

ASSESSING STIMULUS CONTROL AND PROMOTING
GENERALIZATION VIA VIDEO MODELING WHEN TEACHING
SOCIAL RESPONSES TO CHILDREN WITH AUTISM

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We taught social responses to young children with autism using an adult as the recipient of the social interaction and then assessed generalization of performance to adults and peers who had not participated in the training. Although the participants' performance was similar across adults, responding was less consistent with peers, and a subsequent probe suggested that the recipient of the social behavior (adults vs. peers) controlled responding. We then evaluated the effects of having participants observe a video of a peer engaged in the targeted social behavior with another peer who provided reinforcement for the social response. Results suggested that certain irrelevant stimuli (adult vs. peer recipient) were more likely to exert stimulus control over responding than others (setting, materials) and that video viewing was an efficient way to promote generalization to peers.

Key words: generalization, social skills, video viewing

Research has identified a number of effective procedures for teaching social responses to children with autism, including the use of play scripts (Goldstein & Cisar, 1992), prompt-delay fading and reinforcement (Charlop, Schreibman, & Thibodeau, 1985), and video modeling (Marzullo-Kerth, Reeve, Reeve, & Townsend, 2011). In many of these studies, children were taught to initiate social behavior with adults (typically the trainers) even though the ultimate goal was to promote relationships with peers. Arranging adults to serve as recipients of social interaction is convenient and efficient, because it eliminates the need to recruit and train similar-

aged peers to participate in social skills programs. The aim is for skills acquired with adults to generalize to peers who did not participate in the intervention.

Nonetheless, few studies with adults as recipients of the social interaction evaluated whether the skills generalized to peers, although a number of studies assessed generalization to other novel adults or to family members (e.g., Charlop et al., 1985; Charlop-Christy & Kelso, 2003; Gena, Krantz, McClannahan, & Poulson, 1996; Matson, Sevin, Fridley, & Love, 1990). More commonly, studies that examined generalization of social skills to peers included peers in training (e.g., Delano & Snell, 2006; Krantz & McClannahan, 1993; Sarokoff, Taylor, & Poulson, 2001). Although successful generalization of social skills across adults or peers has been reported (e.g., Charlop et al., 1985; Krantz & McClannahan, 1998; Williams, Donley, & Keller, 2000), a number of studies found that participants' performance levels in the generalization context were below that in training (e.g.,

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Charlop-Christy & Kelso, 2003; Delano & Snell, 2006; Leaf, Dotson, Oppeneheim, Sheldon, & Sherman, 2010; Thorp, Stahmer, & Schreibman, 1995; Woods & Poulson, 2006).

Several factors could be responsible when a participant's level of responding toward adults is not comparable to that directed toward peers. In particular, irrelevant stimuli in the training context (e.g., physical features or responses of the recipient), alone or in combination with relevant stimuli, may have gained control over the trained response (e.g., Rincover & Koegel, 1975; see also Kirby & Bickel, 1988, for discussion). The presence of an adult versus peer *per se* also may set the occasion for differential responding as a result of a child's different reinforcement history with adults and peers. Moreover, generalized responding may extinguish rapidly if the type, amount, or schedule of reinforcement provided by the peer is not adequate to maintain the level of performance observed during training (Foxy, McMorro, Bittle, & Ness, 1986).

When teaching children to interact appropriately with others (e.g., share toys when requested), the target responses should come under control of the relevant motivating and discriminative conditions (e.g., a person asking the child to share) rather than features of the training setting that are considered irrelevant to the target response (e.g., specific person, location or types of toys). Few studies, however, have focused exclusively on generalization or evaluated potential sources of stimulus control that set the occasion for the response during social skills training. Generalization typically has been assessed by conducting a few observations (i.e., probes) immediately after the participants acquired the target responses. Furthermore, multiple dimensions of generalization often were evaluated simultaneously, making it difficult to identify the sources of control responsible when responding fell below trained performance during generalization tests. For example, changes in person have been combined with changes in other factors, such as the setting or materials (e.g.,

Charlop, Dennis, Carpenter, & Greenberg, 2010; Leaf *et al.*, 2012; Marzullo-Kerth *et al.*, 2011).

The literature would benefit from more systematic evaluations of generalization. Such analyses should include repeated assessment of performance under generalization conditions, along with continued assessment of performance under the training conditions, (a) to compare levels of performance under the different stimulus conditions, and (b) to ensure that the skills would be maintained. In Williams *et al.* (2000), for example, experimenters taught children with autism to ask questions about hidden objects. Throughout all phases, each participant's mother conducted a generalization session in the living room of her home immediately after the experimenter conducted a training session in the child's bedroom. Examination of the data revealed that the children's performances were similar in the training and generalization contexts. This outcome, however, might have been obscured if the experimenters had assessed generalization just once or twice after training, because the children's level of responding was quite variable.

In addition to repeated assessment, further analyses of generalization should include systematic strategies for identifying relevant or irrelevant sources of stimulus control, particularly when responding does not show the level or type of generalization desired (e.g., Halle & Holt, 1991; Rincover & Koegel, 1975), along with interventions to promote generalization. A burgeoning literature has shown that video modeling, either alone or combined with prompting and reinforcement, is highly effective in teaching a variety of social skills (Charlop & Milstein, 1989; Charlop *et al.*, 2010; Marzullo-Kerth *et al.*, 2011). The use of videos may be ideal, particularly for promoting generalization from adults to peers. Videos offer a practical way to expose viewers to multiple exemplars of recipients (i.e., peers) and other irrelevant stimuli (setting, materials) that could gain control of responding

during training sessions with an adult (Ducharme & Holborn, 1997).

In this study, we focused on generalization from adults to peers during social skills training because of the limited research in this area and the importance of ensuring that skills taught within the context of interactions with adults generalize to peers. The analysis included repeated assessment of generalization to both novel adults and peers while the participants continued to receive maintenance sessions in the training context. We also assessed the role of two additional potential irrelevant sources of stimulus control (setting and materials) that could have been responsible, at least in part, for reduced performance during sessions with peers. Finally, we evaluated the effects of video viewing on performance during generalization probes.

METHOD

Participants, Settings, and Materials

Participants included four children who had been diagnosed with autism by a professional unassociated with the study. The participants, who were recruited from a day center that specialized in intensive behavior-analytic therapy for children with autism and other developmental disabilities, reportedly would attend to short (at least 2 min) video clips. All participants attended an integrated classroom, which consisted of four to six children with autism and at least eight typical children, during 50% of their instructional time at the center. John was a 4-year-old boy who spoke in complex sentences and requested items using sentences of four words or more. Emma was a 4-year-old girl who spoke in three-word simple sentences. Staci was a 6-year-old girl who spoke in complex sentences consisting of up to six words. Mike was a 6-year-old boy who spoke in three-word simple sentences.

Five typical children who were members of the integrated classroom served as the peers during generalization probes. The peers, one girl

(designated Peer 4; see further information below) and four boys, ranged in age from 3 to 5 years. They were chosen based on having regular attendance at the treatment center, no diagnosed disability, average social competence as determined by the classroom behavior analyst, and parental consent to participate. The typical peers were rotated randomly during the study, so that every typical peer was paired with every participant with autism at some point in the study. Four adult therapists at the day-treatment center who did not work with the participants outside the study also participated in generalization probes. All adult participants were female and between the ages of 24 and 27 years. The first author, a 26-year-old woman, served as the therapist during the training sessions. All adults also were paired with every participant with autism at some point during the study.

The study took place at the day-treatment center. Baseline and training sessions took place in a single, unused room at the facility. Generalization probes were conducted in four different settings, as shown in Table 1. Settings included the integrated classroom, a large playroom area, a small playroom area, and the participant's one-on-one treatment classroom. The integrated classroom and playroom areas contained numerous play activities, tables, and chairs. The participant's one-on-one treatment classroom contained five to six desks. Sessions took place at the participant's assigned desk. Other students were occasionally present in these settings.

An activity or toy was present during all training and generalization sessions. Toys were chosen based on results of a multiple-stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996; see Table 1). During the video viewing condition, the experimenter used a laptop to show social skills modeling videos created prior to training. Each video was filmed in the training session room and included the same toy used in the participant's training condition. Two videos, each consisting of

Table 1
Settings and Materials for Each Participant

	Participant			
	John	Emma	Staci	Mike
Setting				
S0	Training room	Training room	Training room	Training room
S1	Integrated classroom	Integrated classroom	Integrated classroom	Integrated classroom
S2	Big playroom	Big playroom	Big playroom	Big playroom
S3	Small playroom	Small playroom	Small playroom	Small playroom
S4	One-on-one classroom	One-on-one classroom	One-on-one classroom	One-on-one classroom
Materials				
M0	iPad	Dolls	Play-doh	iPad
M1	Puzzles	Fire truck and house	Markers	ABC toy
M2	Cars	Play-doh	Glitter and stickers	Leapster
M3	Blocks	iPad	Blocks	Computer
M4	Trio game		Trio game	Movie

different peer models who were not involved in any other aspect of the study, were created for each participant. The peer models performed the participant's target response once on each video. A total of four different peer models (one girl and three boys, aged 3 years to 5 years) appeared in the videos.

Response Measurement and Reliability

Each participant's assigned behavior analyst at the treatment facility was consulted about the most appropriate social response to target. Three participants (John, Emma, and Mike) had trouble during turn-taking situations. They did not ask for items to be returned and sometimes engaged in problem behavior in these situations. John was taught to say "Give it back, please" within 5 s of an item being taken from his hands. Emma and Mike were taught to say "my turn" within 5 s after a 1-min timer sounded indicating that the other person's turn with the toy was finished. Staci did not spontaneously help others or respond to requests from others. She was taught to ask "What do you want?" when someone indicated a desire for something and Staci was in possession of more than one play item. For all participants, the targeted social response was considered incorrect if it was emitted at the same time as problem behavior;

however, this never happened. Once a target behavior was chosen, the experimenter instructed the children's therapists to refrain from prompting the specific targets outside experimental sessions.

Trained therapists who conducted the training sessions collected data on a trial-by-trial basis using paper and pencil during baseline, training, generalization probes, and video viewing sessions. During generalization probes, the therapist collected data outside the room by observing through a one-way observation panel. Data on correct unprompted occurrences of the target response, as defined above, were expressed as the percentage of trials with a correct response by dividing the number of trials with a correct response by the total number of trials in the session. Data on the type of prompt required for the participant to exhibit the correct response also were collected during training sessions.

Observers collected data on procedural integrity during at least 40% of baseline and training sessions for each participant. A trial was scored as correct if the therapist set up the opportunity for the participant, delivered a prompt when necessary (training sessions only), delivered reinforcement according to the designated schedule (training sessions only), and responded correctly to the target response. Procedural integrity was

100% for each participant. The experimenter (first author) collected procedural integrity data during all generalization probes. For John, a correctly implemented trial was scored if the adult or peer returned the item within 5 s of John saying, "Give it back, please." For Emma and Mike, a correctly implemented trial was scored if the adult or peer gave the item to Emma or Mike within 5 s of the participant's statement "my turn" when the timer sounded. For Staci, a correctly implemented trial was scored if the adult or peer said, "Give me something to play with," named an item when Staci asked, "What do you want?," and did not accept an item if Staci offered an item not requested. Mean percentage of procedural integrity for the adults was 99%, 100%, 100%, and 99.6% for John, Emma, Staci, and Mike, respectively. Mean percentage of procedural integrity for the peers was 99%, 99%, 100%, and 96%, for John, Emma, Staci, and Mike, respectively.

A second observer independently collected data from outside the room by observing through a one-way panel (baseline and training sessions) or by observing live video feed in a separate room (generalization probes). Interobserver agreement, determined for at least 40% of the sessions for each participant, was calculated on a trial-by-trial basis by dividing the number of agreements by the total number of trials possible and converting the result to a percentage. An agreement was defined as both observers scoring the same response (or lack thereof) in the trial. For targeted social responses, mean interobserver agreement was 100% for John during training sessions and generalization probes; 99% (range, 90% to 100%) and 100% for Emma's training sessions and generalization probes, respectively; 99% (range, 95% to 100%) for Staci during training sessions and generalization probes; and 100% for Mike's training sessions and generalization probes. For adult procedural integrity, mean agreement was 99% (range, 90% to 100%) for John and 100% for the remaining participants. For peer procedural integrity, mean

agreement was 99% (range, 90% to 100%) for John, 99% (range, 90% to 100%) for Emma, 100% for Staci, and 99% (range, 90% to 100%) for Mike.

Design and General Procedure

A concurrent multiple baseline design across participants was used to evaluate the effects of the independent variables on the acquisition and generalization of the targeted social responses. In addition to staggering the introduction of training, we varied the number and timing of the baseline generalization probes across participants. At the beginning of the initial training phase, we learned that Emma (second participant) would be leaving the treatment facility in a few months. To expedite her progression through the study, we introduced her training even though the first participant (John) had not yet shown a clear increase in responding. In addition, after training, she received fewer generalization probes than did the other participants.

Baseline for Training and Generalization Probes

Baseline sessions for the training and generalization probes were conducted 3 to 5 days per week. At least 30 min separated generalization probes with adults and peers. Baseline generalization probes (set of four probes) always were conducted on the same day as the baseline sessions for training. Baseline generalization probes were conducted in the training room with a different peer and different play materials (stimulus control baseline for training setting) and in a different setting with a different peer and the training play materials (stimulus control baseline for the training materials). (See supporting information on the Wiley Online Library or contact the authors for a listing of the specific person, setting, and materials associated with each baseline generalization probe for each participant.) During baseline training sessions, the participant and the therapist were present in the training room, along with the play materials used during training sessions. At the start of

John's and Staci's sessions, the therapist said, "Let's play with [item]." At the start of Emma's and Mike's sessions, the therapist said "Let's take turns." John and Staci had access to the play materials at the start of the session. For Emma and Mike, the therapist had access to the play materials at the start of the session. The therapist presented 10 opportunities for the target response to occur and gave the participants 10 s to respond correctly during each opportunity. They were given 10 s to emit the target response during baseline (vs. 5 s in training) to ensure that a delayed latency to respond was not responsible for the absence of correct responding in baseline.

During John's session, an opportunity to emit the target behavior was defined as the therapist taking the iPad out of his hands, which gave John the opportunity to request the item to be returned by saying "Give it back, please." This occurred once every 1 min. If John did not request the item, the therapist gave John the iPad to arrange a subsequent opportunity unless he was engaging in problem behavior at that time (in that case, the therapist waited until problem behavior had ceased for 10 s). At the start of Emma's and Mike's sessions, the therapist began playing with a box of dolls (Emma) or had possession of the iPad (Mike) and set a timer for 1 min after saying "Let's take turns." When the timer sounded, Emma and Mike had an opportunity to request a turn by saying "my turn." In the absence of a correct response, the therapist reset the timer to 1 min to arrange the next opportunity. Staci sat at a table with the training play materials (a variety of Play-Doh colors and cookie cutters) during her sessions. The therapist sat next to Staci in a location where the therapist could not reach the materials. The session began when the therapist said "Let's play with Play-Doh." Once Staci began to play, the therapist asked for an item by saying "Give me something to play with." This gave Staci the opportunity to ask "What do you want?" If Staci handed the therapist an item without engaging in the response first, the therapist said "I don't want

that one." If this occurred or Staci did not respond at any time, the therapist waited 1 min and then presented another opportunity by saying "Give me something to play with." If the targeted response or a functionally equivalent response occurred at any time during the sessions, the child received the natural reinforcer associated with the response (e.g., if a mand was the target social response, the child was given the item). This occurred once with Emma. If Staci asked the therapist what she wanted and provided the item requested, the therapist said "thank you" and began playing with the item. This occurred once. No other reinforcement was delivered for correct responses during baseline.

Procedures during the baseline generalization probes were identical to those for the baseline sessions described above. The therapist trained the generalization adults and peers through role play before conducting sessions until they met the mastery criterion of five consecutive trials with 100% accuracy. During baseline generalization probes with peers, the peer wore a small Bluetooth in his or her ear. This allowed the therapist to communicate with the peer during the session and provide additional coaching if needed. During sessions with peers, the therapist gave the play materials to the participant (John and Staci) or peer (Emma and Mike) and told the pair to "go play." The therapist then left the room and observed the session through a one-way panel. If the participant displayed any problem behavior, an adult who was not associated with the study entered the room and asked both students to sit quietly. After the participant refrained from problem behavior for 5 s, the play material was returned to the participant (John and Staci) or the peer (Emma and Mike), and the peer was prompted to present the next trial. The adult then left the room. This occurred in every baseline probe with John and his peers. If the participant became aggressive towards the peer, an adult who was not associated with any other part of the study stood behind the pair and remained for the duration of the probe to block

aggression if it occurred. This occurred in every baseline probe with Emma and her peers.

Social Skills Training

The therapist conducted training sessions three to five times per week, one session per day. The participant had 10 opportunities to emit the target behavior during each session. The same materials were used during each training session. The therapist and the participant were present in the training room. At the start of each session, the therapist told the participant, "Let's play" or "Let's take turns." The therapist then set up an opportunity for the target response using the procedures described for the baseline sessions. The therapist taught the target response using most-to-least prompting, prompt fading, and reinforcement. Initially, the therapist delivered the most intrusive prompt (a full model) and then attempted to fade to a less intrusive prompt on each trial. For example, when teaching turn taking, the therapist said, "Say, 'it's my turn.'" The therapist then faded the prompt to a model prompt by saying "It's my turn." On subsequent trials, the therapist faded the model prompt by providing fewer words (e.g., saying, "it's").

If at any time the participant did not respond to a prompt within 5 s, the therapist delivered a more intrusive prompt until he or she responded correctly. The participant received a reinforcer (edible item identified via a preference assessment for John, Emma, and Mike; token for Staci) and praise on a continuous schedule for both prompted and unprompted responses. Because the target responses for John, Emma, and Mike were mands, they received the natural reinforcer associated with the response for 1 min. The therapist then set up another opportunity for the response, as described above. If Staci engaged in the target response and provided the requested item, the therapist said "thank you" and presented another opportunity after 1 min by putting down the play item and requesting another item. As in baseline, Staci had at least 10 extra duplicates of her play materials so that she

could respond appropriately to the therapist's requests. After the child performed the skill independently on 50% of the opportunities, the reinforcement schedule was increased to fixed-ratio (FR) 2. During reinforcement thinning procedures, the natural reinforcer was still delivered on a continuous schedule. After the child performed the skill independently on 60%, 70%, and 80% of the opportunities, the schedule was thinned during the following sessions to FR 3, FR 4, and FR 5, respectively. When the reinforcement schedule reached FR 5, the child received two reinforcers during the session, one mid-session and one at the end of the session. Training continued until the participant emitted the target response independently on 80% of the opportunities across three consecutive sessions. Generalization probes were then conducted.

Posttraining Generalization Probes

Person change only. Procedures were identical to those described for the baseline generalization probes. Generalization to different adults and peers was examined while all other variables were kept constant. The purpose was to determine if the level of performance with the trainer would generalize to other adults and, if so, to peers. By keeping all other variables constant, we tested the potential role of this specific irrelevant variable (recipients of the interaction who had not participated in training). Testing generalization to novel adults prior to novel children would help us determine if the lack of generalization was specific to people or to adults versus peers. As in baseline, at least 30 min passed between adult and peer generalization probes. No more than one probe with an adult and one probe with a peer were conducted in a single day. If the participant did not engage in the correct response on 100% of the opportunities during an adult or peer generalization probe, a maintenance session was conducted the following day with the therapist in the training setting and with the training materials. During these maintenance sessions, procedures were identical to those in the training

sessions; however, the therapist delivered no prompts.

Stimulus control test (person, setting, materials change). Results of the initial generalization probes showed that the participants' performance with different adults was identical to that during training. Although some responding occurred in the probes with peers, the levels were generally lower than those with the adults. This suggested that the recipient of the interaction exerted at least some stimulus control over the response. Kirby and Bickel (1988) suggested that partial generalization is not possible (i.e., generalization is all or nothing). Thus, another possible explanation for our findings was that the presence of the adult combined with other irrelevant aspects of the training (the setting or materials) exerted stimulus control over responding. If so, the presence of the setting or play materials (separately or combined) may have been responsible for the participants' responding in the generalization probes with peers. To evaluate the possible role of these irrelevant sources of stimulus control, we changed the setting and materials with both adults and peers. Procedures were identical to those in the generalization probes described above (see supporting information for this article on the Wiley Online Library or contact the authors for a listing of the settings and plays materials used during stimulus control tests).

Video viewing. In this phase, we evaluated the effects of having the participants observe a peer engage in the target response while he or she played with another peer who then provided reinforcement. The peers who appeared in the videos did not participate in any other part of the study. Each video clip was approximately 2 min. The clip showed the opportunity for the target response as described previously, followed by the target social response, and then the peer's response to the target response. During the video viewing sessions, the participant and a peer from previous generalization probes were in the room with the therapist. The participant and peer both

sat at the table. The therapist told both children, "We are going to watch a movie and learn how to play." The video was shown on a laptop computer that sat on the desk in front of the children. The participant and peer watched each of the two videos twice. Next, a session was conducted with the same peer who viewed the video. Procedures were identical to those in the stimulus control test in which the participant and peer were placed in a different setting and with a different play material. Each session was conducted in a new setting and with a new play material. Thus, sessions were conducted in four different settings and with four different play materials (with the exception of Emma, who received fewer generalization probes). Identical sessions were conducted with four adults to compare the level of generalization from adults to peers. The condition continued until the participant performed the target correctly during 80% or more of the trials for at least three consecutive sessions. (See supporting information or contact the authors for a listing of the people, settings, and materials used in each session.)

Postvideo viewing. Generalization probes during this condition were the same as the previous condition (video viewing). The only difference was the video was not shown to the participant and the peer prior to the probe with peers. The condition continued until participants responded correctly during at least 80% of trials for at least three consecutive probes.

RESULTS

Figure 1 shows data from the social skills training and maintenance sessions conducted throughout the study for each participant. All participants engaged in few or no responses in baseline, met the mastery criterion within 10 sessions during training, and sustained their performance in the maintenance sessions across the remainder of the study. None of the participants exhibited the correct social response during baseline generalization probes (data not

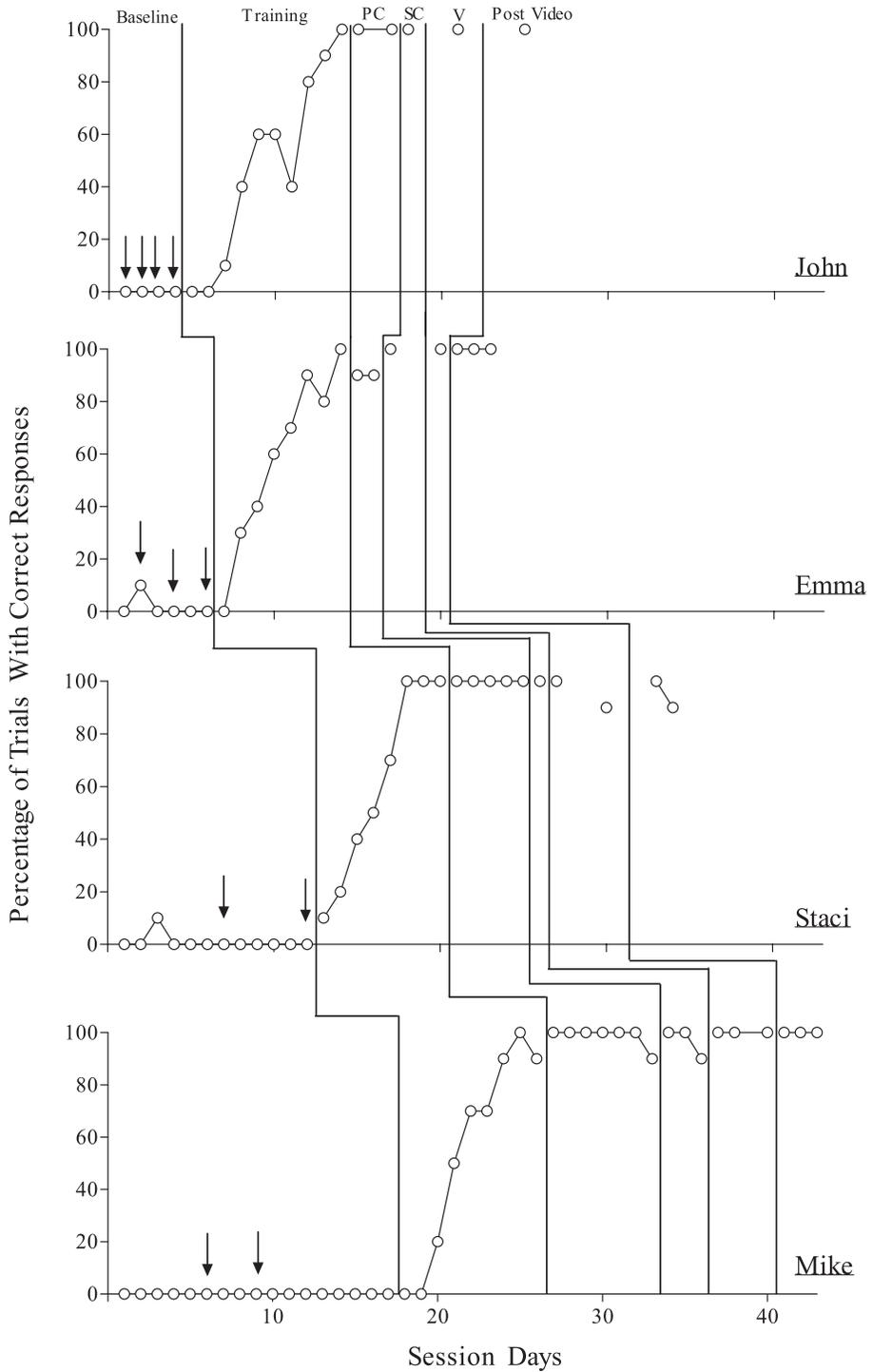


Figure 1. Percentage of correct responses with the trainer during baseline, training, and posttraining phases for each participant. Arrows indicate days when baseline generalization probes were conducted. PC = person change; SC = stimulus control test; V = video viewing.

shown; arrows on Figure 1 indicate when baseline probes were conducted). Figure 2 shows the participants' posttraining performance during generalization probes. In the first phase (person change only), performance during generalization probes with adults was similar to that during training; however, performance was less consistent during generalization probes with peers. John said "Give it back please" on 100% of the opportunities when an adult took an item from his hands. He also emitted the target response on 100% of the opportunities with two peers but on only 30% of the trials and 70% of the trials with the other two peers. Emma exhibited the response on 100% of the trials during all generalization probes with adults in the first phase. However, she emitted the target response between 10% and 50% of opportunities during generalization probes with peers. Staci emitted the target response "What do you want?" on 100% of the opportunities during five of six sessions with adults in the first phase. During generalization sessions with peers, Staci emitted the target response between 20% and 60% of opportunities. Mike emitted the target response "my turn" on 100% of opportunities during seven of eight sessions with generalization adults in the first phase. During sessions with peers, Mike performed the target response between 20% and 70% of opportunities.

These levels of responding with adults and peers remained unchanged for all participants when the generalization probes were conducted in a new setting and with new materials in the second phase (stimulus control test). Because Mike's responding decreased to 80% of opportunities with an adult during the first stimulus control test, we conducted two additional probes. With the introduction of video viewing, all participants began to respond at the mastery criterion level with peers, and they continued to do so when the videos were removed. The exception was Mike, whose responding initially decreased to between 60% and 80% of opportunities with peers when the video was removed.

However, he emitted the target response on 100% of opportunities during the last three probes with peers.

DISCUSSION

Results of this study showed generalization of a social response to different adults, but inconsistent and incomplete generalization to peers, after initial training with a single adult. The stimulus control test suggested that neither the training setting nor the materials exerted control over responding, because performance remained unchanged when both variables were modified. Other elements of the training context (e.g., motivating operation, statements made by the recipient of the conversation) likely exerted at least some control over responding in combination with the presence of the adult. However, these other elements also remained constant across generalization probes with adults and peers, suggesting that it was the presence of the peer *per se* (or the absence of the adult) that influenced performance in the generalization context. Thus, our findings suggest that certain irrelevant stimuli (recipient of interaction) may be more likely to exert stimulus control over responding than others (location, materials) following social skills training under invariant conditions.

The factors responsible for the reduced level of performance in the presence of the peer versus adult are not entirely clear. We hypothesized that a differential reinforcement history with adults and peers may have been responsible for the outcomes. At this specialized facility, participants had a long history of receiving reinforcement from trained adult staff. Peers probably were less likely to provide reinforcement for the participants' appropriate social behavior. In addition, although the participants previously had received some social skills training with peers at the facility, this training was always led by an adult who delivered supplemental reinforcers for engaging in the targeted social response. It also

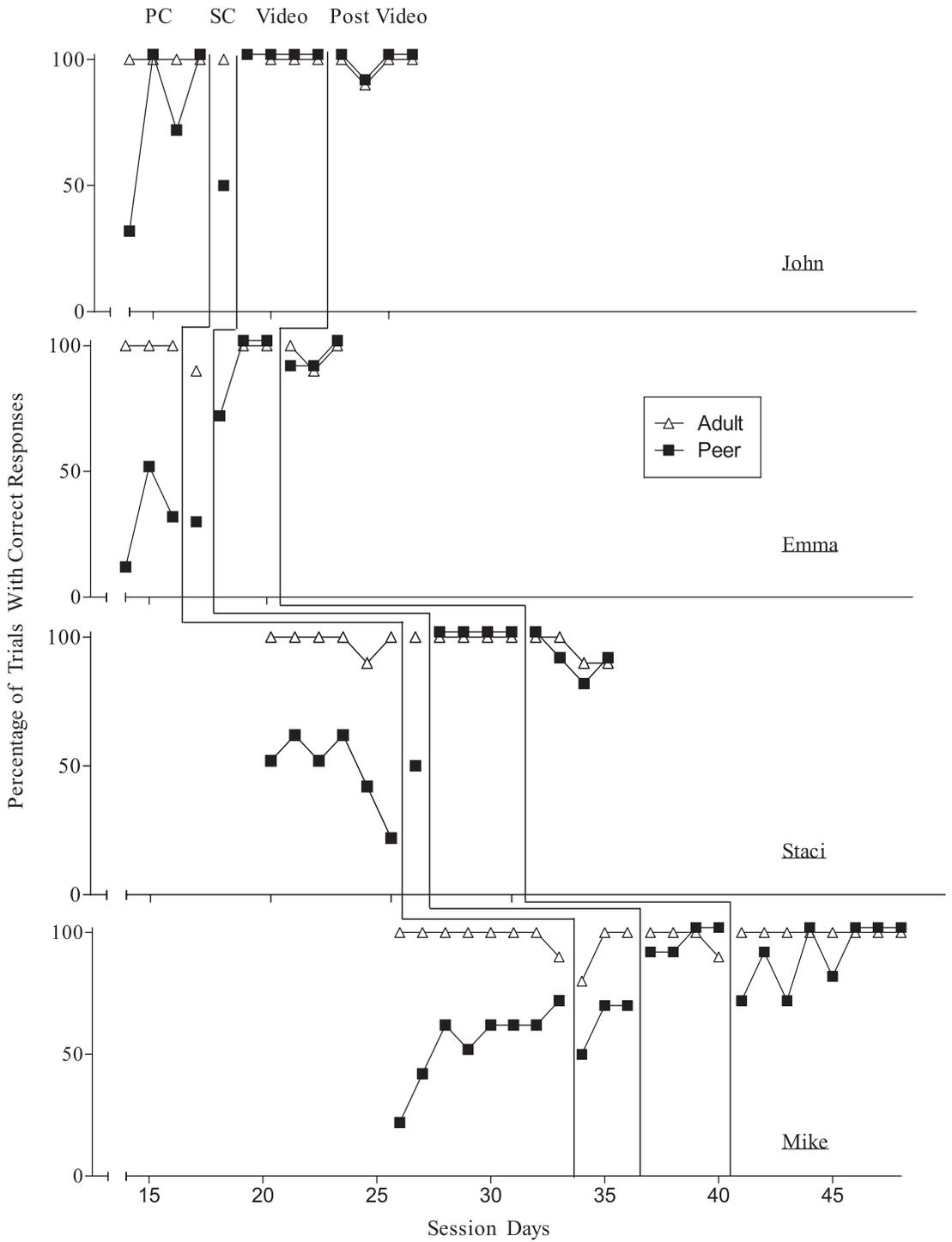


Figure 2. Percentage of correct responses during daily generalization probes with adults and peers across person change only, stimulus control test, video viewing, and postvideo viewing conditions for each participant. PC = person change; SC = stimulus control test.

should be noted that all adult trainers were female, whereas all but one of the peers was male, because no male trainers were available and we obtained parental consent for only one female peer. Therefore, differences in gender per se could have occasioned differential responding across adults and peers. This possibility seems unlikely, however, because the participants' performance was similar with the female and male peers.

The reduced level of responding rather than the total absence of responding with peers seems more consistent with problems related to response maintenance than to problems with stimulus control (Koegel & Rincover, 1977). Peers were prompted to provide immediate reinforcement for the targeted social responses throughout the generalization probes, and the procedural integrity data revealed relatively small differences between adult and peer integrity. Closer examination of the data also showed no relation between integrity levels and participant performance during the probes. Therefore, the peer's behavior during the generalization probes per se does not seem responsible for the differential outcomes with adults and peers. The difference between adult and peer integrity was most pronounced for Mike. The adults in Mike's generalization probes responded correctly on 100% of opportunities with the exception of one probe, during which the adult did not return the toys within 5 s of his request (it was delayed). The peers' integrity was more variable, ranging from 80% to 100% of opportunities. Peers 1, 3, and 5 sometimes failed to return the toy to Mike within 5 s of his request (it was delayed). Peers 2 and 4 sometimes returned the toy to Mike even though he had not requested it. Both peer integrity and Mike's performance improved during the video viewing condition, suggesting that improvements in peer integrity may have been responsible for the increases in Mike's performance during that condition. Within-session data also were examined for all participants to determine if the targeted response failed to be maintained across trials with peers (i.e., to

determine if there was a decreasing trend in the data). None of the participants' responding showed this pattern, with the exception of Emma. Prior to video viewing, Emma tended to respond at the beginning of sessions with peers, and her responding decreased toward the end of the session. Potential mechanisms responsible for this pattern are unclear, however, because the peer implemented the procedures with 100% integrity during all but one session throughout the study.

Further attempts to identify potential differences between the behavior of the adults and peers were conducted by viewing videotaped sessions for all participants, except for Emma (we did not have permission to videotape her sessions). Anecdotally, it was noted that the adults who participated in the turn-taking contexts (for Emma and Staci) played with the toys more animatedly than did peers. For Staci, the adults were sometimes more enthusiastic than the peers, and the adult's tone was a bit more exciting. It is possible that these differences in the quality of toy play and tone of voice functioned as motivating operations that altered the value of the consequence for engaging in the target response. We could not see any differences in the sessions with adults versus peers for John and Mike.

Viewing videos of a peer engaging in the target response and receiving reinforcement from another peer (in the absence of an adult) corresponded with fairly immediate increases in performance for all participants. Our findings are consistent with prior research on video modeling (e.g., Charlop & Milstein, 1989; Charlop et al., 2010) and extend this research by showing that video viewing may promote generalized performance after a skill is acquired. The intervention may have functioned as multiple-exemplar instruction because the participants viewed two new peers as recipients of the social response in the targeted situation (Ducharme & Holborn, 1997). On the other hand, it may have set the occasion for generalized imitation to occur during the probe that immediately followed video

viewing, an outcome that might result from live modeling as well. If results of our initial evaluation of generalization reflected participants' differential reinforcement histories with adults and peers, data from the video viewing condition suggest that observing peers delivering reinforcement may be an effective intervention in lieu of direct exposure to contingencies from peers. It should be noted, however, that the peers also participated in the video viewing intervention (i.e., the participant and peer watched the video together and then immediately participated in a generalization probe). Therefore, we are unable to separate the effects of the peer's involvement in training from those of viewing the videos per se.

The study has several additional limitations. One limitation is that adults and peers delivered the natural reinforcer for the targeted social response in the generalization probes. This reinforcement contingency, repeatedly provided across probes with multiple recipients, may have promoted generalization per se. The increase in responding across the initial person change generalization probes for John and Mike is consistent with this explanation. Repeated exposure to the reinforcement contingency also hinders our ability to evaluate the effects of stimulus control alone. Another possible limitation is that the peers who participated in the generalization probes were members of the participant's integrated classroom, and all of the adults were employed at the treatment center. This means that the participants had previous encounters with both the adults and peers. Although not all the adults served as therapists in the participants' classrooms, it is possible that the adults may have established a prior history with the participants. Another limitation is that the length of baseline generalization probes was not staggered across all participants (Staci and Mike had the same number of baseline generalization probes), although the implementation of these probes was staggered across time. In addition, because we had to expedite Emma's participation to ensure completion prior to her discharge date,

she received the video viewing intervention immediately before the introduction of this intervention for John. Finally, an adult was present during all of Emma's peer sessions because of the severity of her aggression, but the adult was able to fade her location to the corner of the room by the end of the study.

The external validity of these findings might be enhanced in future studies by using completely novel adults, peers, and settings to assess generalization of social skills across recipients. Although results suggested that the skills generalized across settings, all of the sessions were conducted at the treatment center, where the participants had an extensive history with behavior-analytic intervention. Future research also should evaluate this methodology with more advanced social skills (e.g., engaging in conversation or inviting others to participate in activities). Future research also might examine the use of videos to promote generalization across other stimulus parameters (e.g., settings, contexts, or play materials) when posttraining probes suggest problems with generalization and stimulus control. Finally, results for one of our participants (Mike) suggested that peers' integrity improved after they watched the videos. The use of video modeling as part of peer training might be another avenue for future research on developing appropriate relationships between children with autism and their peers.

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