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Using Video Modeling to Teach Complex Social Sequences to Children with Autism

Christos K. Nikopoulos[1] and Mickey Keenan[2]

Abstract

This study comprised of two experiments was designed to teach complex social sequences to children with autism. Experimental control was achieved by collecting data using means of within-system design methodology. Across a number of conditions children were taken to a room to view one of the four short videos of two people engaging in a simple sequence of activities. Then, each child's behavior was assessed in the same room. Results showed that this video modeling procedure enhanced the social initiation skills of all children. It also facilitated reciprocal play engagement and imitative responding of a sequence of behaviors, in which social initiation was not included. These behavior changes generalized across peers and maintained after a 1- and 2-month follow-up period.

Key words: autism, children, video modeling, social interaction, sequences, play.

Introduction

Peer social interactions serve many important functions in children's development and lives generally (Dunn & McGuire, 1992). Essential components of any instance of social interaction are regarded as both the responses and the initiations; that is, social interaction is reciprocal. In autism, however, it is that reciprocity of social exchange that is missing more than anything else (Rutter, Mawhood, & Howlin, 1992), and is manifest as a lack of both social responses and initiations to other people (Roeyers, 1996). In fact, research has demonstrated that children with autism appear to interact socially with peers for limited periods of time if any, make and accept fewer initiations, and spend more time playing alone, in comparison to their peers (Koegel, Koegel, Frea, & Fredeen, 2001). These deficits in the social domain usually persist across time and are observed even in adulthood (Njardvik, Matson, & Cherry, 1999). In particular, children within the autistic spectrum must learn not only to respond appropriately to the social initiations of peers, but also to initiate a social interaction (Oke & Schreibman, 1990). Consequently, not only is it important that any treatment program include teaching and promotion of valuable social skills (Charlop-Christy & Daneshvar, 2003; Hwang & Hughes, 2000), but also that the promotion of social initiation must remain one of the major targets as it may be more impaired than responsiveness (Hauck, Fein, Waterhouse, & Feinstein, 1995; Schopler & Mesibov, 1986).

Moreover, although a number of studies have demonstrated that social and communication skills of children with autism can be improved, a persistent problem

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remains; the establishment of more complex behaviors. That is, a child with autism may need continuous adult prompting to complete a sequence of already learned activities (MacDuff, Krantz, & McClannahan, 1993). Indeed, it has been demonstrated that in the absence of adults' prompts, children with autism are more likely to display stereotypies such as hand flapping, vocal noise, twirling round and round, non-contextual laughter, or other repetitive behavior (McClannahan & Krantz, 1999).

Recently, it has been suggested that video modeling could be an effective and technologically advanced method for supporting and developing appropriate skills in children with autism (Schreibman, Whalen, & Stahmer, 2000). Video modeling, as the name implies, is modeling in which the model is not live, but videotaped (Grant & Evans, 1994). It is a scientifically approved intervention for children with autism that has been used to teach simple but socially relevant behaviors (e.g., Charlop-Christy & Daneshvar, 2003; Charlop-Christy, Le, & Freeman, 2000; D'Ateno, Mangiapanello, & Taylor, 2003; Kinney, Vedora, & Stromer, 2003; Sherer et al., 2001; Shipley-Benamou, Lutzker, & Taubman, 2002; Taylor, Levin, & Jasper, 1999). Currently, however, video modeling has not been evaluated in teaching children with autism to perform complex social sequences. Specifically, it would be useful to examine how many sequences of behavior could be included in individual video clips in terms that effective activity schedules would be constructed using video clips instead of booklets of pictures (cf. McClannahan & Krantz, 1999). This will offer the possibility of a time-efficient and personnel conserving teaching tool (Charlop & Milstein, 1989), as it has the added advantage in that it does not require extensive training prior to implementation for children with autism to imitate short videotaped social interactions (e.g., Nikopoulos & Keenan, 2004a, 2004b, 2003).

Accordingly, the present study comprised of two experiments was designed to examine: a) if video modeling could be effective in building a sequence of social behaviors, b) whether a history of imitating through video is necessary prior to imitating a video of a sequence of different behaviors, c) whether increases in reciprocal play are facilitated when social initiation occurs and d) generalization and maintenance of the behavior changes after one- and two- month follow-up period.

EXPERIMENT 1
Method

Participants

Three children who were attending a special school participated in this study. All children had received a diagnosis of autism by outside agencies according to DSM-IV (American Psychiatric Association, 1994) criteria for autism. After a complete description of the study and its objectives, formal written parental consents were obtained for all of the participants. The Childhood Autism Rating Scale (CARS, Schopler, Reichler, & Renner, 2002) was administered for the adaptive behavior rating of the children. Also, an extensive exploration of the official school records and an especially designed Likert-type scale/questionnaire which was given to the teachers were used for gathering any additional information concerning the behavioral characteristics of these children.

J. was a verbal 6.5-year-old boy, diagnosed with autism and epilepsy. His expressive language consisted of incomplete sentences and he engaged in delayed

echolalia. J. was classified in the mild-moderate range of autism having a score of 31 points on the CARS, with restricted imitation repertoire. The only other records the school had was that he had a formal norm-referenced psychoeducational evaluation indicated a standard score of 86 and a percentile rank of 16. Standard scores indicate how far above or below the average an individual score falls, typically, having an average of 100 and a standard deviation of 15. On the other hand, a percentile is a score that indicates the rank of a student compared to his/her peers (same age or same grade), using a hypothetical group of 100 students. For example, a percentile rank of 50 describes a child who has scored equal to or better than 50% of his/her peers. J. also performed limited interactions with adults or other children, and he had not developed any peer relationships appropriate to his developmental level. He enjoyed solitary activities mainly, such as construction toys, jigsaws, bicycles, and dressing up activities. He often displayed restricted patterns of interest and set patterns of routines and behaviors that were sometimes extremely active and aggressive to others.

P. was a 6.5-year-old boy, having some speech, though it was mainly echolalic. According to the CARS he scored within the range of severe autism, having a total of 41.5 points. The only other records the school had was that he had been evaluated using a psychoeducational assessment having a standard score of 72 and a percentile rank of 3. P.'s receptive language was limited to one- or two-word instructions, he used a few basic non-verbal behaviors to communicate, and he lacked any interaction with other children or adults. He displayed some stereotyped and repetitive motor mannerisms (i.e., whole body movements), non-functional routines or rituals as well as restricted patterns of interest with books or a computer. P. displayed limited play and imitation skills, engaging mainly in stereotyped solitary activities. Likewise J., P., exhibited extremely active behaviors that often were aggressive to others.

S. was 7 years old with autism, having some speech that was mainly echolalic. His score on the CARS was 44 points indicating a severe range of autism, while his nonverbal IQ score had been measured as 79 points in accordance with the Merrill-Palmer Scale (Roid & Sampers, 2004; Stutsman, 1948). S. lacked any interaction or response with other people even in the form of non-verbal behaviors. He displayed restricted imitation and play skills, engaging only in making bubbles or riding a bicycle as well as in stereotyped and repetitive motor mannerisms such as taping furniture with a hard object. He also exhibited extremely active behaviors, which could become aggressive to other children. Other aspects of S.'s behavior included lack of eye contact, limited concentration span, an encompassing pre-occupation with stereotyped and restricted patterns of interest, routines or rituals.

Settings

One semi-naturalistic room of the school was used throughout this study. That is, children viewed the videotapes and were assessed during all conditions in the same room shown in the videotapes. That room measured 3.5 x 6 meters and was completely unknown to all participants. A 17-inch television was used and a chair was placed 1.5 meters away. However, during the assessment sessions a special curtain was employed to cover the television and the chair, making them as invisible as possible. A camcorder mounted on a long tripod with a wide-angle lens was used to

record each session. Due to the room restrictions, it was impossible to prevent the participants having access to that camcorder.

Stimulus materials

Six everyday objects and one toy were used across conditions in this study. These included a ball, a table, two rags, a vacuum cleaner, a plant pot, and a jacket. These objects were selected because all participants were familiar with them, and therefore no specific instructions were required on how to operate these objects appropriately.

In addition, four videotapes were constructed, in which a 10-year-old child with learning difficulties and average social interaction skills was used as a model. Verbal instructions, modeling in vivo, and behavior rehearsal were the techniques used to teach the model how to perform the required behaviors in the videotapes; only this child and the experimenter were shown in each videotape. A peer was selected as a model because findings of previous experiments showed that children with autism could learn equally well from both adults and peers as models (Ihrig & Wolchik, 1988), either familiar or unfamiliar ones (Nikopoulos & Keenan, 2003). In all videotapes, the model was shown emitting a social initiation to the experimenter, before they both together engaged in an activity or a sequence of activities.

Dependent measurements

Data were collected for five behaviors during the maximum five minutes spent in the experimental room:

Social initiation. In the literature, social initiation has been referred to as any motor or vocal behavior directed to another person, when a child with autism begins a new social exchange, distinguished from a continuation of a previous social sequence (e.g., Brady, McEvoy, Wehby, & Ellis, 1987; Hauck et al., 1995). Hence, social initiation in this study was defined as the targeted child approaching the experimenter, emitting any verbal (e.g., "Let's play", "Let's move the table", or "Let's sit down") or gestural (e.g., taking him by the hand) behavior and leading him towards the activity previously viewed on the video. Moreover, following the suggestion made by Cooper (1987), 10 seconds was the response interval between the presentation of the model and the child's behavior in order to be defined as an instance of imitation. In addition, on occasions that the model emitted more than one social initiation in the videotape, then each imitative response of a child was scored separately. A latency recording system was used for measuring social initiation.

Reciprocal play. Reciprocal play was defined as each child engaged in play with the experimenter using the toy in the manner for which it was intended, after he had emitted a social initiation response. For measuring this behavior, total duration and a 10-second partial interval recording system was used.

Imitative response. This behavior was scored only in Condition Video 4 and it was defined as a child displaying each of the three activities previously viewed in the videotape, in the same or similar way as the model had done. For measuring imitative responses a latency recording system was used. The recording for the second and third activity began when a previous activity had been completed.

Object engagement. Whenever a child engaged in isolated play with the available toy (i.e., a ball) was defined as object engagement. A 10-s partial interval recording system was used to measure this variable.

Other behaviors. Whenever a child engaged in a behavior that could not be included in any of the above categories, was scored as other behavior (e.g., standing still or walking, sitting on the table or floor without doing anything specifically, engaging in stereotypic speech). A 10-s partial interval recording system was used to measure the time spent engaged in these behaviors.

Experimental design

A multiple baseline across subjects design (Heward, 1987) was used for the three participants (i.e., J., P., & S.) while data in all conditions were collected in the experimental setting. During all sessions there were no specific consequences delivered to the children contingent on their performance. Two to three sessions were conducted each day, depending on each child's daily routine, each lasting approximately 5 minutes. Between each session was about 5-8 mins break. Thus the total time spent in any one day was approximately a maximum of 30 mins. Because the number of sessions per day varied (i.e., between 2-3) depending on the constraints of daily routines, the first 2-3 sessions of exposure to video modeling could span two days or they could occur on one day.

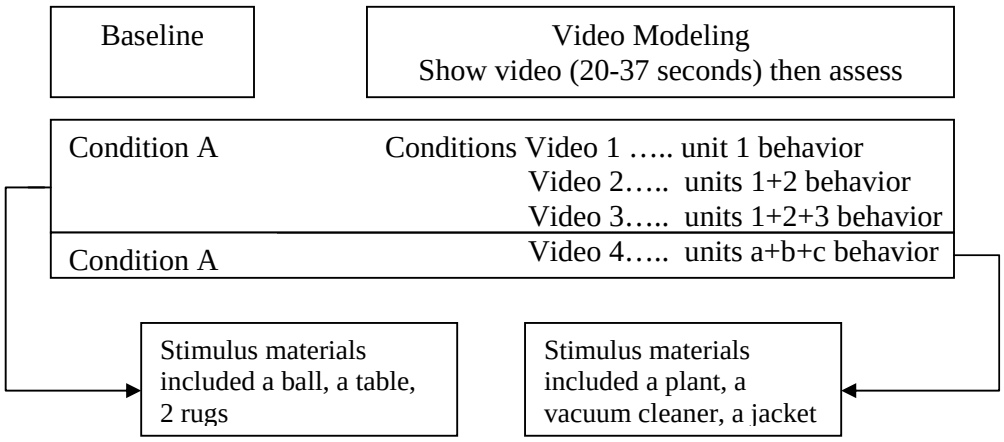
Procedure

Figure 1 gives an overview of the general procedure used for each child.

Baseline. Prior to baseline, the participants were assessed for TV watching. Provided that a child was able to watch TV for at least one minute he experienced baseline assessment. During this assessment there were no video presentations nor was any reference made to the TV, which was hidden behind the curtain in the same room. Both the experimenter and the child entered the room, while the former went and sat on the chair. The experimental materials (i.e., a ball, a table, & two rags or a plant, a vacuum cleaner, & a jacket) were placed on the floor, as they would be shown later in the video during Conditions Video 1, 2, 3, and 4.

Each session was scheduled to last five minutes. During that time, the experimenter's behavior was similar to that later to be shown in the videotapes; that is, he only responded to the children's requests as necessary. An interval of between five to eight minutes separated each session. Then, the child was taken away from the experimental setting to an outside area.

Figure 1.



Video modeling (Conditions Video 1, 2, 3, & 4). During all of the video modeling conditions, each child firstly viewed one of the 20- to 37-second videotapes once, in the room that the subsequent assessment would take place. The duration of each assessment was five minutes, unless the children had imitated the activities shown in the video in less time. During that time, the experimenter's behavior was exactly the same as in the video, responding to the children's requests whenever it was necessary. Following the video presentation, the experimenter covered the TV and the video machine with a curtain to prevent children having a further access to them, and he approached the chair to sit on it. As in the baseline, the stimulus materials (i.e., a ball, a table, & two rags or a plant, a vacuum cleaner, & a jacket) were laid on the floor as in the video.

Across conditions, different videotapes were used; however, the model, the experimenter, and the materials were exactly the same. Thus, in Condition Video 1, each child viewed a videotape of 20 seconds total duration. In that video, the experimenter was shown entering a room with the model, wherein a particular toy near a chair, a table and two rags were positioned in different places. The experimenter sat on the chair and after a few seconds the model approached the experimenter, took him by the hand saying, "Let's play" and led him to that particular toy. Together the experimenter and the model played with the toy for about 10 seconds. When a child succeeded in emitting a social initiation response within the first 10 s and played with the experimenter using the ball in three consecutive sessions, then he experienced Condition Video 3.

In Condition Video 3, each child viewed a videotape which depicted the model engaging in a sequence of three activities with the experimenter within 37 seconds. These modeled activities included playing with a ball, moving a table, and sitting on the rags. Prior to each activity, the model had emitted a social initiation response to the experimenter. That is, when the experimenter and the model had completed the 10-second play with the toy, the model emitted another social initiation, by approaching the experimenter, taking him by the hand saying, "Let's move the table", leading him to the table, and moving the table for 1.5 meters about away. Afterwards, the model emitted one more social initiation, by approaching the experimenter, taking him by the hand saying, "Let's sit down", and finally leading him to sit on the rags. When a child succeeded in emitting a social initiation response within the first 10 s before engaging in each of the three activities shown in the video with the experimenter, then he was transferred to Condition Video 4. This had to occur in three consecutive sessions; otherwise he was transferred to Condition Video 1 for additional three sessions. However, each child was assessed again in Condition Video 3, after he had met the criterion in Condition Video 1. During the reintroduction of Condition Video 3, if a child failed to emit a social initiation and therefore to engage in the modeled activities with the experimenter for a second time, then he was assessed in Condition Video 2.

In Condition Video 2, a child viewed a video of 31 seconds total duration in which the model emitted two social initiations and engaged in two activities (i.e., playing with a ball & moving a table) with the experimenter. Specifically, when the experimenter and the model had completed the 10-s play with the toy, the model emitted another social initiation, by approaching the experimenter, taking him by the

hand saying, "Let's move the table", leading him to the table, and finally moving the table for 1.5 meters about away. This condition did not follow Condition Video 1 as expected, in an attempt to see if a history of imitating one set of behaviors (i.e., emitting a social initiation and playing with a ball) would facilitate the imitation of a sequence of three sets of behaviors. Nonetheless, if a child met the criterion of emitting a social initiation response within the first 10 s before engaging in each activity shown in the video with the experimenter in three consecutive sessions in Condition Video 2 and in the subsequent Condition Video 3, then he experienced Condition Video 4.

Prior to the assessment in Condition Video 4, each child viewed a video which depicted the model alone engaging in three activities within a 35-s time period. This videotape was analogous to the one used in Condition Video 3 in terms of the number of the activities (i.e., three different activities), but different in terms of the type of activities. That is, whereas in Condition Video 3 the three activities were playing with a ball, moving a table, and sitting on the rags, the video in Condition Video 4 showed the model watering a plant, vacuuming the floor, and hanging a jacket. In this video, only the model was depicted and therefore there was not any social initiation response involved. Condition Video 4 was the last of all the video modeling conditions, independently of the children's performance.

Finally, an interval of about five to eight minutes separated each session in all conditions. During that time, each child was taken away from the experimental setting in an outside area where general social praise or edibles were given to each child on some occasions (including baseline) in order to maintain general participation within the experimental context (Tryon & Keane, 1986).

Generalization

Peers (GP). This specific assessment was conducted in the absence of any video display and was exactly the same as baseline. However, a different 11-year-old typically developing peer took part; she entered the room with each participant and then she approached the chair and sat on it. This assessment was conducted after J. had experienced 13 video modeling sessions, P. 21 sessions, and S. 27 sessions, respectively.

Follow-up

Follow-up measures were obtained one and two months after the final measurements had been taken. The procedures were identical to those during baseline, and a total of six sessions were conducted for each child. In addition, the setting during follow-up sessions was identical to the setting used during all baseline, video modeling, and generalization sessions.

Social validity

The social validation of the treatment outcome of this study was assessed by ten mothers of school-aged children. These mothers were not familiar either with the participants or with the objectives of the study. They watched separately in their homes videotaped vignettes that consisted of two baseline and two intervention sessions. These videotaped vignettes depicted one baseline session with the experimental stimuli used in Conditions Video 1 to Video 3, and one session with the stimuli used in Condition Video 4. Also, there was one scene from a video modeling

session in Condition Video 3 and one from a session in Condition Video 4. The scenes were selected and presented in random order. After the observers had been given the definitions of the different behaviors, they had to identify those scenes in which the child emitted social initiations and then engaged in activities with the experimenter. Also, in the scenes wherein the experimenter was not involved, the observers had to identify those scenes that the children used the specific stimuli in the manner for which they were intended. Also, they were asked in which scenes they viewed the children of the study behaving in a way similar to their typically developing children.

Interobserver agreement

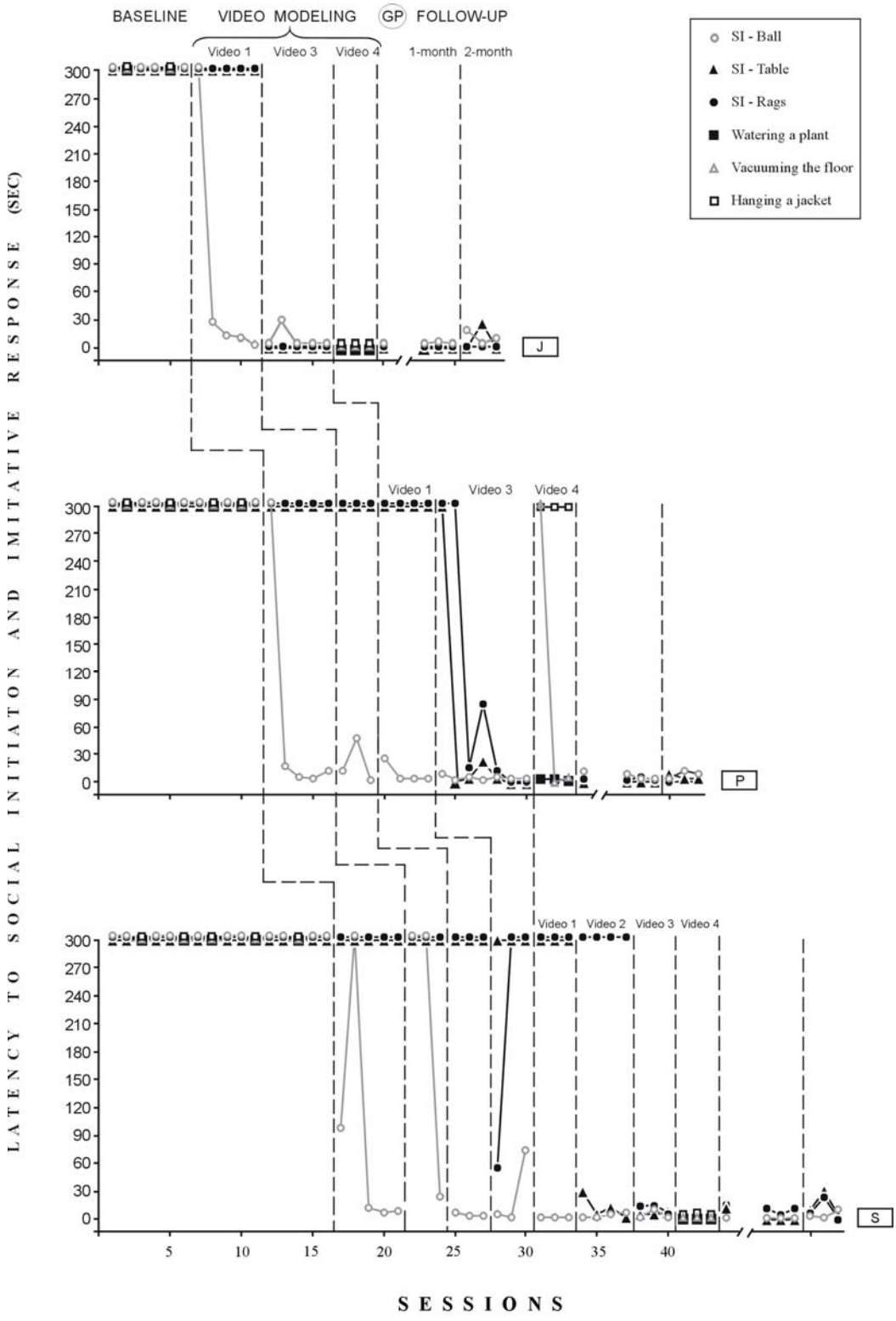
Interobserver agreement is measured to evaluate the quality of the obtained data in any behavioral research. It typically involves comparison of the measurements taken by two or more observers who record their data independently in order to establish their degree of consistency (Sarafino, 2001). This was assessed on 39% of all observations and at least one reliability session was obtained for each child during all conditions. The second observer was blind to the experimental conditions as well as to the objectives of the study. This observer was provided with sufficient training based on videotaped vignettes from the baseline sessions and role play in relation to the definitions of the dependent variables. The percentage of the interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements, and then multiplying the result by 100. Average reliability was 95% (range, 88% to 100%), while the percent agreement across each dependent measurement respectively, was: a) Social initiation 100%, b) Reciprocal play 95% (91% - 99%), c) Imitative response 100%, d) Object engagement 92% (89% - 95%), and e) Other behaviors 90% (88% - 94%).

Results

Latency to social initiation and to imitative responses

Figure 2 shows the results of video modeling procedures for each child during each condition. During baseline, J.' latency to social initiation was at the highest level of 300 seconds. Similar performance was recorded for the set of the three imitative activities (i.e., social initiation is not included) during the second and fifth sessions. When video of one set of behaviors (i.e., social initiation and playing with a ball) was shown in Condition Video 1, the latency dropped to a level of about 7 s within five sessions. J.' performance was similar during the subsequent assessments in Condition Video 3, in which a video of three sets of behaviors (i.e., a social initiation prior to playing with a ball, moving a table, and sitting on the rags) was shown. The same level of about 5 s for J. to emit a social initiation prior to engagement with any activity also occurred during the test for generalization across peers (GP). In Condition Video 4, the time taken for J. to imitate each of the three modeled activities (i.e., watering a plant, vacuuming the floor, and hanging a jacket), was no more than 5 seconds. Similar results were obtained in the first month of follow up, whereas latency to social initiation prior to playing with a ball and moving a table with the experimenter increased slightly for one session in the second month of a follow-up assessment.

Figure 2.



Results for P. were generally similar to those for J. However, P. did not meet the criterion during the first introduction of Condition Video 3 (Session 17). Following four additional sessions in Condition Video 1 wherein P. met the criterion, each social initiation across the three sets of activities occurred at a level of about 6 s in Condition Video 3. This performance also generalized across peers (GP). In Condition Video 4, imitative responding occurred only for the first two activities of the sequence (i.e., watering a plant and vacuuming the floor) in three and two sessions, respectively. During the first and second month of the follow-ups, however, latencies to social initiation remained at very low levels for each set of behavior.

For S., a similar set of results to that for P. was obtained. However, S. did not meet the criterion even when Condition Video 3 was reintroduced (Session 28). Thus, Condition Video 1 was implemented for third time and social initiation occurred within the first 4 s within three sessions. This responding was sustained in the following condition when a social initiation each time prior to playing with a ball and moving a table was required (Condition Video 2). Thereafter, the latency to respond remained at very low levels across all the remaining conditions and the two follow-up assessments.

Reciprocal play

Results for time spent in reciprocal play for all participants can be seen in Figure 3. Thus, in baseline (Sessions 1 – 6) for J. there was no evidence of reciprocal play. When a social initiation occurred after the video viewing during Condition Video 1, time spent in reciprocal play increased substantially to an average of about 235 s per session in that condition. Thereafter, there was a decrease for time spent in reciprocal play across conditions, with an average of about 144 s, 84 s and 89 s during Condition Video 3 and the two follow-ups, respectively.

Time spent in reciprocal play for P. was variable across conditions. However, there was a general increase from a mean of 0 s per session during baseline to a mean of 85.5 s (range, 81 to 105) per session, whenever a social initiation response occurred throughout the study. For S., similar results were also obtained. That is, there was an increase in time spent in reciprocal play from an average of 0 s per session during baseline to an average of 75 s per session during all condition in which a social initiation to the experimenter occurred.

Concurrent behaviors

Figure 4 shows the results for the concurrent behaviors for all the three children. Across all conditions for J., other behaviors which occurred during baseline at a level of about 97%, decreased substantially to a level of near 1%, after the first exposure to Condition Video 1. Instead, imitative responding relevant to each video display predominated at an average of 99% per session. Similar results were obtained for P. and S. That is, there was a general tendency for all concurrent behaviors to decrease at a level of about 1% whenever target responses occurred.

Figure 3.

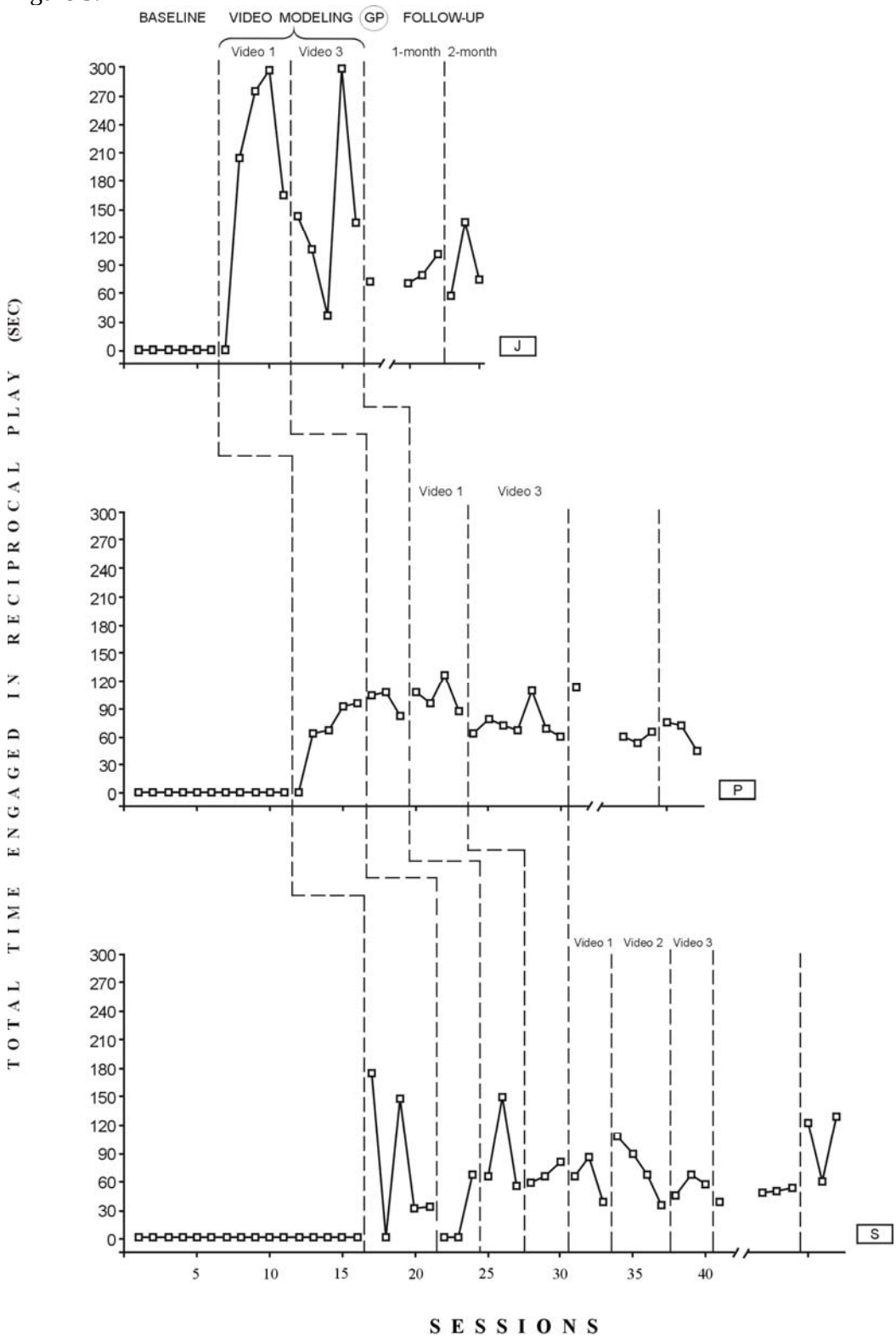


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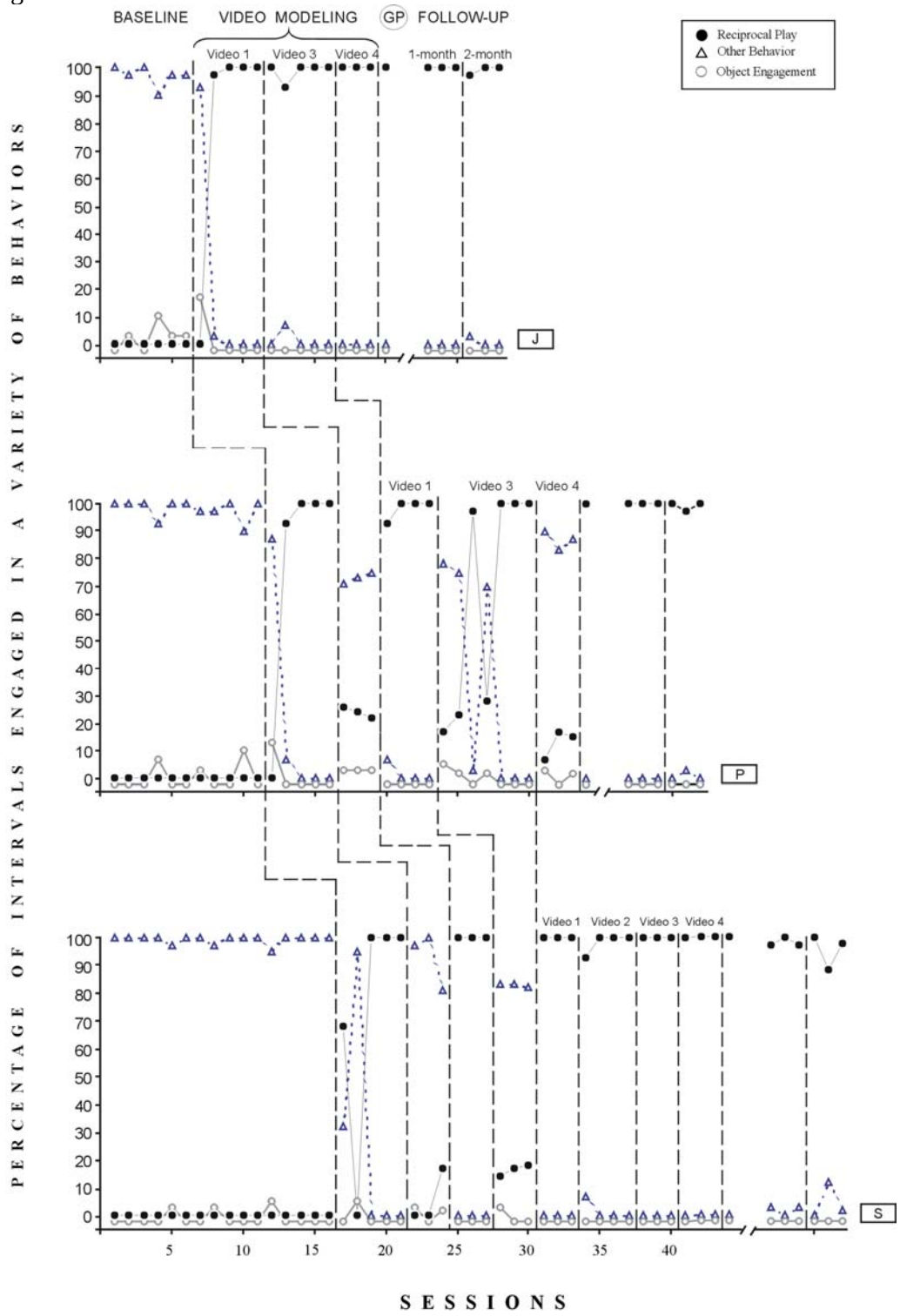
Figure 4.



EXPERIMENT 2
Method

Participant

One girl (i.e., Z.) who was attending the same special school and had been diagnosed with autism by outside agencies participated in this study. The only reason for recruiting this child for this experiment was that she joined the study some time later than the other participants due to illness. As it happened in the previous experiment, the Childhood Autism Rating Scale (CARS, Schopler et al., 2002) was administered for the adaptive behavior rating of the child. Again, the official school records and the same Likert-type scale/questionnaire which was given to the teachers were used for obtaining any relevant information regarding the behavioral characteristics of the child. Likewise, a complete written description of the study and its objectives was given to the parents of the child and formal consent was obtained by them.

Z. was a verbal 7.5-year-old girl, diagnosed with autism. Although she could speak quite fluently, her speech was not always consistent, appearing delayed echolalia. According to the CARS, she scored within the range of mild-moderate autism, having a total of 34.5 points. The only other records the school had was that she had a standard score of 61 and a percentile rank less than 1 had been measured using a norm-referenced psychoeducational report. Z. displayed limited interactions with other children and with adults in the form of compliance mainly. She exhibited limited imitation skills, and she preferred solitary activities such as playing with bicycles, skates or dressing up tasks. She also displayed a few repetitive behaviors (e.g., requesting or asking the same things) and occasionally she followed set patterns of behavior, rituals, or routines.

Settings, stimulus materials, and dependent measurements

This study was implemented at the same school as in Experiment 1, and therefore the same room was used. Thus, during all conditions the child viewed the videotapes and was assessed in the same unknown room shown in the videotapes. In addition, the same everyday objects (i.e., a table, two rags, a vacuum cleaner, a plant pot, and a jacket) and the toy (i.e., a ball) were used across conditions. Also, the same four videotapes were used thoroughly and the same child with learning difficulties participated as a model. Finally, data were collected for the same five behaviors as in previous experiment during the maximum five minutes spent in the experimental room, and using the same measurement systems.

Experimental design

An A-B design was used in this study. During all sessions the data collection was conducted in the experimental setting. As it occurred in Experiment 1, no specific consequences were provided to the child by the experimenter during all of the conditions. Also, as in Experiment 1 two to three sessions were conducted each day while the initial teaching sessions did not take place in any single day.

Procedure

The general procedure is similar to Experiment 1 as shown in Figure 1. As the participant of this study was able to watch videos or TV for at least one minute, there

was no prior training for promoting this skill. Also, likewise in Experiment 1, the procedure included the baseline and the video modeling conditions and an interval of between five to eight minutes separated each session during all conditions. At that time, the child was taken away from the experimental setting in an outside supervised play area.

In general, the procedure of this experiment comprised of the same five conditions as previously (i.e., baseline & 4 video modeling), with one important exception. That is, following the baseline, the child experienced Condition Video 3 instead of Condition Video 1. Thus, Conditions Video 1 and Video 3 replaced each other, and therefore following the baseline the child experienced Condition Video 3 first, wherein a video of three sets of activities had been shown. This was done, in an effort to determine whether a sequence of three sets of behaviors could be imitated when a history of one set of behaviors had not been established or alternatively, whether a history of one set of behaviors was indeed necessary for the child prior to imitating a sequence of three sets of behaviors. Thereafter, the rationale and the criterion performance for the child to be transferred from one condition to another remained the same as in the previous experiment. Similarly, each session lasted up to five minutes and the experimenter demonstrated a behavior exactly the same as in the video, responding only to the children's requests whenever it was necessary.

Generalization and follow-up

As in Experiment 1, generalization across a different peer (GP) was conducted following 12 video modeling sessions in the absence of any video display; therefore it was exactly the same as baseline. Two follow-up measures were obtained (i.e., 1-month & 2-month) and the procedures were identical to those during the baseline.

Social validity and interobserver agreement

The procedure in this social validation assessment was identical to that in Experiment 1, in which the same ten mothers of school-aged children participated. Interobserver agreement was obtained for about 30% of all observations across all conditions and the total reliability was 96% (range, 90% to 100%). Specifically, the percent agreement across each dependent measurement respectively, was: a) Social initiation 100%, b) Reciprocal play 97% (93% - 99%), c) Imitative response 100%, d) Object engagement 94% (91% - 95%), and e) Other behaviors 91% (90% - 95%).

Results

Latency to social initiation and to imitative responses

Figure 5 depicts the results of all video modeling procedures for Z., in relation to the latency to social and imitative behavior. During baseline, Z.'s latency both to social initiation and to imitation of the set of the three modeled activities (i.e., watering a plant, vacuuming the floor, and hanging a jacket) was at the highest level of 300 seconds. In the subsequent Condition Video 3, latency to social initiation decreased to an average of 105 s, but only for engaging with the experimenter in the first activity (i.e., playing with a ball). Video modeling for one set of behaviors (i.e., social initiation and playing with a ball) was then implemented (Condition Video 1) wherein responding met the criterion within the minimum three sessions. This performance sustained thereafter for all sets of behaviors and activities, generalized across peers (GP), and maintained at one- and two- month follow-up measurements.

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Reciprocal play

The results for time spent in reciprocal play for Z . are shown in Figure 6. During baseline there was no evidence of reciprocal play which remained at a level of 0 s per session. After the first exposure to video display (Session 7) time spent in reciprocal play increased substantially at an average of about 109 s per session during the video modeling procedures (Conditions Video 1 & 3), and 92 s per session during the two follow-up assessments.

Concurrent behaviors

Figure 7 shows the results for the intervals in concurrent behaviors. In baseline (sessions 1-6), 67.6% of intervals were occupied by other behaviors and object engagement occupied 32.4% of the intervals. In the following condition (Video 3), other behaviors increased at a level of about 79%, while imitative behavior relevant to the first activity shown in the video also increased at a level of about 16% per session. From the introduction of Condition Video 1 (Session 10) and thereafter, target responses predominated at a level of 100% per session. This improved performance generalized across peers (GP) and maintained after 1- and 2- month follow-up assessments.

General discussion

In the present study, all the research objectives were addressed successfully; that is, video modeling intervention in all of the four children built a sequence of social behaviors. Also, it was demonstrated that a video clip of three different behaviors was imitated by all children when a history of one or two behaviors had been established. Specifically, it was shown that short video clips (i.e., range, 20-37 secs) resulted in rapid changes in behavior within 9 and 10 sessions of training for Z. and J., while 18 and 24 sessions were required for P. and S., respectively. Moreover, the results revealed that video modeling was effective in building a sequence of three behaviors in which social initiation was not included. Importantly, this occurred without any previous training with the relevant stimuli or videos. Whenever an imitative response occurred, then all the competing behaviors (i.e., isolated object engagement & other behaviors) reduced substantially whereas the levels of reciprocal play increased dramatically. This was a significant finding regarding memory issues as it seemed that independently of how much time the participants spent in playing, they did perform the subsequent behaviors in the absence of any prompt. In addition, successful responding in these children also generalized across peers and was maintained after one- and two- month follow-up period. Furthermore, the social validation assessment showed that the ten mothers of school-aged children recognized the scenes from the intervention conditions in which the participants either emitted a social initiation or used the presented objects in the manner for which they were intended. These mothers further claimed that their own typically developing children would behave in a similar way as the participants did, under those specific circumstances.

It is worth mentioning that, in comparison to J. and Z., additional practice was necessary for the two other participants (i.e., P. & S.) in order that imitation of the sequence of the three sets of behaviors occurred; that is, the behavior had to be trained

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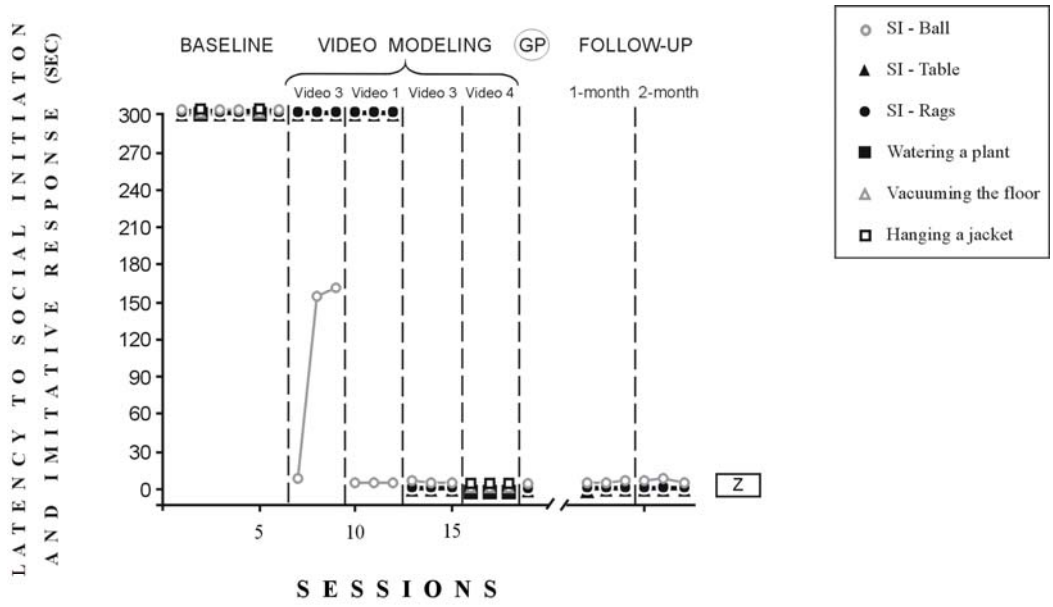
Figures 5 & 6.



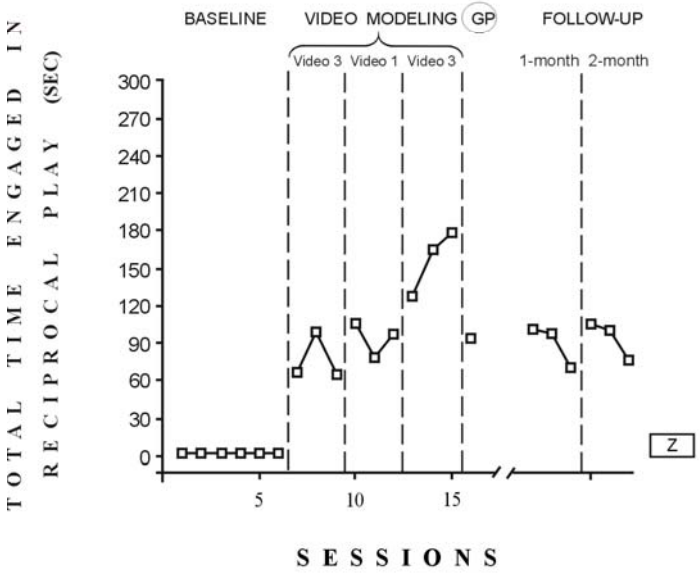
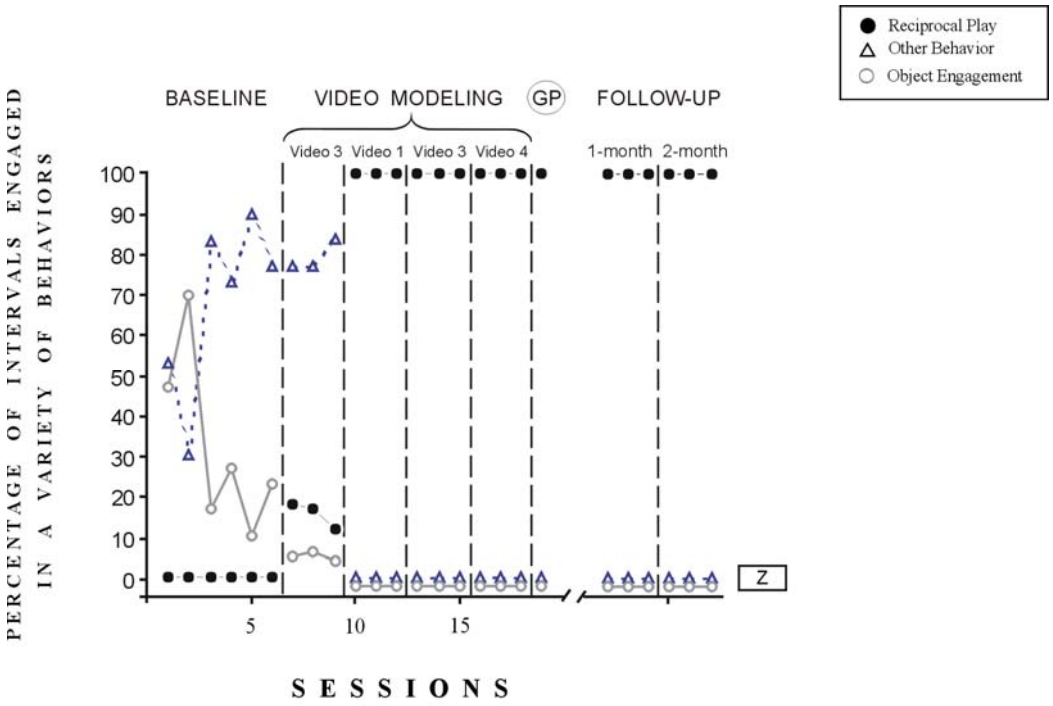


Figure 7.



for a sufficient length of time. Thus, P. had to experience Condition Video 1 twice and S. to experience Condition Video 1 three times and Condition Video 2 once, before they both imitated the whole sequence of behaviors in Condition Video 3. This sensitivity of the experimental design to the behaviors of the participants is an example of the strengths of single-case research designs. Thus, instead of exposing each child to the same numbers of sessions, it is each individual child's behavior that tells the experimenter that he/she is ready for the next condition. It might be a case that because both children displayed only some speech, mainly echolalic, their imitation and verbal or gestural development was also affected (Carpenter, Pennington, & Rogers, 2002). In fact, it has been suggested that abnormalities in social behavior and play are more severe in children with autism with very limited language than in those who have some speech (e.g., Lord & Pickles, 1996). Indeed, the fact that both children J. and Z. were verbal – along with their similar scores on the CARS – provides further support on the suggestion that there is a relationship between social functioning and language development in individuals with autism (Ingersoll, Schreibman, & Stahmer, 2001). Nevertheless, anecdotal evidence showed that both of the children with limited language skills began imitating the verbal components presented in the video (e.g., "Let's play", "Let's move the table", or "Let's sit down"). Although, the establishment of pragmatics in language or temporal relatedness (e.g., Duchan, 1986) was not included in the objectives of the current study that was a major accomplishment for these children, as echolalia of children

with autism usually appears to serve important communicative and cognitive functions (Wetherby, Prizant, & Hutchinson, 1998). Indeed, these children's echoic responses along with their gestural movements functioned in promoting the social interactions between them and the experimenter or peer (cf. Stevenson, Krantz, & McClannahan, 2000).

It is common that the behavior gains obtained by children with autism do not generalize in the absence of specific programming for generalized performances (e.g., Charlop-Christy et al., 2000). In order to achieve this, large numbers of training sessions may be necessary to develop behaviors that will be more likely to be exhibited in generalization situations (e.g., Chandler, Lubeck, & Fowler, 1992). In the current study, however, children's performance in Condition Video 4, wherein no previous training or practice had been taken place, demonstrated that video as a therapeutic means can successfully promote generalization across stimuli. The fact that not even the behaviors required in this condition were similar to those in the preceding ones probably indicates that a general tendency for children to imitate a video modeled activity was enhanced. In other words, children's responding in the presence of physically different stimuli might be an indication of a functional equivalence class (Masia & Chase, 1997; McGuigan & Keenan, 2002). In addition, this generalization may have occurred due to the similarities between the environments depicted in the videotapes and in vivo. That is, the nature of a structured testing procedure might minimize distractions and therefore assist the participants to exhibit the imitative responses (McDonough, Stahmer, Schreibman, & Thompson, 1997).

Literature has shown that children with autism usually lack imitative skills (e.g., Garfinkle & Schwartz, 2002), as it also was the case for the participants of this study. However, the successes reported, here, mainly relied on the ability of these children to imitate the modeled behaviors, which may have been facilitated by the video medium. Interestingly, all of the children performed the activities in the same sequence as these had been presented in the video. The same also occurred during the conditions in which the video was not present (i.e., generalization & follow-ups). It might be a case that the stimulus materials (e.g., toy, everyday objects, or models) had been captured close enough together in terms of the two-dimensional TV screen, and therefore all these important cues enhanced the acquisition of the stimulus control of the subsequent successful responding (cf. Rincover & Ducharme, 1987). Moreover, the acquisition and maintenance of the participants' imitative behavior occurred in the absence of any experimenter-implemented contingencies or prompts. This could be attributed to several factors. First, whilst the experimenter lacked of a history of reinforcement with the participants, the latter's responding could be acquired and maintained by naturally occurring contingencies of reinforcement (e.g., Gena & Kymissis, 2001; Kohler & Greenwood, 1986). That is, the video display might have altered the reinforcing effectiveness of the toy/objects as an example of an establishing operation (Nikopoulos & Keenan, 2004a) which was evidenced by the fact that extinction did not occur in any of the generalization situations (e.g., Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998). Second, a history of reinforcement for imitative responding might exist for these participants by the social community prior to the current study (Masia & Chase, 1997), providing an instance of generalized imitation (e.g., Baer & Deguchi, 1985; Young, Krantz, McClannahan, & Poulson,

1994). For example, children's imitative performance during video modeling training could have been influenced by their reinforcement histories with respect to the same or similar stimulus materials (i.e., toys, objects) or to the modeled responses (e.g., social interaction, reciprocal play) (Bondy, 1982). This is consistent with the suggestion that as soon as an imitative response of a person has been reinforced, then that person will tend to imitate other behaviors, even if they contain some apparent elements in common with the imitative behavior that was reinforced (Martin & Pear, 2002). Third, the use of an audio component (i.e., "Let's play", "Let's move the table", or "Let's sit down") in the videotapes could have served as a verbal discriminative stimulus that affected the subsequent responding of the participants. Following this suggestion, video modeling could be examined as an example of rule-governed behavior (e.g., Catania, 1997; Skinner, 1957). Notwithstanding the mechanism responsible for the effectiveness of video modeling, the promotion of the participants' imitative performance was a significant achievement as imitation skills in children with autism provide an important route not only to social learning (Carpenter et al., 2002) and to language development (e.g., Ross & Greer, 2003), but also to the development of interactions with their peers for longer periods of time (Schopler & Mesibov, 1986).

Replication is the essence of believability in research (Schreibman, 2000). Data from the second experiment replicated those of Experiment 1 in that video modeling was shown to be effective in building sequences of at least two sets of three different behaviors. Furthermore, these results confirmed those of the previous experiment in that a history of at least one behavior was necessary to be established before a child with autism imitated a sequence of three behaviors. However, whether this intervention affected the participants' social interaction or ability to follow sequence of behaviors or time spent in reciprocal play under more natural conditions (e.g., in their classrooms or at home) remains unclear. It could be argued that the selection of the children used for the study invoked some sort of bias for the success of the studies. However, the comparisons of baseline performances with experimental conditions that counters this suggestion. In other words, because baseline performances were substantially changed, the experiments are deemed a success. However, like any good study, the findings raise other questions. For example, in what way do IQ scores affect performance? Does age affect performance? Questions regarding sample size are often raised in relation to single-case research designs and have been addressed elsewhere (e.g., Johnston & Pennypacker, 1993). The search for functional relations between dependent and independent variables is advanced if experimental control over behavior can be demonstrated. This we demonstrated for each of the kids, and their individual differences were not masked by group averages. Of course, replication with additional children needs to be addressed in future studies. It could also be argued that S.'s initial increase in reciprocal play and then decrease across subsequent conditions occurred, perhaps, due to the lack of novelty with materials after repeated exposure. This needs to be addressed in future studies because it is not possible to decide on the basis of the current design. Similarly, did J.'s other behaviors decrease over time because he became more familiar to the environment? Again, we need to wait for the findings of future studies. Furthermore, future research could examine how video modeling might facilitate responding in peer group arrangements, as opposed to the one-to-one context of this study.

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Data of the current study suggest that a video modeling intervention could be an alternative method in the design of a prolonged activity schedule (cf. McClannahan & Krantz, 1999) making use of the visual strengths usually observed in children with autism (e.g., Bondy & Frost, 2001; Tissot & Evans, 2003). Unlike activity schedules, however, video modeling did not require any initial instructions or specific training (e.g., graduated manual guidance); it did not demand prerequisite skills such as identification of picture versus background, matching identical objects or picture-object correspondence skills; and also it did not require contingent reinforcement upon the successful imitations, rather an occasional delivery of a general praise or a small tangible reward would help children maintain general responding within the play context. Interestingly, recent efforts to combine the basic elements of these two procedures as a video-enhanced activity schedule have also been shown effective in teaching children with autism a variety of skills (e.g., Dauphin, Kinney, & Stromer, 2004; Kimball, Kinney, Taylor, & Stromer, 2003; Kinney et al., 2003). Yet, it could be argued that although video modeling may be appropriate in some settings, it would not be practical in community settings such as supported employment as opposed to activity schedules or script-fading procedures. Undoubtedly, the usefulness and practicality of video modeling in such settings has to be addressed in future studies. Towards that direction, a few studies have produced preliminary evidence that interventions based on the use of videos could be effective in teaching purchasing shills in children with autism across community settings (Alcantara, 1994; Haring, Breen, Weiner, Kennedy, & Bednersh, 1995; Haring, Kennedy, Adams, & Pitts-Conway, 1987). Nevertheless, the methods developed in these experiments have clarified and determined either the necessary components of a video clip or the appropriate training history in children with autism that would enable video modeling procedures in teaching environments. The establishment of more complex behaviors in the treatment of children with autism still remains a challenge; that is, a child with autism may need continuous adult prompting to complete a sequence of new or already learned activities. Following this research demand, it would appear that the implementation of such time-efficient video modeling techniques holds great promise in the treatment of children with autism in clinical practice. This possibility may be accelerated by recent advances in video and computer technology.

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Figure captions

Figure 1. Overview of the general procedure for Experiment 1. After baseline each child was exposed to a sequence of video modelling conditions. The sequence of conditions varied for each child depending on his/her performance in each condition (see text for sequences for each child). During Conditions Video 1, 2, & 3, the model, the experimenter, and the stimulus materials remained unchanged; during Condition A the same stimulus materials were used. In Condition Video 4 the model and the experimenter were the same as in other conditions. However, new stimulus materials replaced the previous materials; additional baseline sessions (Condition A) were introduced to assess the effects of these materials. Unit 1 behavior stands for social initiation (SI) and playing with a ball, Unit 1+2 behavior for (SI), playing with a ball and moving a table, Unit 1+2+3 behavior for (SI), playing with a ball, moving a table, and hanging a jacket, and Unit a+b+c behavior for watering a plant, vacuuming the floor, and hanging a jacket, respectively.

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Figure 2. Latency to social initiation towards the experimenter and peer and to imitative responses for J., P., and S. during the baseline, video modeling, generalization and follow-up conditions. GP indicates the generalization sessions across peers.

Figure 3. Total time engaged in reciprocal play for J., P., and S. during the baseline, video modeling, generalization and follow-up conditions. GP indicates the generalization sessions across peers.

Figure 4. Percentage of 10-sec intervals of reciprocal play, object engagement, and other behaviors for J., P., and S., during all conditions. GP indicates the generalization sessions across peers.

Figure 5. Latency to social initiation towards the experimenter and peer and to imitative responses for Z. during the baseline, video modeling generalization and follow-up conditions. GP indicates the generalization sessions across peers.

Figure 6. Total time engaged in reciprocal play for Z. during the baseline, video modeling, generalization and follow-up conditions. GP indicates the generalization sessions across peers.

Figure 7. Percentage of 10-sec intervals of reciprocal play, object engagement, and other behaviors for Z., during all conditions. GP indicates the generalization sessions across peers.

Authors' note

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