

EMPLOYING TASK ARRANGEMENTS AND VERBAL  
CONTINGENCIES TO PROMOTE VERBALIZATIONS  
BETWEEN RETARDED CHILDREN<sup>1</sup>

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This study investigated the effects of arranging task events for interdependence, to increase the probability of social responding. During task interdependence, the subjects, participating in dyads and a four-person group, obtained task materials (a puzzle piece) from their partner before completing their task (appropriately placing the puzzle piece). The verbal contingency required a verbal request to precede a subject's receiving a task material from his partner. The verbal contingency yoked with task interdependence made task completion contingent on the appropriate verbalization. The findings from two experiments suggested that task interdependence was sufficient to increase partner-directed verbalizations for three of the four subjects. When the verbal contingency was added, all subjects increased their requests and other verbalizations to partner. Applied to a four-person group, the verbal contingency yoked with varying levels of task interdependence correspondingly affected the pattern and level of group communications. The greater the task interdependence, *i.e.*, the more members each subject depended on to complete his task, the more complex the social network of verbal contacts, and the higher the level of both requests and other verbalizations for the group.

DESCRIPTORS: verbal contingencies, task arrangement, task interdependence, verbal responses, generalization, structurograms, reliability, retardates

Events occurring before and after a child's responses may affect that behavior in predictable ways. When subsequent events such as adult attention (Allen, Hart, Buell, Harris, and Wolf, 1964; Hart, Reynolds, Baer, Brawley, and Harris, 1968; Patterson and Brodsky, 1971), peer attention (Wahler, 1967), and material reinforcers (Whitman, Mercurio, and Caponigri, 1970; Kirby and Toler, 1970) are delivered contingent on a child's contacts with his peers, social interaction with peers increases, and the child's social isolation correspondingly diminishes. In addition, investigators have demonstrated that antecedent events, such as task or curricular activities, facilitate different types of

social behavior. Nursery school reports, for example, suggest that interactions with a single child occur more frequently in block and game areas of the nursery, while parallel play occurs in the art and play areas (Hartup, 1970). More complex social interactions occur during dramatic play (Charlesworth and Hartup, 1967) and in the doll corner (Shure, 1963). For older children, Gump, Schoggen, and Redl (1957) reported that aggressive patterns dominate during swimming and helping responses during crafts. Also, when the individual task is emphasized, interaction decreases. Behavior analysis of antecedent events and their effects on social interaction indicates that reinforcement for using outdoor play equipment will increase social play (Buell, Stoddard, Harris, and Baer, 1968), and some toys produce more social play than others (Quilitch and Risley, 1973).

Laboratory procedures have employed antecedent event arrangements to facilitate coordinated interaction. Hake and Vukelich (1972)

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classified event arrangements employed in these studies by specifying the tasks (interdependent or dependent) that mediate reinforcement. During interdependent tasks, participants depend on each other for task completion and reinforcement, while during dependent tasks, one participant depends on the other for task completion and reinforcement. Hake and Vukelich classified the response requirements mediating reinforcement as response-sharing or response-exchange. In response-sharing (*e.g.*, Mithaug and Burgess, 1968) both participants respond to produce reinforcers for one or both during a single cooperative episode. In response-exchange (*e.g.*, Burgess and Nielsen, 1974) one participant responds to produce a reinforcer for the other during a single cooperative episode. Responses and reinforcers may be equalized over time when participants take turns responding, person one responding for person two's reinforcement and then person two responding for person one's reinforcement.

Although investigations in the laboratory and natural settings have indicated that antecedent event arrangements may affect interaction patterns in significant ways, few studies have demonstrated the efficacy of employing these conditions to remediate social deficits. Usually, deficits in social responding are decreased by arranging reinforcers contingent on an appropriate social response. However, when the desired response is emitted infrequently and the occasions for reinforcement are correspondingly limited, antecedent events could be arranged for task interdependence, thereby increasing the probability of social responding. More specifically, task conditions may be arranged to increase verbal interactions between retarded children, provided that a verbal requirement is included in the condition of interdependence. When a child needs a partner's physical assistance to complete a task, and delivery of that assistance is contingent on the child's appropriate verbalization, then verbal and physical contacts with the partner may increase. On the other hand, the absence of a verbal contingency (when no verbalization is required) may result in the

partner volunteering assistance, thereby eliminating the need for verbal interaction.

In the present study, task interdependence and a verbal contingency were used to increase level and to control pattern of both contingency-required verbalizations and collateral verbal responses between two pairs of retarded children.

## METHOD

### *Subjects*

Four male students enrolled in special education classes at the Experimental Education Unit participated in the study. Three were mildly retarded and one, Grant, was moderately retarded (I.Q. = 55). All students had major language and communication deficits at the time of the study. Grant was 10-yr old and communicated in single words, had no reading or math skills, but had some number recognition. He was occasionally aggressive and did not interact with other children. Don was 12-yr old, had a verbal I.Q. of 75, and was described by teachers as living in a fantasy world and as having difficulty relating to other children. His reading skills were at the preprimer level and math skills were at beginning addition. Martin was 10-yr old, also communicated in single words, was reading at a primer level, and could write his numbers. Tim was 11-yr old, was delayed 2 yr in language skills and diagnosed as having a moderate speech disorder. His teachers described him as being withdrawn and seldom interacting with other children, who occasionally made fun of his speech. His reading skills were at a preprimer level and math skills at the first-grade level.

### *Setting and Task Materials*

All sessions were conducted in a room equipped with two to four desks and chairs and a videotape camera for recording. In Experiment I, the subjects sat facing each other. In Experiment II, dyad partners sat across from each other and beside members of the other dyad.

Each subject had a wooden puzzle consisting of 10 interlocking pieces 0.5 cm in thickness

which fit into 21.6 by 29.2 cm wooden board backing. The puzzles were of a policeman, a turtle, an airplane, and a duck. The pieces ranged in size from 2.5 by 3.8 cm to 5 by 10 cm in area with a wide assortment of shapes.

#### *Definitions and Reliability Procedures*

Two undergraduate work-study students collected data from the videotapes for reliability comparisons with the experimenter, who was a graduate student in special education. All three memorized the response definitions, observed examples of each response category, and practised recording data from videotapes. Each had experience observing and recording behavioral data from videotapes of previous experiments.

The data collected included mutually exclusive categories of *verbal requests* for puzzle pieces, *verbal prompts* for partner to request puzzle pieces, *other verbalizations* exclusive of requests and prompts, and *task initiations* consisting of task material transfers from one subject to his partner.

*Verbal requests* were statements such as "give me . . . , can I have . . . , or (name of item), please", directed to partner to retrieve a needed puzzle piece. Direction of the verbalization was determined by the orientation of the subject's head as well as his arm and hand movements of reaching or pointing towards partner or the needed puzzle piece in partner's possession. *Verbal prompts* were defined as any verbalizations to partner directing him to request a puzzle piece. Examples of such statements included "Grant, say 'may I have the piece, please'", "you're supposed to ask for the piece", and "ask for the piece first". Direction again was determined by orientation of the subject's head and his arm or hand movements of reaching or gesturing. *Other verbalizations* were defined as all other verbal statements directed to partner exclusive of verbal requests and verbal prompts. For all response categories, partner's name also was employed to define the direction of the verbal contact from one subject to another. *Task initiations* were those responses of picking

up a puzzle piece and handing it to partner. The initiation or giving of the piece resulted in a transfer of material to partner.

In Experiment I, the dependent variables were *requests*, *prompts*, *other verbalizations*, and *task initiations*. In Experiment II, which focused on the verbal contacts between all members of a four-person group, the dependent variables were *requests* and *other verbalizations*.

The reliability observers independently viewed the videotapes and recorded every occurrence of a response in each of the four categories. These data were totalled for each trial period during which a subject completed a puzzle. Generally, the subjects completed the same puzzle twice during each daily session.

Reliability values were determined by computing Robinson's Coefficients of Agreement for all observation pairs in each of the four response categories (Robinson, 1957). This correlation-like measure, which is sensitive to response variability, has advantages over Pearson's  $r$  and per cent agreement because it assesses the degree of agreement between each set of observations as well as the relationship between the two observations. Agreement values vary from zero, indicating no agreement, to 1.00, indicating complete agreement. A major difference between this and the more familiar per cent measure is that response variability affects the coefficient of agreement. The per cent measure provides the same reliability value regardless of variation in the data. Robinson's Coefficient of Agreement will yield a higher reliability value for data sequences with greater variance, given comparable differences between sets of observer scores. On the other hand, the reliability values will be lower for data sets with less variance and when most data values are at or near zero levels, again given equal differences between observer scores.

#### EXPERIMENT I

In a previous experiment, Grant and Don from dyad one completed eight-piece puzzles

during task interdependence conditions when a verbal contingency was manipulated experimentally. During the task independence baseline condition, each subject had the puzzle pieces and board backing required to complete his task and earn candy reinforcers. The subsequent conditions were: *task interdependence*, during which Grant had Don's pieces and Don had Grant's pieces; *task interdependence with the verbal contingency*, during which subjects were required to make a verbal request before retrieving a piece for their board backing; *task interdependence without the verbal contingency*; and then *task interdependence with the verbal contingency* again. The results indicated that Grant and Don's request frequencies increased during the verbal contingency. Also, both subjects' other verbalizations to partner increased during the first verbal contingency but decreased during the remaining conditions. One interesting finding was the increase in Don's other verbalizations when task interdependence was introduced following baseline. In the third condition, these levels reached even higher frequencies, suggesting that both task interdependence and verbal contingencies were contributors in the verbal pattern that developed. The present experiment evaluated in more detail these effects of task arrangements and verbal contingencies.

### Procedures

Two dyads, Grant and Don in dyad one and Martin and Tim in dyad two, participated in the 20-min daily sessions.

*Verbal conditions.* A verbal contingency was manipulated in three major conditions. During Conditions I and III, when the verbal contingency was not in effect, the experimenter allowed the subjects to trade puzzle pieces freely without requesting. When the verbal contingency was in effect in Condition II, the experimenter instructed the subjects to request puzzle pieces before retrieving them from his partner. When a piece was retrieved without an appropriate request, the experimenter returned it to partner's desk without comment.

*Task conditions.* During each of the three major verbal conditions, task arrangements followed an *independence-interdependence-independence* change sequence. During *task independence*, each subject had both puzzle pieces and board backing, and was independent of partner in the placing of puzzle pieces and the earning of candy reinforcers. During *task interdependence*, each subject had the board backing while his partner had subject's puzzle pieces. Subject was to obtain pieces from partner, who also was to obtain pieces from subject. During all sessions, subjects received an M&M after properly placing every second puzzle piece on the board backing.

Dyad 1's Condition I lasted 10 days, four days for *task independence*, three days for *task interdependence*, and three days for *task independence*. Dyad 2's Condition I lasted 14 days, seven days for *task independence*, four days for *task interdependence*, and three days for the final *task independence*. For both dyads, task conditions changed from independence to interdependence and back to independence at three-day intervals during Conditions II and III.

Reliability checks occurred for at least one session day during each three-day condition and two or more session days for conditions with more than three days. Over half of all daily sessions were checked for both dyads. The two reliability observers independently observed and recorded frequencies of puzzle-piece exchanges (task initiations), requests for puzzle pieces, prompts for partner to request, and other verbalizations to partner. These frequencies were totalled for each puzzle trial. The Robinson's Coefficients of Agreement for each category respectively were: 0.97, 0.99, 0.94, 0.98, for Grant and Don; and 1.00, 1.00, 0.93, and 0.95 for Tim and Martin.

### RESULTS AND DISCUSSION

Figures 1 and 2 present data for the two dyads on task initiations, requests for puzzle pieces, prompts for partner to request, and other verbalizations to partner. During Condition I

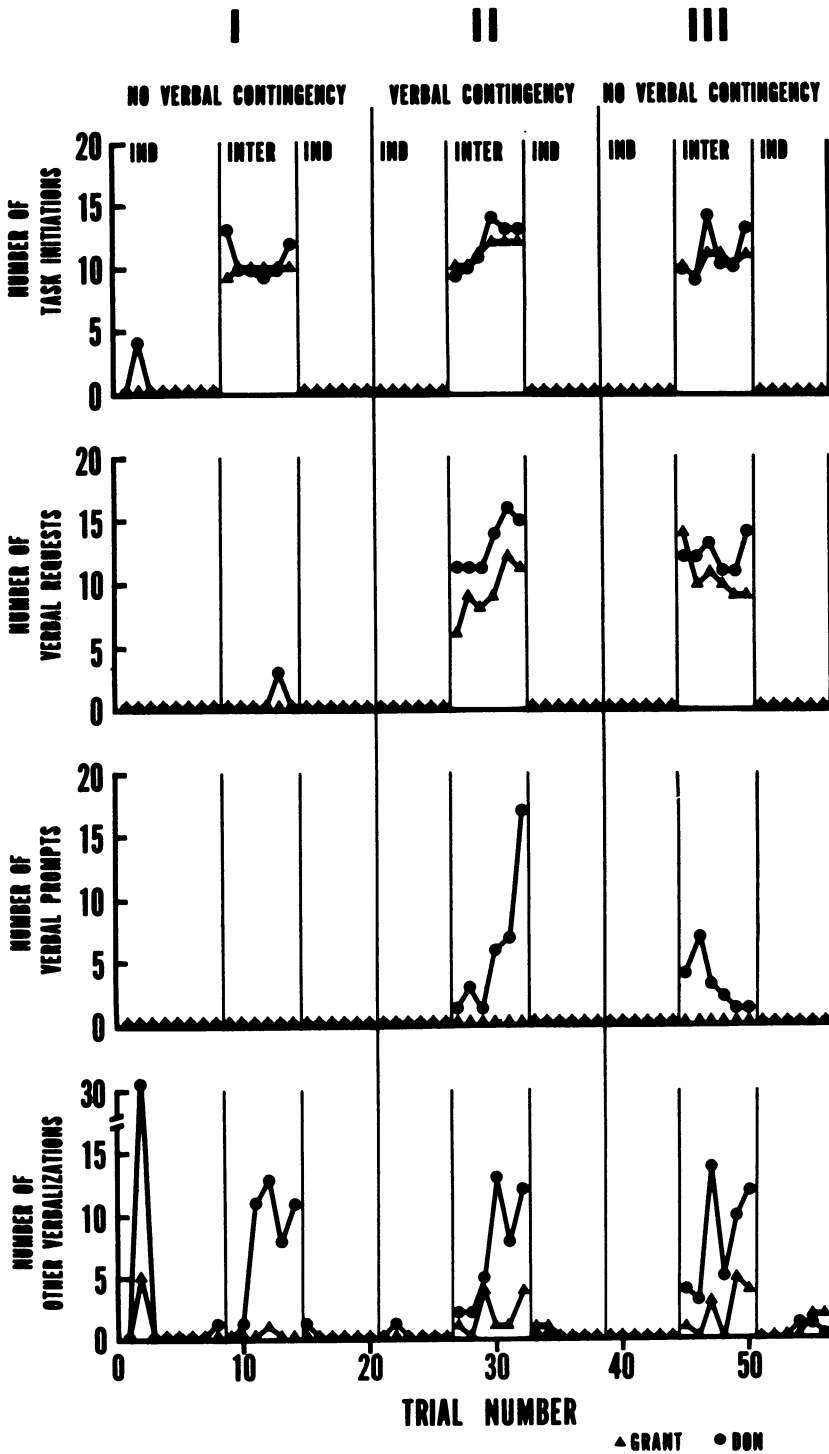


Fig. 1. Grant (triangles) and Don's (circles) frequencies of task initiations, first graph from the top, verbal requests to partner for puzzle pieces, second graph, prompts for partner to request, third graph, and other verbalizations, bottom graph; during the no-verbal contingencies of Conditions I and III, and verbal contingencies of Condition II; as task independence, IND, and interdependence, INTER, alternated within each verbal condition.

task interdependence, Grant and Don exchanged puzzle pieces (task initiations). Martin and Tim, however, failed to solve the interdependence problem. Partner had subject's puzzle pieces and the experimenter would not allow a trading of board backings. On the eighth day (Trials 15 to 17) the experimenter added a third trial (Trial 17) to provide another opportunity for the subjects to initiate puzzle-piece exchanges on their own. When this did not occur, he provided a single cue by suggesting that they trade pieces, with Martin giving pieces to Tim who in turn could give pieces to Martin. Both subjects increased and maintained task exchanges on the eighteenth and subsequent trials. Also during Condition I interdependence, Don, Martin, and Tim's other verbalizations to partner increased. Grant's however, did not.

When the verbal contingency was introduced in Condition II, verbal requests, prompts from Don to Grant and from Tim to Martin, and other verbalizations to partner increased during task interdependence and then decreased during the subsequent task independence. Grant's other verbalizations to partner also increased during Condition II interdependence.

When the verbal contingency was discontinued in Condition III, task initiations, verbal requests, and other verbalizations to partner maintained for all subjects during task interdependence. Prompts from Don to Grant and from Tim to Martin decreased slightly from the previous task interdependence of Condition II.

For Don, Tim, and Martin, other verbalizations to partner were a function of task interdependence during both verbal and nonverbal contingencies. When conditions changed from independence to interdependence, other verbalizations to partner increased, and when conditions changed back to independence these frequencies decreased. Grant's other verbalizations increased during Condition II task interdependence when the verbal contingency was in effect. In Condition III, when the verbal contingency was discontinued, Don's other verbalizations were still controlled by task interdependence,

increasing in its presence and decreasing during task independence.

For all subjects, requests increased in Condition III interdependence when the verbal contingency was no longer in effect. The subjects may have learned to respond to cues associated with the material arrangements during task interdependence. In this regard, the *absence* of the experimenter's contingency instructions in Condition III may have had less effect on the subjects' verbal requests than the stimulus properties of the task, which remained constant. Also, Don's and Tim's prompts, which may have come under stimulus control of task cues, could have been important reminders to request before retrieving a puzzle piece.

In summary, these findings suggest that task interdependence alone was sufficient to generate noncontingency required verbalizations from three subjects, and task interdependence combined with a verbal contingency produced noncontingency required verbal responses from the fourth subject. Furthermore, the verbal patterns that developed during Condition II task interdependence increased again during Condition III interdependence when the verbal contingency was not in effect. Task independence, on the other hand, limited verbal interactions across all conditions. However, during the final independent task condition, noncontingency required verbalizations increased for all subjects. This was a marked contrast to the results obtained in preceding independent conditions, where the levels were near zero.

## EXPERIMENT II

The task interdependence and verbal contingencies that affected verbalizations between dyad members also may determine who verbalizes to whom in a four-person group. For example, different conditions of interdependence between specified members may increase those patterns in comparison to verbalizations with others in the group. In addition, some conditions of member interdependence may produce greater

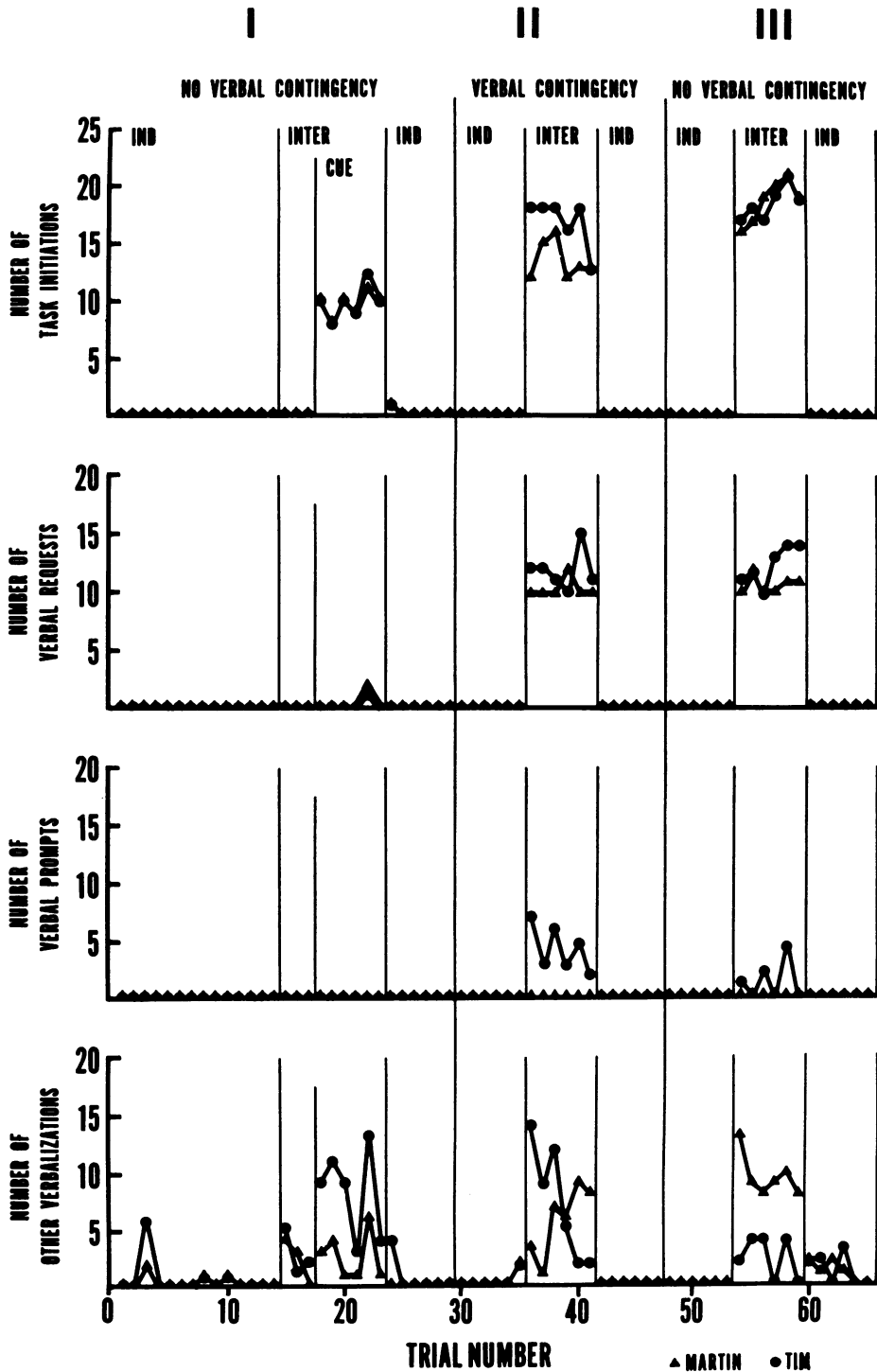


Fig. 2. Martin (triangles) and Tim's (circles) frequencies of task initiations, first graph from the top, verbal requests to partner for puzzle pieces, second graph, prompts for partner to request, third graph, and other verbalizations, bottom graph; during the no verbal contingencies of Conditions I and III, and the verbal contingencies of Condition II; as task independence, IND, and interdependence, INTER, alternated within each verbal condition.

communication levels for the group. This experiment investigated the effects of different conditions of interdependence within a four-person group.

### Procedure

The two dyads from the preceding experiment were combined to form a single four-person group that participated in 14 daily 20-min sessions. The subjects sat across from their partner (Grant across from Don and Martin across from Tim) and beside a member of the other dyad (Grant beside Martin and Don beside Tim). Each had separate and different 10-piece puzzles to complete.

The four condition changes consisted of task interdependence between subject pairs of the same dyad, interdependence between triads, interdependence between subject pairs again, and then interdependence between all four subjects.

During the first condition, *interdependence-2*, which lasted five days, Grant and Don were dependent on each other; Martin and Tim similarly required puzzle pieces from each other.

During the second condition, *interdependence-3*, which lasted three days, each subject's puzzle pieces were distributed between his partner and a member of the adjacent dyad. For example, Grant's pieces were distributed between Don and Tim, Don's pieces between Grant and Martin, Martin's between Don and Tim, and Tim's pieces were distributed between Grant and Martin.

The third condition, *interdependence-2*, which also lasted three days, was the same as the first. Puzzle pieces were distributed between members of the same dyad, Grant and Don's pieces were in each other's possession, and Martin and Tim's pieces were in each other's possession.

During the fourth and final three-day condition, *interdependence-4*, each subject's pieces were distributed among *all* other group members.

During each session, the subjects completed their 10-piece puzzles twice for a total of 28

trials over the 14-day experiment. The verbal contingency was in effect during all conditions. When a piece was retrieved without an appropriate request, the experimenter returned it to partner's desk without comment. As in the preceding experiment, subjects received an M&M candy after appropriately placing every second piece on the board backing.

Two reliability observers independently observed two of the videotaped sessions during the first condition and one session during each of the three subsequent conditions, for a total of five reliability checks over the 14-day experiment. The observers recorded the frequencies of requests and other verbalizations for each puzzle-completion trial. The Robinson's Coefficients of Agreement for observing the direction of verbal contacts between specific partners ranged from 0.90 to 0.99 with a median of 0.97. The agreement coefficients ranged from 0.84 to 0.98 with a median of 0.96 for requests; and from 0.87 to 0.98, with a median of 0.96 for other verbalizations.

### RESULTS AND DISCUSSION

Figures 3 and 4 present verbalization frequencies per puzzle trial for all dyad combinations. The request frequencies in Figure 3 reflect the effects of the interdependent tasks when two, three, and four group members were dependent on each other for puzzle pieces. During the first interdependent condition, when pieces were distributed between members of the same dyad, requests were confined to the Grant-Don and Martin-Tim pairs. During the second interdependent condition, requests between pairs again reflected the puzzle-piece distributions between the Grant-Don, Martin-Tim, and Grant-Tim, and Don-Martin pairs. This pattern dissolved when the two-person interdependent condition was re-introduced in the third condition. During the final condition, when puzzle pieces were distributed among all group members, requests occurred between all possible pairs, indicating again the effects of the puzzle-piece distributions.



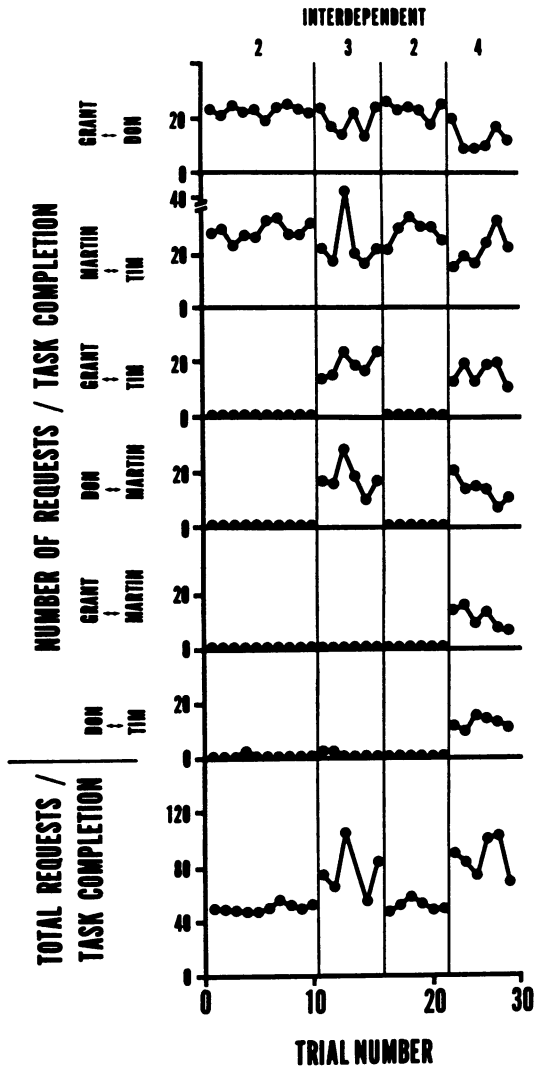


Fig. 3. Subjects' request frequencies during two-person interdependence, 2, three-person interdependence, 3, and four-person interdependence, 4, for the Grant-Don pair in the first graph from the top, the Martin-Tim pair in the second graph, the Grant-Tim pair in the third graph, the Don-Martin pair in the fourth graph, the Grant-Martin pair in the fifth graph and the Don-Tim pair in the sixth graph. The bottom graph presents total requests per trial for the group of four subjects combined.

Also of note were the effects of the four condition changes on the total verbalization frequencies for the group. The bottom graph in Figure 3 presents the total frequencies of requests during the four conditions. Clearly, the three- and four-person interdependent condi-

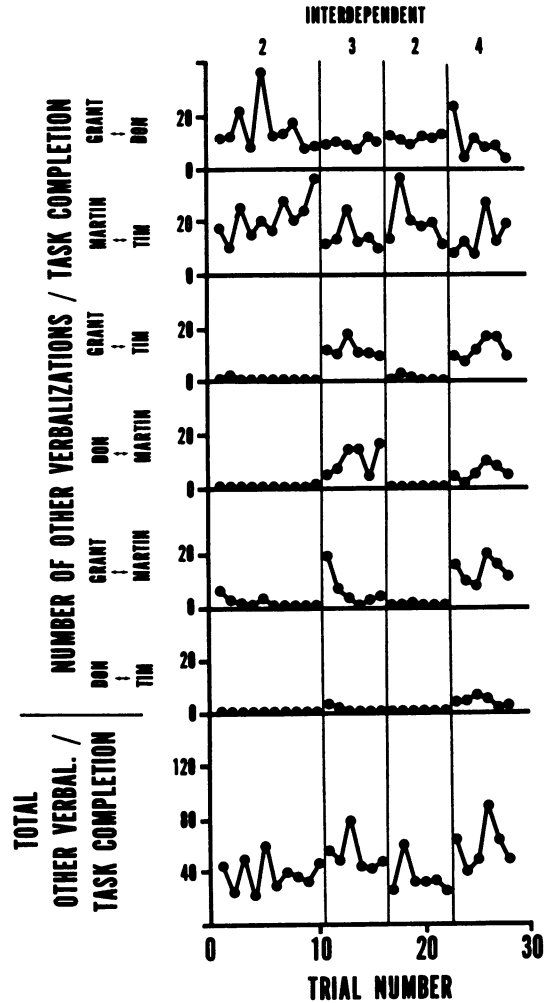


Fig. 4. Subjects' other verbalization frequencies during two-person interdependence, 2, three-person interdependence, 3, and four-person interdependence, 4, for the Grant-Don pair in the first graph from the top, the Martin-Tim pair in the second graph, the Grant-Tim pair in the third graph, the Don-Martin pair in the fourth graph, the Grant-Martin pair in the fifth graph, and the Don-Tim pair in the sixth graph. The bottom graph presents total other verbalizations per trial for the group of four subjects combined.

tions produced more frequent requests (means of 73.8 and 81.2 respectively) than the two-person interdependent conditions (means of 48.8 and 49.3 for the first and third conditions respectively).

Data for other verbalizations in Figure 4 presented similar results. Again, interdependent

conditions affected the pattern and level of verbalizations between subjects, which were higher during the three- and four-person interdependent conditions (means of 51.0 and 58.0 respectively) than during the two-person interdependent conditions (means of 38.6 and 32.0 for the first and third conditions respectively).

The effects of task interdependence on each subject's verbal responses were not shown in Figures 3 and 4, which presented the sum of the contacts between all possible pair combinations, rather than the contributions of individual members to the total frequencies recorded for a given dyad. One dyad member could contribute more to the total than his partner by either requesting or verbalizing about nontask topics more frequently. Furthermore, data in Figures 3 and 4 did not show the effects of task conditions on individual members' response distributions. These questions are addressed in the Figure 5 structurograms which depict the direction, magnitude, and pattern of requests and other verbalizations between all dyad combinations for the four conditions. The length of the arrows from one subject to another is directly proportional to the mean frequency of verbalizations directed between subjects during a condition.<sup>2</sup> For example, during Condition I, the longer arrows from Don to Grant for requests and other verbalizations indicate that Don's verbalizations to Grant were proportionately more frequent than Grant's responses to Don.

For all subjects, the interdependence-2 condition limited requests to members of interde-

pendent dyads, Grant's requests to Don, Don's to Grant, Martin's to Tim, and Tim's to Martin. During interdependence-3, contacts between interdependent members were at higher frequencies than with independent members, *e.g.*, contacts between Don and Grant, and between Don and Martin were greater than between Don and Tim. During interdependence-4, contacts between the formerly independent members increased to levels comparable with those of other interdependent members, *e.g.*, Don-Tim and Grant-Martin contacts increased from the interdependence-3 condition.

Although other verbalizations were distributed in similar patterns, some variations between subjects were evident. Don, Martin, and Tim's other verbalizations were distributed in patterns that corresponded with the condition of interdependence in effect. During Conditions I and III, when each subject depended on one member, verbal contacts with that person were more frequent than with nonresource members. During interdependence-3, other verbalizations to a second peer increased, *e.g.*, Don's contacts with Martin, Martin's contacts with Don, and Tim's other verbalizations to Grant. During interdependence-4, the social network expanded to include the remaining member of the group. Don increased his responses to Tim, Martin increased his other verbalizations to Grant, and Tim increased his contacts with Grant. In both interdependence-3 and interdependence-4 conditions, the expanding social networks were a function of the dependence between subjects for puzzle pieces.

Grant's other verbalizations were the lowest frequencies of the group, and his patterns of contact with other members did not correspond perfectly to the condition of interdependence in effect. His highest levels of other verbalizations were to Don during the first condition. During interdependence-3, this level decreased. Grant's responses to Don and Tim were higher than his other verbalizations to Martin, who was not a resource person during that condition. During the interdependence-2 of the third con-

<sup>2</sup>The length of the initiation arrows connecting subjects was computed by converting mean frequencies into standard scores and adding a constant positive value (the value of the highest negative standard score) to convert all standard scores to positive values. Where  $x$  represents the mean frequency,  $X$  represents the grand mean for all mean frequencies,  $z$  represents the standard score, and  $s$  represents the converted standard score:

$$s = \frac{x - X}{\sigma_s} + 0.94$$

With  $X = 4.41$

$\sigma_s = 4.54$

Highest Negative  $z$  value = 0.94



subject's request in the presence of the discriminative stimulus, task interdependence. The effect of the verbal contingency was to ensure that partner would deliver puzzle pieces contingently. In Condition III, when the verbal contingency was no longer in effect, subject was not required to request pieces, although he continued to do so. Subjects may have learned the discrimination that task interdependence set the occasion when requesting would be reinforced. Partner's continued prompts for subject to request also provided discriminative cues, (*i.e.*, Don and Tim's prompts during Condition III interdependence when the verbal contingency was no longer in effect).

A second factor contributing to the maintenance effects of Condition III interdependence may have been the mutual reinforcement properties inherent in the exchange of puzzle pieces. Subject and partner mediated each other's reinforcement because their response of giving a puzzle piece resulted in reinforcement for partner. In this regard, they were less immediately dependent on the experimenter than on each other to earn reinforcers, although all steps in the sequence were necessary. The experimenter was the final link in the chain of events leading to reinforcement. He delivered a reinforcer to each subject for correctly placing a puzzle piece on the board backing. This arrangement was different from other studies (Allen *et al.*, 1964) where the experimenter played a direct role in reinforcing social responses. In the present study, the experimenter's role during reinforcement was minimized by focusing on the final step in the sequence, one that involved task completion rather than social responding. The more immediate consequence for requesting puzzle pieces occurred when partner gave subject the requested item. To the extent that puzzle-piece deliveries served as conditioned reinforcers (through continued association with reinforcement that occurred at the final step in the sequence) subject and partner were involved in an exchange of reinforcers when they complied with each other's requests for pieces. Maintenance of

this pattern may have depended on each subject's reliability in the delivery of reinforcers to partner. The frequency of subject's request response would then vary with his partner's schedule of delivering pieces contingently. During Condition III, when the verbal contingency was not in effect, the experimenter did not require partner to deliver pieces contingently. A gradual extinction of this pattern would result in partner's intermittently reinforcing subject for requesting.

The results of this study have applied significance, especially for educators interested in developing social skills through the programming of curricular events. One implication is that some tasks or task arrangements promote more interactions between children than others. The present study identified one variable, interdependence, that affected children's interactions while completing a task. Many curricular tasks in the classroom require the responses of only one student to complete. Some of these might be arranged for interdependence, thereby providing a practical and realistic procedure for developing academic skills, while at the same time promoting cooperative interaction. In this study, a popular preschool task traditionally employed with individual children was arranged for task interdependence to promote verbal interactions between several retarded children. A similar approach could be applied to other tasks. Additional research on different tasks and arrangements may be necessary before this approach could be applied with different populations and age groups.

The investigation of task interdependence was expanded in Experiment II by manipulating dependency arrangements between members of a four-person group. In the past, behavior analysis of social interaction has measured the frequency or rate of contact, rather than the pattern or distribution of social responses between several subjects. Sociometric research on choice behavior, however, has measured group structure by assessing the relationship between choices for all possible pair combinations in a

group. The resulting sociogram depicts who chooses whom on such criteria as best friends, work partners, lunch comrades, and so on. It also identifies the overchosen as well as the social isolate who receives few choices at all (Gronlund, 1959). Unfortunately, modification of the social structure in order to remediate social deficits has not been a focus in sociometric research. In this regard, behavior analysis could make a significant contribution. Drabman, Spitalnik, and Spitalnik (1974), for example, reported a study in which sociometric status was shown to be a function of a group token-reinforcement system. The authors concluded that behavior-modification techniques could be employed to change sociometric status.

Experiment II extends this notion to behavioral data by altering the structure of verbal contacts, rather than the structure of sociometric choices. When tasks were arranged for different conditions of interdependence, group members directed more verbalizations toward resource peers than to nonresource peers. In addition, the three- and four-person interdependency arrangements produced higher levels of communication for the group than the two-person interdependence condition. Finally, the structural changes resulting from the task manipulations were presented graphically through structurograms, which, like the sociogram's representation of sociometric test data, depicted specific relationships between each member and all of his peers in the group. However, unlike sociograms, the structurogram provided additional information by depicting contact frequencies with vectors that were proportionate in length to the frequency of contacts directed to the specified peer. This analysis allowed for a detailed accounting of the effects of task conditions on the pattern or distribution of each subject's verbal responses. The data presented in Figures 3 and 4 of Experiment II concealed this information by presenting total contact frequencies for each dyad combination, rather than for individual subjects. Future investigations might consider using data collection and analysis procedures that allow for

a determination of individual effects, while at the same time measuring changes in response distributions at the group level. This is important in sociological research and might be given more attention in behavior analysis. Clearly, the social environment affects and is affected by the frequencies and patterns of a child's behavior. More precise measures of this environment could advance our understanding of the total effects of our treatment programs.

This analysis suggests that a child's social skills may be assessed on criteria other than the rate of his contacts with others or the rate of their contacts with him. Social isolation may occur when a child has but one friend or playmate, or when another child has infrequent contacts with many children. Although both children's total contacts with others may be comparable, the distribution of their responses among their peers could be quite different. Experiment II manipulated interdependence levels to increase each child's range of association with others in the group. This range included contacts with two others during interdependence-3 and with three others during the interdependence-4 condition. An interesting consequence of distributing the dependencies between all group members was an increase in the total communications for the group. One possible explanation is that members competed for "air space" by repeating their verbalizations in order to gain the attention of their intended audience. A second possibility is that subjects who communicated to any or all members of the group produced reaction responses from several, a condition not possible in dyads.

In conclusion, this study offers an alternative approach to remediating social deficits in children whose behaviors militate against employing the frequently successful procedures of strengthening response classes through reinforcement. When social responses are emitted infrequently and occasions for reinforcement are correspondingly limited, antecedent events may be arranged for task interdependence, thereby increasing the probability of social responding.

This study demonstrated the effects of such an approach. When curricular tasks were arranged so that children had to respond jointly to complete the task, social responding increased. When a child wants a toy in another child's possession for example, social contact is more probable than when he has independent access to desired objects. This condition of social dependence suggests that objects of value be mediated by another person, requiring a contact response from the solicitor before his receiving the valued commodity. In this study, the valued object was the puzzle piece (backed by candy reinforcers), the mediator was subject's partner and the social contact required to obtain the puzzle piece was the verbal request. More generally, such requests as for water, food, and so on, are in a class of "responses which vary together with the relevant deprivation. A man gets a drink of water in many ways—by reaching for a glass of water, by opening a faucet, by pouring water from a pitcher, and so on. The verbal operant *water* becomes a member of this group when it is reinforced with water" (Skinner, 1957, p. 32). In much the same way, the request for puzzle pieces, also a verbal operant, was reinforced by a social event, partner's giving of the puzzle piece. What distinguishes the contingencies of this study from the more general conditions described by Skinner, or from the natural conditions of the child's dependence on parent, was that the dependence was mutually shared (or interdependent) by two children with the effect of promoting verbalizations between both.

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