

AN EXPERIMENTAL ANALYSIS OF "SPILLOVER" EFFECTS  
ON THE SOCIAL INTERACTION OF BEHAVIORALLY  
HANDICAPPED PRESCHOOL CHILDREN<sup>1</sup>

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The effects of prompting and social reinforcement directed to target subjects on their social behavior and that of peers who never received prompting and reinforcement for positive social behavior, were examined. In a combined reversal and multiple-baseline design, three behaviorally handicapped preschool boys who exhibited divergent social behavior repertoires and varied histories with social reinforcement events, were sequentially exposed to intervention conditions in order to investigate "spillover" of treatment effects. Prompting and reinforcement increased positive social behavior and decreased negative social behavior emitted by all target subjects. The results also demonstrated a "spillover" effect on two target subjects, who at various times were not under intervention, and on the peers as well. The findings suggest that: (a) the direct and indirect effects of intervention procedures may be enhanced by designing treatment based on the social repertoire and reinforcement histories of the subjects; and (b) the treatment "spillover" effect may be increased by applying procedures to two children at once, rather than to one at a time.

DESCRIPTORS: peers, social reinforcement, social behavior, preschool classroom, recording and measurement techniques, vicarious reinforcement, behaviorally handicapped preschoolers

In recent years, a growing number of experimental studies has been concerned with promoting constructive social interaction among preschool children (Buell, Stoddard, Harris, and Baer, 1968; Harris, Johnston, Kelley, and Wolf, 1964; Hart, Reynolds, Baer, Brawley, and Harris, 1968; Kirby and Toler, 1970; O'Connor, 1969). These studies indicate that the intervener selects a specific behavior, such as cooperative play, and engineers the social and physical environment so that this behavior is maintained.

In a related area of social behavior research, a considerable number of correlational studies (Charlesworth and Hartup, 1967; Hartup, Glazer, and Charlesworth, 1967; Kohn, 1966;

Marshall and McCandless, 1957) indicates that the interactions of preschool children with age-appropriate social repertoires are reciprocal. That is, those children emitting the most positive social behaviors receive the most positive social events from peers and *vice versa*. Similarly, Drabman and Lahey (1974) and Drabman, Spitalnik, and Spitalnik (1974) reported that reduction of disruptive behavior by a problem child may result in the target child receiving more positive sociometric ratings by peers. Strain and Timm (1974) reported results suggesting that changes in the rate of positive social responses by the recipient of contingent adult attention may be accompanied by comparable changes in the social behavior of interacting peers. Viewed together, these correlational and functional analysis data suggest that as a child increases his rate of emitting positive social behaviors, his peers will in turn increase their rate of emitting positive social behaviors toward him.

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In numerous studies when a target child's appropriate academic behavior has been modified, desirable behavior changes have been observed in nonreinforced peers (*e.g.*, Broden, Bruce, Mitchell, Carter, and Hall, 1970; Hall, Lund, and Jackson, 1968; Kazdin, 1973; Surratt, Ulrich, and Hawkins, 1969). This "spillover" effect has been conceptualized under the general rubric of vicarious reinforcement (Bandura, 1971), or the incidence of behavior change that results from the individual observing the delivery of reinforcement to another. Although learning mediated by vicarious reinforcement seems to be a reliable laboratory phenomenon, its operation in natural settings is less clear. The results reported by Strain and Timm (1974) may readily be interpreted as evidence of vicarious reinforcement effects on social interaction. However, a number of critical theoretical and practical questions remain unanswered. For example, are there differential effects on nonreinforced children with dissimilar behavior repertoires and reinforcement histories? How might a "spillover" effect be enhanced in applied settings?

The present investigation extends prior research by attempting to answer the questions: (a) do the individual behavior repertoires of nonreinforced (peer group) children affect the degree of "spillover" observed; and (b) can "spillover" effects be effectively used in applied settings to maximize behavior change and make intervention more efficient?

## METHOD

### *Setting*

The investigation was conducted in the language classroom unit of the Regional Intervention Program, an early education center for behaviorally handicapped preschool children operated by the Tennessee Department of Mental Health, Nashville, Tennessee. Language classroom sessions, each 2.5 hr, were conducted five mornings per week. Scheduled activities included a group opening exercise, a group language exercise, a snack time, a free-play period,

a story time, and a group closing exercise. Classroom staff consisted of a parent who served as master teacher and three assisting parents.

Data were collected during the free-play period in which the children were allowed to engage in a variety of self-selected activities. Before this study, no educational interventions had been conducted during the free-play period.

### *Subjects*

Three behaviorally handicapped preschool boys (Dan, Hank, and Ricky), enrolled in the language classroom, were aged between 4 yr one month and 4 yr six months, and displayed numerous behavior problems, including delayed speech, tantruming, and opposition to and withdrawal from parents and peers. Their peers were characterized by disorders ranging from mild language delay with no other marked behavioral deficits, to severe language delay with extremely high rates of disruptive, oppositional behaviors. A total of 10 children was enrolled. The three target subjects were in attendance on all experimental days. Attendance for their peers ranged from two to seven, with a mean of 7.2 children present each day. Two criteria were used in selecting the subjects: (a) regularity of attendance, and (b) low rates of social behavior as determined by an ongoing data collection system.

Considerable variability existed in the social behavior repertoires of the three subjects. Dan and Hank were observed to interact occasionally with peers, but their contacts largely involved the confiscation of toys from other children, or physically abusing their peers. Ricky, on the other hand, was extremely isolated. He usually spent the free-play period sitting alone in a corner of the room, where he was ignored by his peers.

No children employed in the Strain and Timm (1974) study participated in this study.

### *Behavioral Measures*

A behavioral code employing two general classes of interactive behavior, with their posi-

tive and negative topographic features, was used:

- I. *Motor-Gestural*: all movements emitted that cause a child's head, arms, or feet to come into direct contact with the body of another child; 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 hand or hands; hug; holding hands; kiss; wave; 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.
- II. *Vocal-Verbal*: all vocalizations emitted while a child is directly facing any other child within a radius of 0.9 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, pointing) clearly indicate that the child is directing the utterance to another child within or beyond a 0.9-m radius.
  - A. *Positive*  
all vocalizations directed to another child excluding screams, shouts, cries, whines, or other utterances that are accompanied by gestures that indicate rejecting, oppositional behavior.
  - B. *Negative*  
screams, shouts, cries, whines, or other utterances that are accompanied by gestures that indicate rejecting, oppositional behavior.

All motor-gestural and vocal-verbal behaviors were also coded as to whether they occurred (temporally) as "initiated" or "responded"

events in an interaction sequence (see Strain and Timm, 1974).

Two categories of teacher behavior were also recorded:

- I. *Prompting*: all physical and verbal activities by the teacher designed to initiate social interaction between the subject(s) and peers. Physical prompts include such activities as moving a child to where other children are playing; moving a child's hands, feet, *etc.*, in such a way that he engages in some ongoing interaction with peers. Verbal prompts include such comments as, "Let's play with your friends", "You can play this game together", or "Now it's time to play on the slide with Karen".
- II. *Reinforcement*: all positive physical and verbal behaviors of the teacher delivered to the target subject(s) contingent on positive social behavior. A typical teacher reinforcement would be, "I like it when you play with your friends, Hank".

#### *Observation Procedures*

Social behaviors of each subject and peers were recorded for six consecutive minutes (18 total minutes of observation). The order in which the subjects were observed was counterbalanced across experimental days. Interactions occurring in the class that did not involve one of the subjects were not recorded. Recording began 1 min after the signal for free play was given by the master teacher. Entries of social behaviors were made by trained observers using coded symbols and a prepared record sheet (see Figure 1, Strain and Timm, 1974). The behaviors were recorded in continuous fashion. Each target behavior observed was entered as having been emitted by either of the subjects (Dan, S<sub>1</sub>; Hank, S<sub>2</sub>; Ricky, S<sub>3</sub>) or any of the peers (P); as belonging to one of the two general behavior classes; as being either positive (+) or negative (−) in type; and as having been initiated or responded in nature. Contingent teacher-attention events were entered by placing the symbol (t) just above

the appropriate target behavior immediately preceding delivery of the event. Teacher prompts were recorded in a like manner, using the symbol (c).

On reliability assessment days, two observers were seated at a three-station observation desk, each station partitioned from the other. All observations were made from this location. Interrater reliability was calculated by dividing the total number of target behaviors and corresponding topographic descriptors recorded in agreement by that number plus those recorded in disagreement. Agreement was reached only when both observers marked the same behavior ( $S_1$ ,  $S_2$ ,  $S_3$ , or P), the same topographic symbols (+ or -), in the same position (before or after behavior symbol), in the same general class, within the same interval block. A criterion of three consecutive days of reliability at 85% or above preceded formal data collection.

#### *Intervention Procedures*

A combination of verbal and physical prompts, plus verbal praise contingent on appropriate social behaviors, was employed to increase the subjects' rate of emitting positive motor-gestural and vocal-verbal responses. The classroom teacher, who had 3 yr experience in the application of behavior modification programs, served as the experimental agent.

Prompts included such verbal comments as: "Now let's play with the other children", "Pass the block to Steve", or "You can play house together". Physical prompts included the following: leading the subject into the proximity of other children, modelling play with other children, or moving a child's body or body part in such a way that the subject joins in positive interaction with peers. Prompts were given at what the experimental agent considered appropriate times; that is, when a subject was not interacting with peers and when there was no good prospect for initiating such interaction. An example would be a subject standing alone in a corner of the room.

Teacher reinforcement consisted of praise

contingent on the positive social behavior of a subject. Praise was always preceded by the experimental agent calling the subject's name, for example, "Dan, I like it when you play with friends."

On experimental days on which intervention procedures were in operation, the prompting and reinforcement strategy was contiguous with the 6-min time interval during which the target subject was designated as the focal point of observation.

#### *Experimental Design*

The study employed a combination of a reversal and multiple-baseline design (Baer, Wolf, and Risley, 1968). The five stages of the reversal design were:

*Baseline I.* No special instructions were given to the classroom staff. Observation of each target subject and peers continued until a stable frequency of positive and negative behavior was obtained for each subject.

*Intervention I.* The experimental agent implemented the intervention procedures described above. The purpose of this stage was to increase and maintain an increased frequency of positive social behavior for each subject.

*Baseline II.* This stage involved a return to conditions operating during Baseline I, in which no prompting or reinforcement for positive social behavior was provided by the experimental agent or any other adults in the class.

*Intervention II.* Intervention procedures were reintroduced in an effort to replicate the behavior changes exhibited during the Intervention I stage.

*Baseline III.* This stage involved a return to conditions operating during the previous baseline stages. Only Dan and Hank were exposed to this condition.

The temporal sequence in which the reversal design was employed across the three target subjects allowed an ABAB assessment of direct and "spillover" effects of intervention applied to one target subject and to two target subjects treated at the same time.

Since the "spillover" phenomenon implies a spread of the effect of the intervention to individuals not receiving reinforcement, a multiple-baseline strategy was also employed. By having intervention begin with each of the target subjects at different times, it was possible to examine the behavior of these children as individual members of a nonreinforced peer group. This was done to assess differential "spillover" effects on children with divergent social reinforcement histories and differing behavioral repertoires.

RESULTS

Reliability

Reliability checks were conducted on the following experimental days: 3, 10, 15, 20, 25, 31, 35, 40, 44, 50, 53, 58, 61, 65, 70. Table 1 presents the range and mean percentage of observer agreement for each behavior reported.

Table 1

Range and mean percentage of observer agreement for each behavior reported.

Behaviors	Range of Agreement Percentage	Mean Agreement Percentage
Dan		
Positive	79-98	93
Negative	76-97	87
Hank		
Positive	79-100	91
Negative	75-98	87
Ricky		
Positive	79-100	95
Negative	94-100	98
Peers		
Positive	78-100	87
Negative	76-100	90
Teacher		
Prompts	80-100	86
Reinforcements	78-94	84

Teacher Behavior

The range and mean frequency of teacher prompts and social reinforcement events directed toward each target subject during each intervention condition is summarized in Table

2. No prompts or social reinforcement for positive social behavior were observed during the baseline conditions. During no conditions were teacher prompts or reinforcement directed toward any of the peers.

Table 2

Range and mean frequency of teacher prompts and reinforcements directed toward Dan, Hank, and Ricky across each intervention period.

Child	Teacher Prompts		Teacher Reinforcements	
	Range	Mean	Range	Mean
Dan				
Intervention I	10-18	12.6	7-15	12.8
Intervention II	12-19	13.2	8-14	11.9
Hank				
Intervention I	9-15	12.6	7-14	12.2
Intervention II	8-16	12.8	8-17	12.7
Ricky				
Intervention I	10-20	15.5	5-8	6.2
Intervention II	11-19	15.2	5-8	6.5

Subject Response Data

Figure 1 presents the frequency of positive and negative behavior for each subject across all experimental conditions. (Positive and negative behavior data points depict each subject's total, i.e., initiated and responded, motor-gestural and vocal-verbal behavior of a positive or negative type for that day.) Positive and negative data points for each subject include interactions with other subjects and peers as well.

During Baseline I, the subjects engaged infrequently in positive social behavior. Dan's mean frequency of positive behaviors was 1.5, compared to a mean frequency of 4.8 negative behaviors. Hank's mean frequency of positive social behaviors during this condition was 6.2, and for negative behaviors was 5.0. Ricky emitted only four positive social behaviors, and no negative behavior.

As Figure 1 indicates, the initiation of teacher prompting and reinforcement during Intervention I rapidly increased the positive social behaviors of each subject. Dan's mean frequency of positive behavior increased to 17.1,

Hank's to 21.7, Ricky's to 8.5. Negative behaviors for all subjects rarely occurred.

When prompting and reinforcement stopped during Baseline II, each subject's positive social behaviors decreased abruptly as follows: for Dan, the mean was 6.2, for Hank, 7.7, and Ricky, 1.7. Negative behaviors averaged 4.8 for Dan and 5.2 for Hank. Again, Ricky did not emit any negative social behaviors.

Figure 1 indicates that resumption of teacher prompting and reinforcement during Intervention II produced behavior changes comparable to those observed during Intervention I. The mean frequency for positive social behavior emitted by Dan, Hank, and Ricky was 21.8, 24.5, and 8.1 respectively. Only five negative social behaviors were emitted by the subjects during this condition.

During Baseline III, when teacher prompting and reinforcement was withdrawn, positive social behavior by Dan and Hank reduced sharply. The mean frequency of positive behavior was 8.9 for Dan and 2.5 for Hank. Negative behaviors by Dan and Hank averaged 5.7 and 5.0 respectively.

#### *Peer Response Data*

First, consider the target subjects in terms of their baseline status as nonreinforced peers. Examining the multiple-baseline aspects of the design, Figure 1 indicates that initiation of Intervention I procedures on Dan was accompanied by a slight increase in positive social behaviors and a like decrease in negative behaviors emitted by Hank. This effect was not observed for Ricky. Further, when Baseline II began for Dan, Hank's positive social behaviors decelerated immediately and negative behaviors increased. A similar "spillover" effect of treatment on Hank's social behavior was observed when Ricky was under Intervention II conditions. Additionally, during Baseline III, Dan's rate of positive behavior exceeded his rate of negative behavior only when other children were under intervention conditions. Ricky's so-

cial behavior was not affected when intervention was in effect on other children.

Figure 2 presents the frequency of positive and negative behavior per peer involving target subjects across all conditions: baseline periods and intervention conditions in which one or two subjects were receiving prompts and reinforcement on each day. Positive and negative data points for the peers represent initiated and responded, motor-gestural and vocal-verbal behavior involving a target subject during that experimental day divided by the number of peers present that day. No target subject behavior is included in Figure 2.

Figure 2 indicates that peers engaged in more negative than positive interaction with the target subjects during the initial baseline condition. Clear "spillover" effects are indicated for positive peer behavior during the first intervention condition involving only one target subject (Dan). Here, the frequency of positive social behaviors per peer was 2.1. Negative interaction with target children occurred infrequently. This effect was replicated during the second intervention condition involving one subject (Ricky). Here, the frequency of positive social behaviors per peer was 2.7. Figure 2 also indicates that when two target subjects were under intervention procedures on the same day, positive social behavior by peers increased dramatically over baseline and intervention conditions involving only one target subject. In the initial two-subject (Dan and Hank) intervention period, the frequency of positive social behaviors per peer was 4.8, with minimal negative social behavior occurring. Similar results were observed during the second two-subject (Hank and Ricky) intervention period. Here, the frequency of positive social behaviors per peer was 5.2. Negative behaviors occurred on only two of the eight days during this period.

#### DISCUSSION

The major findings were that (a) the intervention procedures directed toward the target

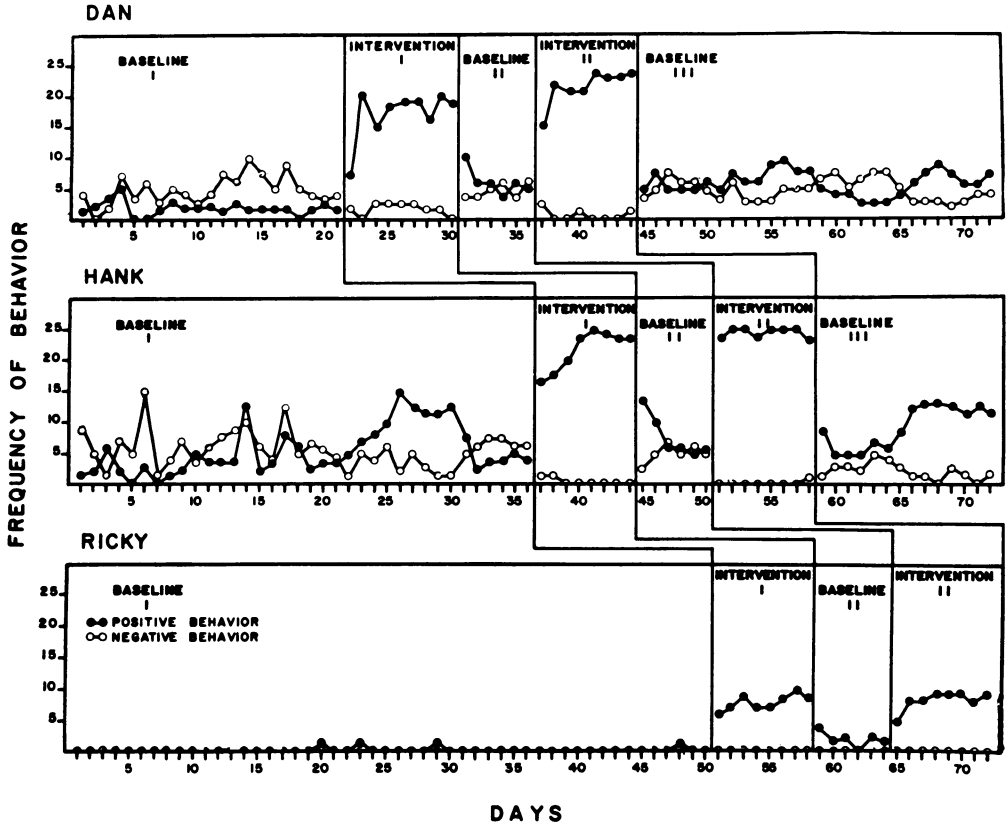


Fig. 1. Frequency of positive and negative behavior for Dan, Hank, and Ricky across all experimental conditions.

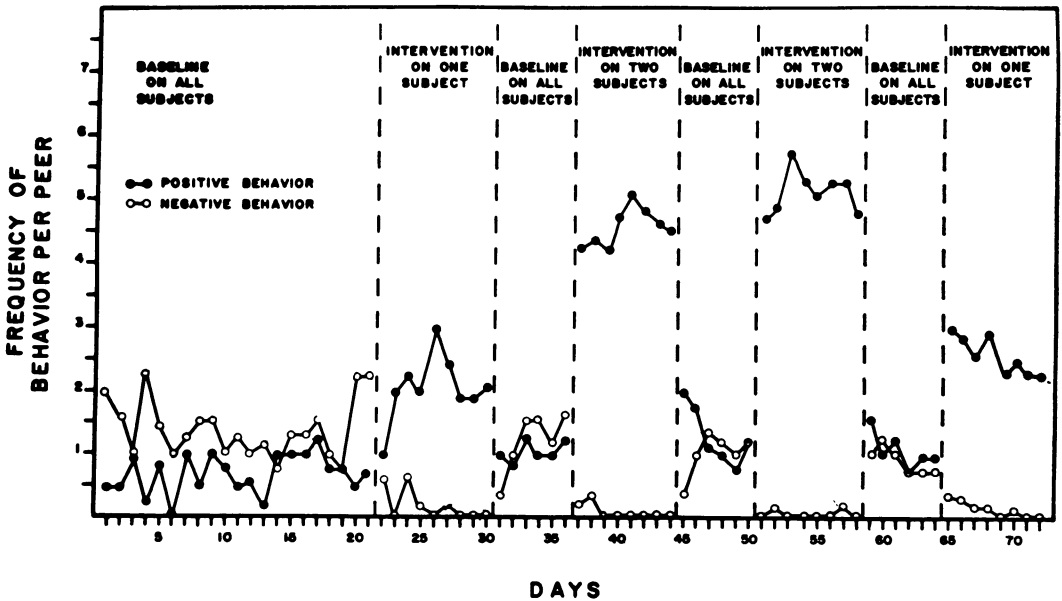


Fig. 2. Frequency of positive and negative behavior per peer involving target subjects across all baseline, intervention on one subject, and intervention on two subjects' conditions.

children reliably increased their positive social behavior, and decreased their negative social behavior, (b) the intervention procedures had differential "spillover" effects among children with different social behavior repertoires and reinforcement histories, and (c) the "spillover" effects were greater when intervention procedures were applied to two children at once, rather than to one at a time.

Several factors seem critical to understanding the differential "spillover" effect observed. From examining the initial baseline behavior of the three target subjects, it is clear that their social behavior deficits were dissimilar. Dan and Hank participated in mostly negative interaction with peers, while Ricky displayed few positive behaviors and no negative behaviors. At no time during the study were any "spillover" effects observed on Ricky. It seems reasonable to assume that his extreme social isolation may have restricted the number of occasions on which he could have observed Dan or Hank being prompted or receiving reinforcement for positive social behavior. Although Dan's social behavior could not have prohibited his observation of fellow subjects receiving prompts and reinforcement, his social behavior was minimally affected by intervention procedures applied to others. Hank's social behavior, however, was reliably altered by intervention procedures applied to other subjects.

If a "spillover" effect may be assumed to rely, in part, on the imitation of the behavior that produced positive consequences, then children with divergent imitative skills should be differentially affected. Some indirect evidence suggests that the subjects differed significantly in their ability to imitate. Specifically, during the study, all subjects were engaged in individual language training using procedures adapted from Garcia, Guess, and Byrnes (1973). In this setting, Ricky's imitative behavior was clearly not under stimulus control. Dan's imitative repertoire consisted of gross and fine motor responses, with a few single word utterances. Hank's imitative repertoire was quite

elaborate, and he was successful in imitating complete sentences up to seven words in length. He also was the only target subject who consistently responded correctly to untrained stimuli during language training.

Another factor that may have contributed to the differential "spillover" effect is the reinforcement value of the consequences. Kazdin (1973) suggested that reinforcement may function as a discriminative stimulus for nonreinforced children's behavior because it signals the likelihood that their behavior will be consequted. Significantly, the subjects' prior and concurrent history with social reinforcement was quite different. In several behavior modification projects in which Ricky had been or was engaged, food was used as a reinforcer. Although social praise was paired with food in these training sessions, social praise alone had little effect in maintaining appropriate responding. Dan and Hank, however, were not given any primary reinforcers in other training programs during the study. Their behavior was under the control of social praise in these settings.

Those results regarding the "spillover" effect on peers who never specifically received prompts or reinforcement parallel the dramatic effect observed on Hank. The similar pattern of response seems reasonable as the members of the peer group closely resembled Hank in terms of their social behavior repertoire and their history with social reinforcement events. An interesting aspect of the peer data is the similarity in peer behavior during the first one-subject (Dan) and the second one-subject (Ricky) intervention period. Although the peers' past history with Dan had been primarily negative, they nonetheless increased their positive social behavior to an amount parallel to that observed when Ricky, with whom they had essentially no social interaction history, was under intervention.

The differential "spillover" effects observed in this study strongly suggest that before undertaking intervention, teachers should assess the social and imitative repertoire of individual children, as well as their past and concurrent history



with proposed consequent events. Such assessment should lead to more effective and efficient intervention, since procedures can be directed to those children whose behavior is least likely to change without direct intervention, while teachers may reasonably expect that the social behavior of children with a repertoire similar to Hank's will improve through "spillover".

An additional point of clinical significance is the differential "spillover" effect on peers when one as opposed to two subjects were under intervention procedures. Approximately twice the amount of positive social behavior was emitted by peers during two- rather than one-subject conditions.

Several characteristics of the setting and intervention procedures may delimit the results. First, the program in which the children were enrolled operated on specific behavioral goals and shaping procedures designed to meet these goals. The social praise events used to consequate positive behavior had a history of occurring exclusively as signals for appropriate responding. However, recent evidence (Paris and Cairns, 1972) indicates that teachers typically do not use praise comments in any contingent, informationally relevant relationship. Second, it is doubtful that the control of teacher behavior that occurred in this study could be reproduced in settings in which the use of reversal designs had not been reinforced by consistent and replicable changes in child behavior.

Finally, the fact that prompting and reinforcement was used as an intervention "package" also restricts the results. Although the data suggest that many nonprompted social responses occurred, the relative contributions of each procedure are unclear. In our current research, the effects of prompting plus reinforcement and reinforcement alone are being evaluated.

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