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Two Variations of Video Modeling Interventions for Teaching Play Skills to Children with Autism

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Abstract

The current study employed an adapted alternating treatments design with reversal and multiple probe across participants components to compare the effects of traditional video priming and simultaneous video modeling on the acquisition of play skills in two children diagnosed with autism. Generalization was programmed across play sets, instructors, and settings. Overall, both video modeling procedures proved to be effective in teaching and producing maintenance of play skills. For one participant, these procedures appeared to be equally effective in terms of acquisition of the main dependent variable, scripted play actions. For another participant, scripted play actions were acquired more quickly in the simultaneous condition.

KEYWORDS: autism, play skills, scripts, simultaneous video modeling, video priming

Imitation is considered one of the basic processes of learning and is utilized in the science of applied behavior analysis (ABA) as a means of teaching new behaviors (Nikopoulos & Keenan, 2006; Pierce & Cheney, 2008). A model can be defined as the demonstration of behavior to be imitated or as the individual providing the model (Mazur, 1998). Over the past twenty years, modeling via video has been increasingly used as an effective teaching procedure for children with autism (Bellini & Akullian, 2007). *Video modeling* is defined as the demonstration of behavior that is not live, but is presented via video in an effort to change existing behaviors or teach new ones (Dowrick, 1991). The learner views the model on the screen and is given the opportunity to imitate the observed responses (Reagon, Higbee, & Endicott, 2006).

Video modeling has been effectively used to decrease problem behaviors (e.g., off-task behavior; Coyle & Cole, 2004), as well as increase appropriate behaviors, including social initiations (e.g., Niko-

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poulos & Keenan, 2007), perspective taking skills (e.g., LeBlanc et al., 2003), daily living skills (e.g., Shipley-Benamou, Lutzker, & Taubman, 2002), and helping skills (e.g., Reeve, Reeve, Townsend, & Poulson, 2007). Recently, a number of studies have examined the use of video modeling for teaching play skills to children with autism (i.e., D'Ateno, Mangiapanello, & Taylor, 2003; Dauphin, Kinney, & Stromer, 2004; Hine & Wolery, 2006; MacDonald, Clark, Garrigan, & Vangala, 2005; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Nikopolous & Keenan, 2003; Paterson & Arco, 2007; Reagon et al., 2006; Taylor, Levin, & Jasper, 1999). Effective interventions for teaching play are important because children with autism often fail to develop repertoires of play seen in typically developing children. This literature indicates that video modeling has produced meaningful increases in appropriate play skills, as well as imitation of play scripts, and social initiations across participants. Limitations of this research include lack of strategies to increase unscripted actions and verbalizations, as well as programming for and assessing generalization across settings and materials. In addition, it is unknown which specific procedural variations of video modeling procedures might prove most effective in teaching play skills to children with autism.

Although a number of procedural variations of video modeling have been used to teach learners with developmental disabilities, an important one relevant to the current study is the timing of the video observation relative to the opportunity to engage in the response. In most studies on video modeling, *video priming* is used in which the learner watches a video model (i.e., training session) and later has an opportunity to engage in the response with similar materials, people, and/or settings (i.e., probe session). During training sessions, learners might be prompted to attend to the video (e.g., Charlop & Milstein, 1989; Schreibman, Whalen, & Stahmer, 2000) and/or receive reinforcement delivered contingent upon attending (e.g., Charlop-Christy, Le, & Freeman, 2000; Schreibman et al.) or there may be no prompts and reinforcement for attending (e.g., Hine & Wolery, 2006; Lasater & Brady, 1995; Nikopoulos & Keenan, 2007). During subsequent probe sessions, prompts and reinforcers may (e.g., Taylor et al., 1999) or may not (e.g., Buggey, Toombs, Gardener, & Cervetti, 1999) be used for engaging in the target responses.

Other studies on video modeling have incorporated opportunities to interact with materials and engage in the target imitation responses *while the learner is watching the video* (i.e., during the video modeling training session). Having response opportunities during the video model allows the instructor to provide prompts and reinforcers directly during the training experience. After the training session, the learner is provided with an opportunity to engage in the response with similar materials, people, and/or settings without the video present (i.e., probe session). For example, Kinney, Vedora, and Stromer (2003) embedded videos in Microsoft PowerPoint® slides to teach spelling to a school-age girl diagnosed with autism. While a video of a model correctly writing a word was played, the participant imitated writing it on a worksheet. Taber-Doughty, Patton, and Brennan (2008) compared the effectiveness of video modeling *with* supplementary instruction (termed *simultaneous video modeling)* with video modeling *without* supplementary instruction (termed *delayed video modeling*) to teach library research skills to three children with moderate intellectual disabilities. During the delayed video modeling condition, access to materials was provided over one hour after watching the video. Results indicated that both types of video modeling resulted in acquisition of target skills, but more substantial gains were made using each learner's most preferred method (i.e., delayed video modeling for one participant, simultaneous video modeling for the other participant). While simultaneous video modeling has been examined less frequently in the published research literature than traditional video priming, we have anecdotally observed its frequent use in clinical settings for individuals with autism.

The purpose of the current study was to directly compare the effectiveness of two variations of video modeling typically used in clinical settings for teaching play skills to children with autism. We compared traditional video modeling without supplementary instruction during training (i.e., video priming with no prompts or reinforcement for imitation) and video modeling with supplementary instruction during training (i.e., simultaneous video modeling with prompts and reinforcement for imitation). Rather than conducting a comprehensive component analysis of these interventions, we evaluated them as they were noted to be implemented clinically in various settings with multiple components implemented in packages. We also directly examined attending during the video models to determine whether any observed differences in the effectiveness of these interventions correlated with differences in attending. Generalization was programmed for by training with multiple instructors in multiple settings. In addition, to promote both stimulus and response generalization, multiple versions of each video were used that incorporated different sequencing of actions/scripts, different models using a variety of intonations, and slightly different video camera angles in an effort to produce a generalized repertoire of play behavior that would appear natural rather than rote.

Method

Participants, Setting, and Materials

Two children previously diagnosed with autism by an independent agency participated in the study: Mark (5 years, 4 months old) and Erin (5 years, 11 months old). The participants were selected based on reports from their parents and teachers that they did not engage in imaginative play and that this was an important target for intervention. The participants were able to demonstrate attending to the television for at least 2 min during a television viewing assessment and in-vivo imitation of at least 20 motor movements and 10 simple phrases during an imitation assessment. Sessions were conducted at a private school for children with pervasive developmental disorders that utilized procedures based on applied behavior analysis and in the home of each child. To promote generalization, training and probe sessions were conducted in five different locations throughout the study that were selected quasi-randomly each day. The locations included a classroom, conference room, office, and gym stage in the school, and a multipurpose room at each participant's home. One training and one probe session of each type of video modeling was conducted per day, 5 days per week (not on weekends).

Materials included two play sets, a digital video disk (DVD) player, DVD videos with different play scenarios, highly preferred snacks, and a clear cup. The two play sets were a house and a circus with five characters each (see Table 1) that were selected to be of roughly equivalent difficulty and appeal so that the sets could be randomly assigned to two intervention conditions. During generalization sessions, similar play sets of each type were used to assess generalization across stimuli. The same types of characters and items were available, but no materials were identical to the training sets. The toys used in the study were not available to the participants outside of experimental sessions.

Play Scenario Video Models

Each videotaped play scenario was approximately 2 min in duration and consisted of 10 scripted actions and 10 scripted statements (see Table 1). The background in all videos was plain and the videos were recorded with 5 s between each action. Each video used point of view (i.e., first person perspective) depiction of adult hands acting out the pretend play scenario. The experimenter held the video camera at eye level to show exactly what the child would see when performing the targeted skills (Hine & Wolery, 2006): the play set, the characters and materials, and two hands manipulating the materials. The

Table 1
Play Objects, Actions, and Scripts

Object	Action	Script
House		
Mom	Kisses Dad	"Hi, Honey! Mwah!"
	Pets kitten	"Hi, Kitties! Meow!"
Dad	Opens refrigerator	"Mmmm. I'm hungry"
	Walks through door	"Honey, I'm home!"
Boy	Sits on toilet	"Go to bathroom"
	Stands at sink	"Wash hands. Pshww."
Girl	Taps on computer	"Play Mouse Skills"
	Sits in bathtub	"Sister takes bath"
Baby	Rocks baby	"Bed time (snoring sounds)"
	Jumps up and down	"Baby cries! Waa!"
Circus		
Dog	Rolls on ball	"Don't fall! Woah!"
	Jumps through hoop	"Go through, woof!"
Lion	Goes up and down on see-saw	"Up and down"
	Goes in pool	"Watch this! Splash!"
Elephant	Spins on stage	"Look! Elephant spins!"
	Drinks from trough	"Elephant drinks (slurping)"
Girl	Jumps up and down on bench	"This is fun!"
	Sits on bench	"Time to sit"
Man	Walks through curtain	"My turn! Tada!"
	Goes across tightrope	"Goes across! Wee!"

experimenter operated the camera and recorded the play scenes while three adults assisted in modeling the same play actions and scripts in 3 different sequences with 3 slightly different visual angles (i.e., from directly in front of the play set, from the right of the play set, from the left of the play set) and intonation to promote varied rather than rote responding during acquisition.

A variety of variables were considered in the selection of play sets, characters, actions, and scripts. Parents and teachers were given a preferred activities assessment that surveyed the activities, actions, and play sequences they would like the child to learn. After the toy sets were selected, an observation of typical age-matched peers in a local preschool classroom was conducted in which the researcher observed children playing with the selected play sets. Verbalizations and play actions of each child were recorded and later modified based on the vocal and motor imitation skill levels of the participants.

The sets differed along enough stimulus features to minimize multiple treatment interference while efforts were made to equalize difficulty of play across sets. The house and circus were dissimilar in that the house play set consisted primarily of people figurines whereas the circus play set consisted primarily of animal figurines and the materials and structures of each were different. The vocal scripts were standardized on length (i.e., 3 word statements). In addition, three professionals at the participant's school (i.e., principal, trainers) completed a rating scale about the difficulty of the play actions after watching the video model. They rated the play sequences and play set according to the participant's skill level from 1 (very easy to manipulate characters and/or play items) to 5 (extremely difficult to manipulate characters and/or play items) and could provide other feedback on appropriateness, difficulty, and equivalency. Based on the ratings and comments, the actions and scripts were modified to match the difficulty level more closely across play sets. When the professionals viewed the modified videos, they unanimously agreed on the appropriateness, difficulty level, and equivalency of the actions and scripts.

Each play set was assigned to one learning condition for each participant and play sets were counterbalanced across participants to ensure that differential effects could be attributed to the video modeling procedures rather than characteristics of a particular play set. For Mark, the house was used in the simultaneous video modeling condition and the circus was used for the video priming condition. For Erin, the circus was used for the simultaneous video modeling approach and the house was used for the video priming approach.

Dependent Measures and Data Collection

All sessions were videotaped for subsequent data collection. During training sessions, data were collected on *attending* to the video (priming condition) and the video or materials (simultaneous condition). These data were collected using a 10-s momentary time sampling procedure and summarized as percentage of time samples per session in which the participant was attending. In addition, during training sessions, data were collected on *imitation of vocal scripts* and *imitation of actions* while viewing the video using a per opportunity measure to determine whether the simultaneous video modeling technique was being implemented as intended and determine if participants imitated during the priming condition even though this was not prompted or reinforced. During probe sessions and generalization sessions, frequency data were collected on *scripted verbalizations*, *unscripted verbalizations*, *scripted play actions*, and *unscripted play actions*. Operational definitions for all dependent variables are provided in Table 2.

Interobserver Agreement (IOA) and Treatment Integrity

A second independent observer collected data on the dependent variables during a minimum of 45% of randomly selected sessions across all conditions. During training sessions, IOA on *attending, imitation of vocal scripts, and imitation of actions* was calculated as the number of intervals or trials with agreements divided by the number of agreements plus disagreements multiplied by 100. During probe sessions and generalization sessions, IOA on *scripted verbalizations*, *unscripted verbalizations*, *scripted play actions*, and *unscripted play actions,* was calculated as dividing the smaller frequency of each response by the larger frequency of each response and multiplying by 100. During training sessions, IOA on attending was 100% for each participant. Mean IOA on imitation of vocal scripts was 97.6% for Mark (range = 97%-100%) and 97.3% for Erin (range = 97%-100%). Mean IOA on imitation of actions was 98.4% for Mark (range = 97%-100%) and 97.8% for Erin (range = 97%-100%). During probe sessions and generalization sessions, mean IOA on scripted verbalizations was 98.2% for Mark (range = 97%-100%) and 98.7% for Erin (range = 97%-100%). Mean IOA on unscripted verbalizations was 97.4% for Mark (range = 97%-100%) and 97.6% for Erin (range = 97%-100%). Mean IOA on scripted play actions was 98.5% for Mark (range = 98%-100%) and 98.6% for Erin (range = 98%-100%). Mean IOA on unscripted play actions was 97.2% for Mark (range = 97%-100%) and 97.6% for Erin (range = 97%-100%).

Data on treatment integrity were collected during at least 55% of randomly selected sessions across conditions to ensure that the experimenter implemented the procedures for both video modeling approaches accurately. During training sessions, data were collected on accurate delivery of snacks and use of prompts and summarized as the percentage of correct trials per session. During probe sessions, data were collected on the provision of the appropriate toys and absence of prompts and rewards and summarized as the percentage of correct components per session. For Mark, mean treatment integrity was 98.6% (range = 97% - 100%) during training sessions and 98.4% (range = 97% - 100%) during probe sessions. For Erin, mean treatment integrity was 98.5% (range = 97% - 100%) during training sessions

Table 2
Operational Definitions for Dependent Variables

Term	Definition
Attending	During training sessions, head orientation within a 45° angle of the television
Imitation of actions	During training sessions, motor responses that occurred within 5 s of the video model, matched the complete sequence of the action, and resulted in the same change in the environment as seen in the model
Imitation of vocal scripts	During training sessions, vocal statements that occurred within 5 s of the video model and matched the statement of the video model
Scripted play actions	During baseline and probe sessions, motor responses that matched the complete sequence of the action in the video and resulted in the same change in the environment as seen in the video (MacDonald et al., 2005)
Unscripted play actions	During baseline and probe sessions, either 1) the same actions as seen in the video model but completed with a different character, or 2) play actions that were not modeled in the video but that were appropriate to the context of the toy (MacDonald et al.)
Scripted verbalizations	During baseline and probe sessions, either 1) vocal statements that matched the statement of the video model, or 2) statements that were similar to the modeled response but altered, added, or omitted conjunctions, articles, pronouns, plurality, or verb tense (Stevenson, Krantz, & McClannahan, 2000)
Unscripted verbalizations	During baseline and probe sessions, either 1) a verbalization as in the video model but completed with a different character, or 2) verbalizations that were not modeled in the video but that were appropriate to the context of the toy (MacDonald et al.).

and 98.2% (range = 97% - 100%) during probe sessions. IOA data on treatment integrity were collected during at least 45% of randomly selected treatment integrity sessions. For Mark, mean IOA on treatment integrity was 98.5% (range = 97% - 100%) during training sessions and 98.6% (range = 97% - 100%) during probe sessions. For Erin, mean IOA on treatment integrity was 98% (range = 97% - 100%) during training sessions and 98.2% (range = 97% - 100%) during probe sessions.

Pre-experimental Procedures

Preference assessment. A preference assessment interview was conducted with parents and teachers to determine food allergies, limitations, and preferences for each individual in order to identify snacks to deliver contingent upon attending and imitation during the study. Prior to each session, each participant was allowed to select 1 food item from an array of 8 items indicated during this interview (i.e., pre-session multiple stimulus preference assessment). The item selected was used as a reinforcer during that session. Participants were not given access to these items outside of experimental sessions.

Motivation system pre-teaching. Because a snacks-in-a-cup motivation system would be used during training sessions, participants were systematically exposed to this system prior to the study. Although this system had been used previously in the participant's school programs, this pre-teaching was deemed necessary because this system's effectiveness had never been formally evaluated. The instructor placed a clear cup in front of the student and presented mastered tasks (as reported by his or her teacher). The teacher began by dropping one small piece of food into the cup contingent upon independent compliance with one instruction and immediately giving access to the cup. Although the schedule of reinforcement remained FR 1, the number of instructions was gradually increased to 10 because that was the maximum number of snacks that would be delivered during training sessions before access to the cup was provided. Training was terminated when a participant followed 10 consecutive instructions without reaching for the cup.

Design and Experimental Procedures

An adapted alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985) with multiple probe design across participants was used to evaluate the relative effects of *simultaneous video modeling* and *video priming* on play skills of children with autism. Each day, each participant was exposed to each type of video modeling technique, with the presentation of the techniques quasi-randomly selected according to the order ABBABAAB. After a training session of one type of video modeling, a probe session was immediately conducted with toys depicted in that video. Later the same day, the other type of video modeling was evaluated in the same manner. A reversal to baseline conditions was conducted to evaluate performance during probe sessions with training and generalization play sets in the absence of training (i.e., without watching the video) prior to playing with the toys.

Baseline and probe sessions. During baseline sessions, a play set was placed on the table or floor in front of the child. After the instruction, "it's time to play" (or a similar statement), the participant was given 4 min to play with the toys (MacDonald et al., 2005). The experimenter did not deliver any additional instructions, prompts, or rewards. Throughout the remaining phases, probe sessions were conducted in the same manner immediately after the video modeling session.

Video modeling: Simultaneous . The child was instructed to sit in a chair in front of the DVD player. A clear cup was placed next to the DVD player out of reach and the play set shown in the video was placed in front of the child. The child was shown the video one time. Imitation of vocal scripts was not prompted or reinforced but imitation of play actions was manually prompted and reinforced. During the video the experimenter provided manual prompts, defined as a gentle touch on the child's arm or hand, to assist him or her in imitating the actions modeled. Manual prompts were faded using a progressive time delay procedure that increased by 2 s every 2 consecutive sessions with independent responding or compliance with prompts. Snacks were delivered contingent upon prompted and independent responding during the time delay procedure and were only consumed after the completion of the entire treatment session. If the student attempted to complete the action but made an error, an error correction procedure was implemented. The instructor prompted the student to complete the action, rewound that action on the DVD, and waited 2 s to give the student an opportunity to imitate that action independently. If the participant made an error again the instructor repeated the previous step by rewinding the specific action again. The instructor did this no more than 2 times before using a 0-s time delay to prompt the participant to complete the action correctly. Following completion of the treatment evaluation, a baseline probe was conducted in which the participant played with the simultaneous play set without viewing the video.

Video modeling: Priming. The child was instructed to sit in a chair in front of the DVD player. The clear cup was placed next to the DVD out of reach. Toys were not available during video priming training sessions. The child was shown the video one time. No prompts to imitate were given by the instructor. Preferred snacks were delivered into a clear cup, visible to the child, contingent upon attending to the video. Every 10 s the instructor placed a snack in a cup contingent upon appropriate attending to the video. The instructor also delivered pats to the participant's back during appropriate attending of the video. No reinforcers were delivered contingent upon imitation of actions or verbalizations. Following completion of the treatment evaluation, a baseline probe was conducted in which the participant played with the priming play set without viewing the video.

Both sets simultaneous. For Erin, when video priming resulted in low levels of scripted play actions, the video priming play set (i.e., house) was taught using simultaneous video modeling. The procedures were identical to the *Video modeling: Simultaneous* condition described above. The only exception to these procedures was during sessions 117 through 128, in which preferred snacks were delivered into a cup contingent upon on-task behavior during probe sessions due to high levels of stereotypy (e.g., inappropriately throwing the ball across the room).

Generalization. Stimulus and response generalization were programmed as described above. Generalization was assessed by conducting probes in novel settings, with novel instructors, and with play sets similar, but not identical, to toy sets depicted in videos. First, baseline probes (without video modeling) were conducted with Generalization 1 play sets (i.e., Gen 1 Circus, Gen 1 House). When scripted play actions were low (i.e., generalized responding was not observed), video modeling was used to teach the participants to play with the Generalization 1 play sets. That is, the original videos depicting the teaching sets were shown, followed by access to the Generalization 1 play sets. When scripted play actions increased with the Generalization 1 play sets following this teaching, baseline probes (without videos) were conducted with Generalization 2 play sets (i.e., Gen 2 Circus, Gen 2 House) to assess generalized responding with these novel toys.

Maintenance and play set preference. An assessment of maintenance was conducted 2 weeks (Mark) and 1 week (Erin) after the completion of the study. The participant was brought into one of the five room settings, presented with both play sets, and asked, "Which toy set do you want to play with?" The toy set not selected was then removed. These sessions were otherwise identical to baseline and probes in that the child was given 4 min to play with the chosen play set and no videos, prompts, or reinforcers were used.

Social Validity

After the completion of the study, 16 teachers from the participants' school were asked to participate in a social validity assessment. The experimenter provided a full definition and description of each procedure and showed the video models. Then the experimenter asked the teachers to anonymously respond to the question, "How willing would you be to implement each type of video modeling to teach pretend play to children with autism?" on a scale of 1 to 5 (*1= Not Willing, 2 = Somewhat willing, 3= Not Sure, 4 = Willing, 5= Very Willing)*.

Results

Performance During the Video Modeling

Both participants attended to the video during 100% of time samples across all sessions in both conditions. Imitation of actions during simultaneous video modeling is depicted in Figure 1. The final mean of each phase is calculated based on the last three data points and is reported throughout the results section to provide a measure of final level of acquisition. Data are not provided for imitation of actions during video priming because play sets were not available during video priming training sessions. Mark's imitation of actions (top panel) gradually increased as the time delay was increased until he was imitating all 10 actions during each video model in both conditions. While watching the video with the Gen 1 House, he first imitated 7 actions and then 10 actions during the each of the last two sessions. Erin (bottom panel) also gradually began to imitate more as the time delay was increased, reaching a mean of 8.33 actions imitated per session for the last three sessions. When simultaneous video modeling was used to teach the house play set (previously taught in the priming condition), Erin's imitation also increased as the time delay increased, reaching a final mean of 10 actions. While watching the video with the Gen 1 Circus play set, Erin's imitation of actions increased from 3 in the first probe to 8 in the second probe. While watching the video with the Gen 1 House play set, 3 actions were imitated during both probes. Mark's imitation of vocal scripts (top panel) during the simultaneous condition gradually increased throughout the condition, reaching a final mean of 8.3 (range, 8-10). Mark's imitation of vocal scripts during the priming condition video models was substantially lower at a final mean of .33 (range, 0-1). Imitation of vocal scripts during generalization probes in each condition was comparable to the performance during video modeling in each condition. While watching the video models, Erin's (bottom panel) imitation of vocal scripts during both conditions remained low throughout the treatment evaluation (simultaneous condition range, 0-4; priming condition range, 0-1). When simultaneous video modeling was used to teach the house play set (previously trained with video priming), imitation of vocal scripts with the house increased noticeably (final $M = 5$; range, 4-7) and imitation of vocal scripts with the circus increased only slightly (final $M = 1$; range, 1-2). Similar results were evident while Erin watched the videos with the Gen 1 play sets in each condition with slightly higher imitation of vocal scripts during the Gen 1 House video/play set.

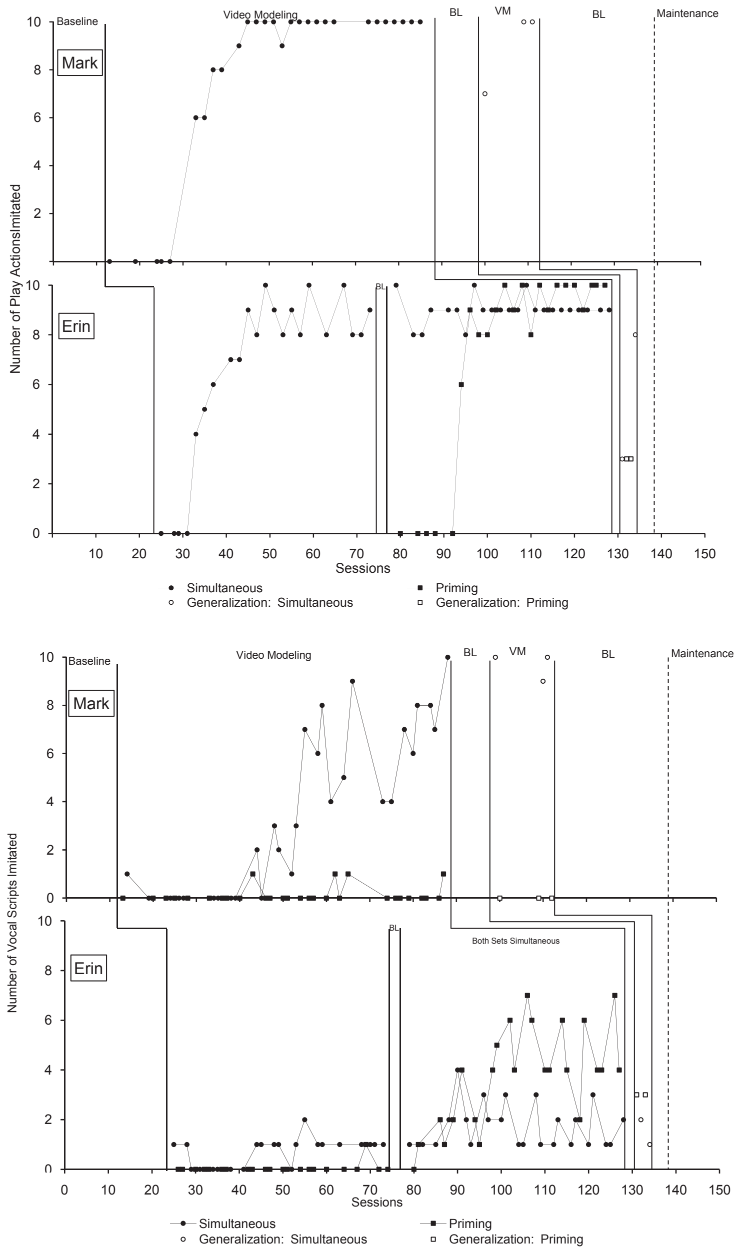

Figure 1. Number of play actions imitated (top panel) and vocal scripts imitated (bottom panel) during simultaneous video modeling training sessions for Mark and Erin.

Performance During Probe Sessions

Scripted play actions. Scripted play actions during probes for both participants are depicted in Figure 2. Mark (top panel) did not engage in any scripted play actions with any of the play sets during baseline; however, scripted play actions steadily increased to final means of 6.6 (range, 6-7) with simultaneous video modeling and 7.6 (range, 7-9) with video priming. During a return to baseline, the Gen 1 House play set and Gen 1 Circus play set evoked two scripted play actions each. As responding was low, the Gen 1 House play set (simultaneous) and Gen 1 Circus play set (priming) were directly taught resulting in an increase in scripted play actions to 5 for the simultaneous video modeling condition and a mean of 3.6 (range, 3-4) for the priming condition. During a return to baseline (without video modeling), scripted play actions increased to 6 with the Gen 1 House play set (simultaneous video modeling) and 4 with the Gen 1 Circus play set (video priming). When a second generalization set in each condition was assessed, scripted play actions occurred seven times with the Gen 2 House play set (simultaneous video modeling) and four times with the Gen 2 Circus play set (video priming). During the maintenance assessment, conducted under baseline conditions, Mark chose the House teaching play set (simultaneous) during 20% of opportunities and the Circus teaching play set (priming) for 80% of opportunities. Scripted play actions during these probes occurred at frequencies similar to prior conditions.

As can be seen in the bottom panel, during baseline with the Circus play set, Erin engaged in one scripted play action during the first session (i.e., putting the girl on the bench). During the simultaneous video modeling probe sessions with the Circus, scripted play actions remained near zero levels for 11 sessions before increasing steadily to a final mean of 6.3 (range, 6-7). During the video priming probe sessions with the House, scripted play actions only once rose to 3 and reached stability at a final mean of 2 actions for the final three sessions. During a return to baseline with both play sets, Erin did not engage in any scripted play actions. When the House play set (previously taught with video priming) was taught using simultaneous video modeling, scripted play actions in the presence of both play scenes steadily increased, although performance with the House (final M = 7.3; range = 6-8) remained lower than with the Circus (final M = 9; range = 8-10). In addition, the variability of scripted play actions with the House play set increased. During a return to baseline (no video modeling) with the teaching play sets, scripted play actions remained comparable to levels during video modeling. When simultaneous video modeling was

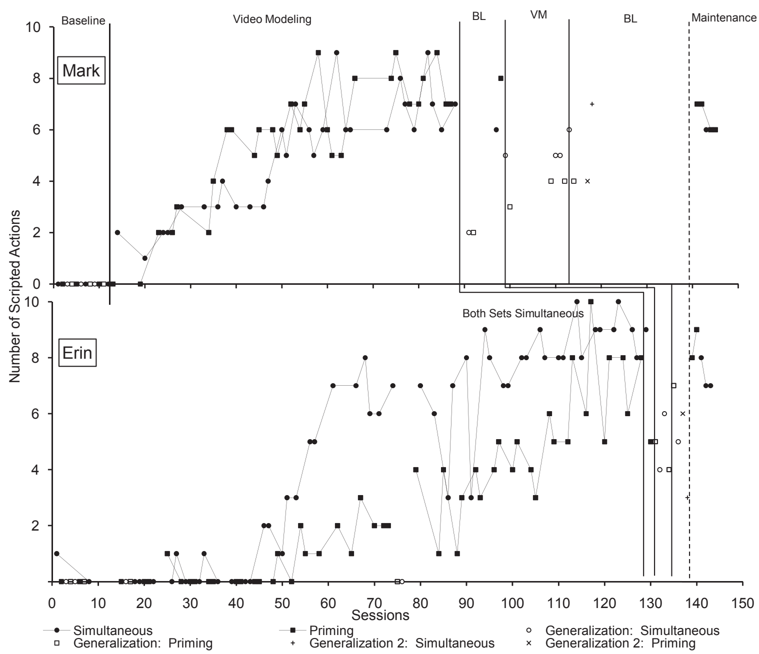

Figure 2. Number of scripted play actions during simultaneous video modeling and video priming probe sessions for Mark and Erin.

used to teach the Gen 1 play sets, scripted play actions increased to a mean of 5 (range, 4-6) for the Gen 1 Circus and a mean of 4.5 (range, 4-5) for the Gen 1 House. During a return to baseline (no video modeling) with the Generalization play sets, there were 5 scripted play actions with the Gen 1 Circus and 7 scripted play actions with the Gen 1 House. When Gen 2 play sets were assessed, there were 3 scripted play actions with the Gen 2 Circus and 6 scripted play actions with the Gen 2 House. During the maintenance assessment, conducted under baseline conditions and without contrived reinforcement, Erin chose the House teaching play set during 40% of the opportunities and the Circus teaching play set for 60% of the opportunities. Scripted play actions during these probes were comparable to prior performance.

Additional measures. Final means (i.e., last 3 data points) for unscripted play actions, scripted verbalizations, and unscripted verbalizations per condition for Mark are depicted in the top bar graph of Figure 3. As seen in the black bars, throughout the study, final mean unscripted play actions were variable per phase, and did not systematically vary by condition or show a trend over time (final *M* = 3.7; range = 2-5.3). Although the participants engaged in some actions with the materials, they were typically repetitive. As seen in the white bars, no scripted verbalizations occurred during baseline. Final mean scripted verbalizations were consistently higher during the simultaneous video modeling condition during the treatment evaluation and generalization sessions of the simultaneous video modeling condition (final *M* = 6.3; range = 4.6-7.3) than the video priming condition (final *M* = 2.5; range = 1-4). During maintenance, however, scripted verbalizations were higher during the video priming condition (final *M* = 5.25) than the simultaneous video modeling condition (final *M* = 4). As seen in the gray bars, final mean unscripted verbalizations were low and variable throughout the study, and did not systematically vary by condition or show a trend over time (final *M* = 0.6; range = 0-1.3).

Final means for unscripted play actions, scripted verbalizations, and unscripted verbalizations per condition for Erin are depicted in the bottom bar graph of Figure 3. As seen in the black bars, throughout the study, final mean unscripted play actions were higher during the video priming condition (final *M* = 4.7; range = 1-7.6) than with the Circus play set (final *M* = 3.3; range = 1-4.6). Across both conditions, unscripted play actions were lower during generalization sessions (final *M* = 1.4; range = 1-2.6) than during all other conditions in the study (final *M* = 5.4; range = 4-7.6). As seen in the white bars, no scripted verbalizations occurred during baseline. Throughout the study, final mean unscripted verbalizations were variable per phase, and did not systematically vary by condition or show a trend over time (final *M* = 3.75; range = 1-6). As seen in the gray bars, final mean unscripted verbalizations did not systematically vary, but did decrease substantially from baseline (final *M* = 4.95; range = 4.3-5.6) to the remainder of the study (final *M* = 1.6; range = 1-2.3).

Social validity. The mean scores for the social validity question were 4.3 (*willing/very willing*) for the simultaneous video modeling procedure and 4.4 (*willing/very willing*) for the video priming procedure.

Discussion

The current study compared the effects of video priming and simultaneous video modeling on the acquisition of play skills in two children diagnosed with autism. Overall, both video modeling procedures proved to be effective in teaching and producing maintenance of play skills. For Mark, these procedures appeared to be about equally effective in terms of acquisition of the main dependent variable,

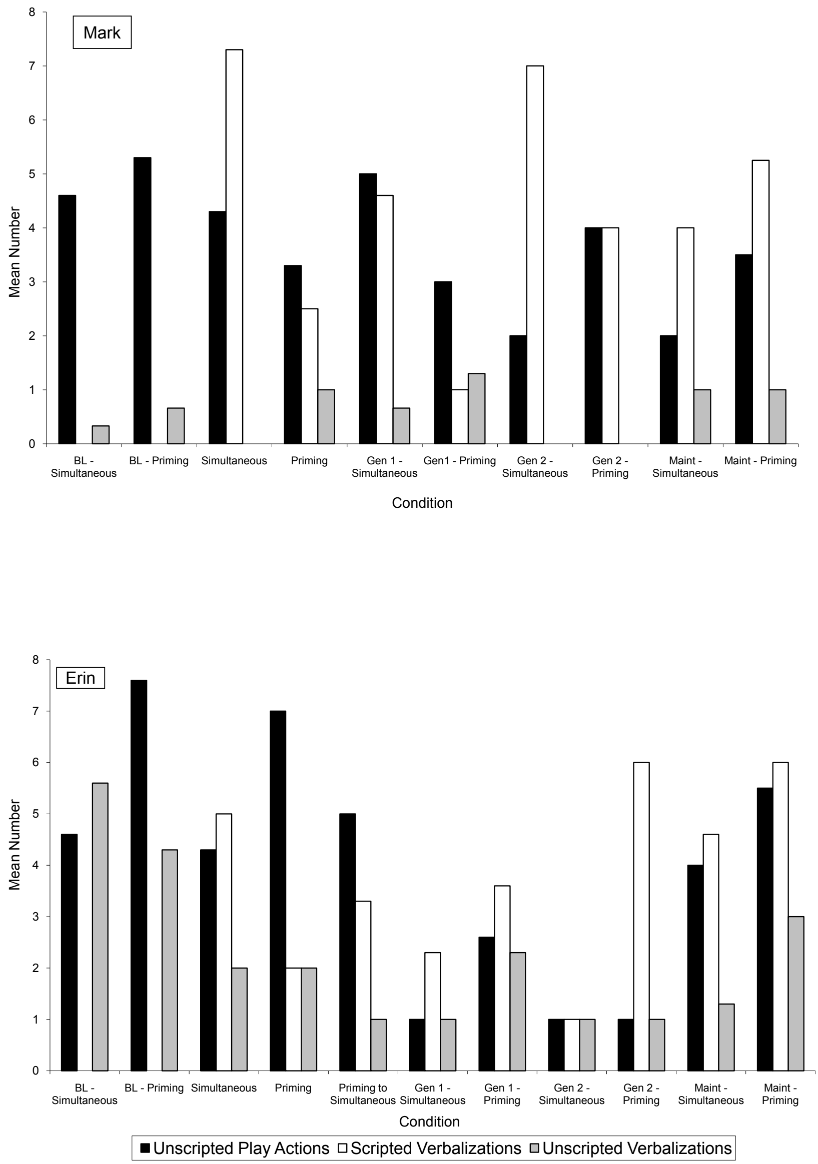

Figure 3. Mean number of unscripted play actions, scripted verbalizations, and unscripted verbalizations during simultaneous video modeling and video priming probe sessions for Mark (top panel) and Erin (bottom panel). BL = Baseline; Gen = Generalization; Maint = Maintenance

scripted play actions. This effect maintained in both conditions when he played with the toys without having watched the videos prior to probe sessions and at the end of the study during the two-week maintenance evaluation. This was an unexpected finding; it was hypothesized that simultaneous video modeling would produce faster acquisition because it included prompts and reinforcement for imitation during training sessions and the video priming condition did not.

For Erin, scripted play actions were acquired more quickly in the simultaneous video modeling condition (Circus). When the original priming play set (i.e., House) was later taught using simultaneous video modeling, scripted play actions increased above all previous data points during the first session. However, the gradually increasing pattern of acquisition in this condition prevents firm conclusions about the superior effectiveness of simultaneous video modeling. An immediate, more substantial increase would have provided more evidence of this. In other words, it is possible that scripted play actions would have increased with the House play set even if it had not been changed from the video priming condition to the simultaneous video modeling condition. In addition, the increase in variability with the Circus play set when the House play set was taught using simultaneous video modeling suggests that either 1) teaching both sets using simultaneous video modeling affected performance with one or both of the play sets, or 2) some other variable may have altered performance at this point in the study. The former might have happened because of the increase in scripted play actions Erin was acquiring. Finally, although attempts were made to use play sets equivalent in terms of level of difficulty and engagement or approachability, it is possible that the differential outcomes observed for Erin may have been due to characteristics of the play sets or scripts (e.g., preference, difficulty) rather than the teaching procedures. High levels of attending in both conditions rule out differential attending to the videos in each condition as a variable affecting acquisition.

Neither of the procedures resulted in high levels of scripted play actions during initial generalization probes with either participant. For both participants, teaching with the original play sets did not produce generalized responding to a novel play set. However, after video training with a second set, generalized responding occurred with a third play set. In addition, for Mark, scripted play actions were higher with the Gen 1 and Gen 2 House (simultaneous) play sets than with the Gen 1 and 2 Circus (priming) play sets. This is an interesting finding because it contrasts with the lack of differential acquisition with the teaching play sets for Mark. This may be due to differential effectiveness of the video modeling procedures. In addition, it is possible that Mark's differential imitation of vocal scripts while watching the House video (simultaneous video modeling sessions) may have affected generalization of scripted play actions. Interestingly, although not prompted or reinforced in either condition, Mark's imitation of vocal scripts increased substantially while watching the House video only. This corresponded to higher levels of scripted verbalizations during House probe sessions, as well. There is also some evidence for at least one other explanation. It was noticed that the Gen 1 and 2 House play sets (simultaneous) were more similar to the teaching house than the Gen 1 and 2 Circus play sets (priming) were to the teaching circus.

For Mark, unscripted verbalizations occurred rarely throughout the study. For Erin, unscripted verbalizations and actions were not facilitated by acquisition of scripted verbalizations and play actions. However, it should be noted that many of her unscripted verbalizations and play actions were repetitive and appeared stereotypic, such that a decrease in these behaviors as she acquired a variety of appropriate behaviors made her play appear more natural.

One potential limitation of this study was the large number of sessions conducted. However, this should be considered in light of the fact that sessions were brief (i.e., less than 10 min) and that anecdotally, both participants appeared to enjoy participation as evidenced by positive affect (e.g., smiles, laughter), no occurrences of refusal to come to experimental sessions, and frequent requests to play with the play sets outside of experimental sessions. Following the study, the play sets were frequently chosen by both participants as rewards for completion of other activities.

A second consideration is that contrived reinforcement was used briefly for Erin to increase on-task behavior and decrease stereotypy. However, it should be noted that during the maintenance assessment conducted 1 week following the study, no contrived reinforcers were used and no stereotypy was observed.

A third consideration is that data were not collected on the order of scripted play actions or verbalizations. This measure is important because engaging in play actions and verbalizations in a varying sequence more closely resembles play of typically developing peers. In the current study, three video versions of each play scenario were used with different sequences, adult models, toy arrangements, and visual angles. Although generalization resulting from this programming was not assessed, it was anecdotally noted that both participants engaged in scripted play actions and verbalizations in a variety of sequences, as well as varying intonation. Future research might investigate optimal methods for producing this type of generalized responding.

In conclusion, based on the results of this investigation, clinicians working with children with autism might consider using video priming without the use of prompts and reinforcement for imitation during training sessions. If video priming and simultaneous video modeling are similarly efficacious, video priming might be considered the treatment of choice, particularly when being conducted by an instructor or caregiver who does not have extensive training in prompting or reinforcement or does not have the resources to be able to teach the learner in a 1:1 ratio format. In addition, this type of video modeling may be preferred for learners who tend to not learn effectively from manual prompts. Future research is needed to replicate the findings of the current investigation.

Note

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References

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional Children*, *73*, 264-287.

Buggey, T., Toombs, K., Gardener, P., & Cervetti, M. (1999). Training responding behaviors in students with autism. *Journal of Positive Behavior Interventions*, *4*, 205-214.

Charlop, M. H., & Milstein, J. P. (1989). Teaching autistic children conversational speech using video modeling. *Journal of Applied Behavior Analysis*, *22*, 275-285.

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30,* 537-552.

Coyle, C., & Cole, P. (2004). A videotape self-modeling and self-monitoring treatment program to decrease off task behavior in children with autism. *Journal of Intellectual & Developmental Disabilities*, *29*, 3-15.

Dauphin, M., Kinney, E. M., & Stromer, R. (2004). Using video-enhanced activity schedules and matrix training to teach sociodramatic play to a child with autism. *Journal of Positive Behavior Interventions*, *4,* 238-250.

D'Ateno, P., Mangiapanello, K., & Taylor, B. (2003). Using video modeling to teach complex play sequences to preschooler with autism. *Journal of Positive Behavior Interventions, 5,* 5-11.

Dowrick, P.W. (1991). *Practical guide to using video in the behavioral sciences.* New York; Wiley.

Hine, J. F., & Wolery, M. (2006). Using point of view video modeling to teach play to preschoolers with autism. *Topics in Early Childhood and Special Education*, *3*, 83-93.

Kinney, E. M., Vedora, J., & Stromer, R. (2003). Computer-presented video models to teach generative spelling to a child with autism spectrum disorder. *Journal of Positive Behavior Interventions, 5,* 22-29.

Lasater, W. M., & Brady, P. M. (1995). Effects of video self-modeling and feedback on task fluency. *Education and Treatment of Children, 18*, 389-408.

LeBlanc, L. A., Coates, A. M., Daneshvar, S., Christy-Charlop, M. H., Morris, C., & Lancaster, B. M. (2003). Using video modeling and reinforcement to teach perspective taking skills to children with autism. *Journal of Applied Behavior Analysis, 36*, 253-257.

MacDonald, R., Clark, M., Garrigan, E., & Vangala, M. (2005). Using video modeling to teach pretend play to children with autism. *Behavioral Interventions, 20*, 225-238.

MacDonald, R., Sacramone, S., Mansfield, R. Wiltz, K., & Ahearn W. H. (2009). Using video modeling to teach reciprocal pretend play to children with autism. *Journal of Applied Behavior Analysis, 42,* 43-55.

Mazur, J. (1998). *Learning and behavior* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Nikopoulos, C. K., & Keenan, M. (2003). Promoting social initiation in children with autism using video modeling. *Behavior Interventions, 18*, 87-108.

Nikopoulos, C. K., & Keenan, M. (2006). *Video modeling and behavior analysis.* Philadelphia: Jessica Kinglsey Publishers.

Nikopoulos, C. K., & Keenan, M. (2007). Using video modeling to teach complex social sequences to children with autism. *Journal of Autism and Developmental Disorders, 37,* 678-693.

Paterson, C. R., & Arco, L. (2007). Using video modeling for generalizing toy play in children with autism. *Behavior Modification, 5,* 660-681.

Pierce, W. D., & Cheney, C. D. (2008). *Behavior analysis and learning* (4th ed.). New York: Psychology Press.

Reagon, K. A., Higbee, T. S., & Endicott, K. (2006). Teaching pretend play skills to a student with autism using video modeling with a sibling as model and play partner. *Education and Treatment of Children*, *29,* 517-528.

Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis, 40,* 123-136.

Schreibman, L., Whalen, C., & Stahmer, A. C. (2000). The use of video priming to reduce disruptive transition behavior in children with autism. *Journal of Positive Behavior Interventions, 2*, 3-11.

Shipley-Benamou, R. S., Lutzker, J. R., & Taubman, M. (2002). Teaching daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions, 2,* 165-175.

Sindelar, P. T., *Rosenberg***,** M. S., & *Wilson***,** R. J. **(***1985***).** An adapted alternating treatment design for instructional research. *Education & Treatment of Children, 8*, 67-76.

Stevenson, C. L., Krantz, P. J., & McClannahan, L. E. (2000). Social interaction skills for children with autism: A script-fading procedure for nonreaders. *Behavioral Interventions, 15,* 1-20.

Taber-Doughty, T., Patton, S. E., & Brennan, S. (2008). Simultaneous and delayed video modeling: An examination of system effectiveness and student preferences. *Journal of Special Education Technology, 23,* 1-18.

Taylor, B. A., Levin, L., & Jasper, S. (1999). Increasing play-related statements in children with autism toward their siblings: Effects of video modeling. *Journal of Developmental and Physical Disabilities, 11,* 253-263.