Journal of Autism and Developmental Disabilities, 1979, 9, 41-54.

Strain P.S., Kerr, M.M. & Ragland, E.U. The use of peer social initiations in the treatment of social withdrawal. In P.S. Strain (Ed.), The utilization of classroom peers as behavior change agents. New York: Plenum Press, 1981.

Strain, P.S., Shores, R. & Kerr, M.M. An experimental analysis of spillover effects on the social interaction of behaviorally handicapped preschool children. Journal of Applied Behavior Analysis, 1976, 9, 31-40.

Strain, P.S. & Timm, M.A. An experimental analysis of social interactions betweeen a behaviorally disordered preschool child and

her classroom peers. Journal of Applied Behavior Analysis, 1974, 7,, 583-590.

Varni, J.W., Lovaas O.I., Koegel, R.L. & Everett, N.I. An analysis of observational learning in autistic and normal children. Journal of Abnormal Child Psychology, 1979, 7, 31-43.

Walker, H.H., Greenwood, C.M., Hops, H. & Todd, M.M. Differential effects of reinforcing topographic componets of social interaction. Analyis and direct replication. Behavior Modification, 1979, 3, 291-321.

Wing, L., Yeates, S.R., Brierley, L.M., & Gould, J. The prevalence of early childhood autism: A comparison of administrative and epidemiological studies. Psychological Medicine, 1976, 6, 89-100.

Young, C.C. & Kerr M.M. The effects of a retarded child's social initiations on the behavior of severely retarded school-aged peers. Education and Treatment of the Mentally Retarded, 1979, 14, 185-190.