Behavior Modification
Volume 31 Number 5
September 2007 660-681

10.1177/0145445507301651
http://bmo.sagepub.com
hosted at
http://online.sagepub.com

Using Video Modeling for Generalizing Toy Play in Children With Autism

Claire R. Paterson
Lucius Arco
Edith Cowan University, Perth, Australia

The present study examined effects of video modeling on generalized independent toy play of two boys with autism. Appropriate and repetitive verbal and motor play were measured, and intermeasure relationships were examined. Two single-participant experiments with multiple baselines and withdrawals across toy play were used. One boy was presented with three physically unrelated toys, whereas the other was presented with three related toys. Video modeling produced increases in appropriate play and decreases in repetitive play, but generalized play was observed only with the related toys. Generalization may have resulted from variables including the toys' common physical characteristics and natural reinforcing properties and the increased correspondence between verbal and motor play.

Keywords: *video modeling; autism; play behavior; generalizing; teaching; children*

Children normally learn how to socially interact through play: first, through independent and parallel play, usually with toys, and, second, by sharing toys in interactive and reciprocal play (Howes, 1985; Mueller & Brenner, 1977). However, children with autism typically show deficits in independent toy play, including ritualistic and repetitive patterns of behavior such as lining up toys by shape or color or showing excessive attachment to particular toys and not relating to others. Such deficits may reduce opportunities for developing interactive play with other children and can

Authors' Note: This study was completed as a partial requirement for the first author's BA (Hon.) degree in psychology. Many thanks to the children and staff of St Simon Peter Catholic Primary School, Western Australia, for their participation and support. Correspondence concerning this article should be addressed to Dr. L. Arco, School of Psychology, Edith Cowan University, Joondalup, WA 6027, Australia; e-mail: l.arco@ecu.edu.au.

consequently contribute to social isolation (Newsom, 1998; Schreibman & Charlop-Christy, 1998; Wolfberg & Schuler, 1993). It seems reasonable to propose that if children with autism were taught more appropriate independent toy play, their opportunities for subsequently developing more interactive social play would be enhanced.

Increasingly, research into teaching methods has focused on video modeling, which consists of children viewing models on video monitors performing specific behavior for the viewers to imitate. Video modeling, which contains models such as peers, adults, or the learners themselves, brings many benefits, including the convenience and portability of demonstrating a wide range of self-help, social, linguistic, and academic behaviors across various settings and the apparent intrinsic reinforcement that comes with simply watching video. Furthermore, video modeling can enhance learning by showing edited video that highlights specific stimuli and behavior, being repeatedly viewed, and can increase its cost-effectiveness by saving on the use of live models (see reviews by Ayres & Langone, 2005; Krantz, MacDuff, Wadstrom, & McClannahan, 1991; Stephens & Ludy, 1975; Sturmey, 2003; Thelen, Fry, Fehrenbach, & Frautschi, 1979).

In the area of toy play, a range of studies has examined the use of video modeling. Conversational skills have been effectively taught to children with autism. Charlop and Milstein (1989) increased levels of correct responding to questions about particular toys (e.g., “Can I play with the puppet?”) in three boys with autism by having them observe video conversations of two people discussing toys. Correct responding generalized across novel topics of conversation, people, and toys and was maintained for 15 months.

A similar study by Taylor, Levin, and Jasper (1999) used video modeling to teach two young boys with autism to make play-related comments (e.g., “This car goes fast.”) to their siblings. The number of play statements substantially increased during the video intervention; however, generalization across novel persons or toys was not examined.

Sherer et al. (2001) also targeted conversational skills by examining effectiveness of teaching five children with autism answers to conversational questions (e.g., “What are your favourite games?” “Where do you live?”) using either “self” or “other” as video models. With self-modeling, the children viewed themselves, whereas peers served as the other models. Three children acquired the new skills, which generalized to novel peers and settings and maintained at 2 months. The data support those of Charlop and Milstein (1989). However, no differences were found in skill acquisitions between the two video conditions.

Apart from observing conversation during play, several studies examined effects of video modeling on motor (nonverbal) play behavior. Charlop-Christy, Le, and Freeman (2000) found video modeling a more efficient procedure when compared with in vivo modeling. Not only were conversational skills increased and generalized, but independent play with toy cars and a coloring set was also moderately increased with one of the children. Nikopoulos and Keenan (2003, 2004) demonstrated decreased latency in initiating play with researchers and increased appropriate play in 10 children with autism. However, results were variable, and the inclusion of researchers in the play activities may have confounded the video modeling effects.

A study by D'Ateno, Mangiapanello, and Taylor (2003) was exceptional in that it examined effects on both verbal and motor aspects of play behavior. Results showed rapid increases in both verbal and motor play behavior in a young girl with autism following introduction of video modeling. However, no generalization measures were reported, and it was not shown whether gains in play behavior would have maintained without continued video modeling. Furthermore, the researchers pointed out that their measures were not sensitive to problems of repetitive behavior characteristic of children with autism, and thus problems such as imitating behavior out of context or in a repetitive manner may have occurred but were not measured.

It seems that evidence supporting efficacy of video modeling and its power to generalize independent toy play remains limited. Also, more comprehensive measurement of toy play, including measures of appropriate and problem motor play, is required. Thus, the aim of the present study was to more closely examine effects of video modeling on generalization of independent toy play. Of course, generalization of behavior can be promoted by various means, one of which is teaching with instructional materials that share common stimulus characteristics. In the present study, two children with autism participated; one child was presented with toys viewed as unrelated in physical characteristics, whereas the other child was presented with toys displaying common characteristics. Also, both verbal and motor aspects of play were measured, and their relationship was examined; and inappropriate as well as appropriate play were measured.

Method

Participants and Setting

Four school-aged boys diagnosed with autism, aged 6 to 9 years, were identified as potential participants for the study. Their parents and teachers were interviewed to assess whether the boys met selection criteria, which included basic nonverbal imitation skills, regular television viewing at home, and ability to attentively watch television for at least 90 s. Two of the boys were excluded from the study because of difficulty in attending to television and high distractibility during preliminary play sessions (e.g., distracted by people walking past or children playing outside). Furthermore, one of the excluded boys was nonverbal, and therefore measures of verbal play behavior were not possible. The other two boys met selection criteria and were willing to participate in the study with parental and school consent.

Luke was 7 years of age, high functioning, and in the second year of primary school. Luke's verbal expression was well developed with fluent speech, but his verbal comprehension was at a lower level than his verbal expression. Luke sometimes required assistance in following verbal instructions, which resulted in the frequent use of social scripts or stories in the classroom to aid his understanding. Although Luke's social interaction with other children was limited, he displayed some social and emotional reciprocity. Luke showed a limited play repertoire with toys such as cars and trucks and mostly engaged in stereotyped and repetitive motor behavior such as spinning the wheels.

John was 6 years of age, high functioning, and in preprimary class. He showed a basic and repetitive play repertoire with a range of toys including trains, dinosaurs, and cars. John often engaged in restricted, stereotypic patterns of motor play, similar to that of Luke, such as spinning wheels on cars. John's verbal expression and comprehension were well developed, and he did not require one-on-one assistance for all class activities. John desired to interact with other children in his class but had difficulty relating to them; he often played with teachers and assistants.

The study took place in a regular suburban primary school located in Perth, Western Australia. The play room (approximately 6 m × 3 m) was located in the school's special education center. It contained a television and video player placed in one corner of the room and also had several desks, chairs, bookcases, and a computer.

Materials

The toys used in the study were categorized as either unrelated or related (see Table 1). The unrelated toys consisted of a construction site, a helicopter play set, and a jet ski with accessories. The related toys consisted of a crane, a bulldozer, a dump truck, and a background mat with accessories. Prior discussions with the boys' parents and teachers had indicated that

Table 1
Description of Unrelated and Related Toys

Unrelated toys	
Toy 1	Construction site, which consisted of two male figurines in hard hats, boom gate with control booth, bulldozer, dump truck,wheelbarrow, and rocks.
Toy 2	Helicopter with winch and net, male figurine, and elephant.
Toy 3	Jet ski and male figurine, crane, and play mat consisting of buildings, streets, and river.
Related toys	
Toy 1	Crane and two male figurines in hard hats, stop sign, barrel, boom gate with control booth, and play mat consisting of buildings, streets, and river.
Toy 2	Bulldozer and two male figurines in hard hats, stop sign, barrel, boom gate with control booth, and play mat consisting of buildings, streets, and river.
Toy 3	Dump truck and two male figurines in hard hats, stop sign, barrel, boom gate with control booth, and play mat consisting of buildings, streets, and river.

transport toys such as cars, trains, airplanes, and boats were preferred and sought-after toys. Such toys were readily accessible in the boys' homes and at school, but play with these toys was viewed as repetitive and limited (e.g., holding cars upside down and spinning the wheels or repetitively examining moving parts).

The videotape models showed a young male adult model engaging in appropriate verbal and motor play with one of the selected toys (see Table 2). Each videotape was approximately 120 s. Normative samples of play behavior were observed prior to making the videotapes by watching two normal-developing boys, aged 5 and 7 years, play with the selected toys. Because earlier research had shown that children with autism learned equally well from either child or adult models (Ihrig & Wolchik, 1988), an adult model was used in this study for expediency.

Measurement

Scoring. Appropriate and repetitive verbal and motor play behavior were recorded using a 10-s partial interval scoring method. An audioplayer with earphone was used to signal 10-s intervals, with each 10-s observational interval followed by a 10-s recording interval. For each interval, up to four target behaviors were recorded onto a tally sheet. Percentages of intervals

Table 2
Description of Videotaped Models

	Modeled Motor Behavior	Modeled Verbal Behavior
Unrelated toys		
Toy 1 (Construction)	Put men in the truck cabin.	"Get in"; "In the truck"
	Open gate and drive truck through.	"Open gate"; "Brmm"
	Push wheelbarrow and tip rocks into bulldozer.	"Get the rocks"; "Tip!"
Toy 2 (Helicopter)	Spin helicopter blades.	Flying sounds; "Chop, chop, chop. . . ."
	Put man in cockpit.	"In you go"; "Let's fly"
	Put elephant in the net.	"Get the elephant"; "Put him in"
Toy 3 (Jet ski)	Put man on jet ski.	"Get on"; "On the jet ski"
	Push jet ski along river.	"Push jet ski"; "Down the river"
	Crash jet ski into bridge.	Crash sounds; "Oh no, crashed!"
Related toys		
Toy 1 (Crane)	Put man in crane cabin.	"Get in"; "Off to work"
	Pick up barrel with crane.	"Get the barrel"; "Lift it up"
	Put second man in the crane seat.	"Get my friend"; "Let's go"

of appropriate verbal and motor behavior and percentages of intervals of repetitive verbal and motor behavior served as dependent measures and were calculated for each observational session. Target behaviors were defined as follows.

Appropriate verbal play behavior was verbal statements or play sounds that were related to both toy and situation. For example, the statement "Stop at the lights" or the play sounds "Brmm, brmm" while driving the toy truck along the floor were recorded as occurrence of appropriate verbal behavior. However, occurrence of verbal statements or play sounds in the absence of related motor play behavior, such as talking about objects not in view or unrelated to play (e.g., talking about sharks while playing with a truck on a road) or making sounds with no corresponding motor play (e.g., making crashing sounds or fire engine siren sounds while not engaged in corresponding motor play behavior during or immediately following the sounds), was not recorded as appropriate verbal play. There was no minimum word length for appropriate verbal behavior.

Appropriate motor play behavior was defined as motor behavior or play action that was related to both toy and situation. For example, putting a figurine man inside the truck or spinning the propeller blades on a helicopter was considered appropriate motor behavior, whereas mouthing a toy or dangling a toy truck in the air was not recorded as appropriate behavior.

Repetitive verbal play behavior was defined as verbal statements or play sounds that were identical to verbal statements or play sounds previously recorded as appropriate during any 3 min of play. For example, the first occurrence of walking a figurine man and saying, "Walk, walk," was recorded as appropriate verbal play. Subsequent occurrences within the following 3 min and for an entire 10-s interval were recorded as repetitive verbal behavior. However, verbal behavior was not considered repetitive if during the same 10-s interval other verbal behavior occurred (e.g., during the same interval "Walk, walk" and "Get in the truck"). Verbal behavior was considered different if the wording was altered in relation to articles of speech or object label. For example, "Walk to the truck" and "Walk to the house" were recorded as two different verbal statements.

Repetitive motor play behavior was defined as motor behavior or play action that was identical to motor behavior previously recorded as appropriate during any 3 min of play. For example, walking a figurine man and saying, "Walk, walk," was recorded as appropriate motor play behavior when it first occurred. Subsequent occurrences of the man walking and a statement such as "Go for walk" within the following 3 min and for an entire 10-s interval were recorded as repetitive motor behavior.

Motor behavior was not repetitive if during any 10-s interval different motor behaviors occurred (e.g., during the one interval, walking the man and then putting it in the truck). Also, motor behavior was not repetitive when the toy related differently to other objects. For example, walking the figurine man over to the truck and walking it over to the house was recorded as two different motor behaviors.

Observer training and interobserver agreement. Observer training occurred in two phases during 3 days before formal observations began. The initial phase consisted of 3 hr of learning the behavior definitions by matching the definitions to behavior in role-plays. The second phase consisted of three 20-min observer training sessions with each child. The first session consisted of the researcher modeling recording procedures while the child played. During the subsequent two sessions, the researcher and observer independently scored until total agreement was achieved during each session.

During formal coobservations, both observers were seated the same distance from the children and simultaneously and independently recorded using individual tally sheets. The second observer was present during 46%

Table 3
Percentages of Interobserver Agreement Means and Ranges Across Children and Behavior

	Appropriate Behavior		Repetitive Behavior	
	Motor	Verbal	Motor	Verbal
Luke	97 (97-100)	98 (97-100)	99 (97-100)	99 (97-100)
John	97 (97-100)	98 (97-100)	99 (97-100)	99 (97-100)

of sessions with Luke and 48% of sessions with John, with a minimum of 25% of sessions for each condition with each child. Interobserver agreement was calculated by dividing the total number of observer agreements by the total number of agreements plus disagreements and multiplying by 100%. Agreement measures for each child and behavior are found in Table 3.

Research Design and Phases

Two separate single-participant experimental designs were used. First, a multiple baseline across Luke's play behavior was used to evaluate effects of video modeling. The multiple baseline also incorporated a withdrawal phase with Toy 1 (see Barlow & Hersen, 1984). Second, generalization of John's play behavior was evaluated with a withdrawal design containing continuous-generalization probes for play with Toys 2 and 3. The design, described by Barrios and Hartmann (1988), features phases of varying durations to minimize probabilities of spontaneous and cyclical events contributing to generalization effects.

Prior to commencing observations, the researcher and second observer familiarized themselves with each child by twice visiting and spending time with each child in his respective classroom and once in the play room. Each child participated in 2 observational sessions per school day, totaling 25 or 26 sessions during 4 weeks.

Baseline. During baseline sessions, the boys were given the instruction "Play with the (bulldozer, helicopter, etc.)." During sessions, each boy sequentially engaged in 3-min periods with each toy. After completion of each 3-min play period, the toy was removed and replaced with the next selected toy. At the beginning of sessions, the toys were arranged in the same order and location on the floor in the middle of the room. Sessions were terminated if the boys left the play area for more than 40 s. No reinforcement, prompting, or correction procedures were used during baseline.

Video modeling. At the beginning of each session, the instruction "Let's watch a video" was given. The child sat on a chair next to the researcher, facing the video monitor, which was about 2.5 m away. The researcher modeled watching the monitor when the video model was played and provided prompts (e.g., pointed at the monitor) if the child withdrew attention for more than 5 s. Each child viewed the video model twice, followed by immediate access to the toy shown in the video. Presentation of toys occurred as in baseline sessions. If the boys left the play area for more than 40 s (i.e., over two consecutive observational intervals), the researcher redirected the boys toward the toys and repeated the verbal instruction "Play with the (bulldozer, helicopter, etc.)." During each 3-min play period, children were praised (e.g., "That was great playing.") when they engaged in appropriate play behavior. Praise was given only once with each toy per session. Video modeling with Toys 2 and 3 was presented only to Luke.

Withdrawal and follow-up. Withdrawal and follow-up sessions consisted of baseline conditions. Follow-up sessions were conducted 7 days, during which no play sessions occurred, after Luke's Session 22 and John's Session 21.

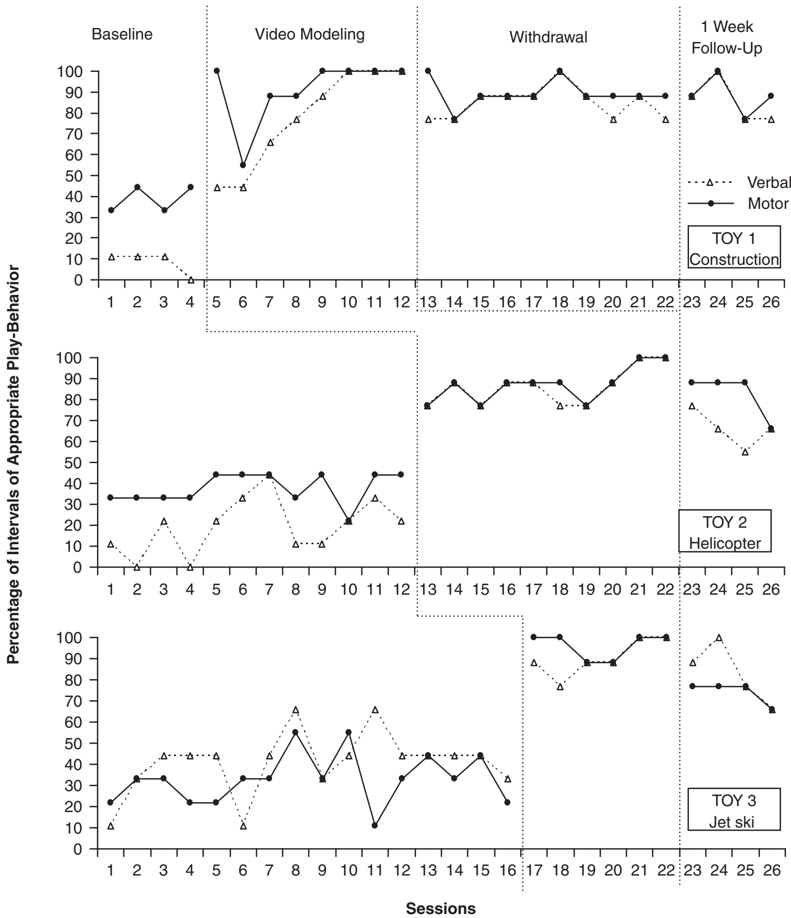
Results

Play Behavior With Unrelated Toys

Figure 1 shows percentages of intervals of Luke's appropriate verbal and motor play behavior across phases and the three unrelated toys. During baseline with Toy 1, Luke engaged in low and stable levels of verbal play behavior (M = 8%, range = 0% to 11%) and motor play behavior (M = 39%, range = 33% to 44%). With Toy 2, verbal and motor play behaviors were at means of 19% and 38%, ranging from 0% to 44% and from 22% to 44%, respectively. With Toy 3, the means were 40% for verbal and 33% for motor, ranging from 11% to 66% and from 11% to 55%, respectively.

With the introduction of video modeling, overall rapid increases in appropriate play behavior were observed. With Toy 1, verbal (M = 77%, range = 44% to 100%) and motor (M = 91%, range = 55% to 100%) play behavior increased to and stabilized at 100% by Session 10. With Toys 2 and 3, verbal and motor behaviors occurred at high levels with low

Figure 1
Percentage of Luke's Appropriate Verbal and Motor Play Behavior During Baseline, Video Modeling, Withdrawal of Video Modeling, and Follow-Up Across Toys



variability (Toy 2 verbal and motor behaviors, respectively: *M* = 86%, range = 77% to 100%; *M* = 87%, range = 77% to 100%; Toy 3 verbal and motor behaviors, respectively: *M* = 90%, range = 77% to 100%; *M* = 96%, range = 88% to 100%).

During withdrawal with Toy 1, play behavior was slightly lower than during the preceding video modeling phase but higher than when observed during baseline (verbal and motor behavior, respectively: *M* = 85%, range = 77% to 100%; *M* = 89%, range = 77% to 100%). During the 1-week follow-up, play behavior appeared slightly lower than during the video modeling phase. Nevertheless, increased effects on verbal and motor behavior were maintained compared with baseline levels across Toy 1 (*M* = 86%, range = 77% to 100%; *M* = 88%, range = 77% to 100%, respectively), Toy 2 (*M* = 66%, range = 55% to 77%; *M* = 83%, range = 66% to 88%, respectively), and Toy 3 (*M* = 83%, range = 66% to 88%; *M* = 74%, range = 66% to 77%, respectively).

Figure 2 shows percentages of intervals of Luke's repetitive verbal and motor play behavior across phases and the three unrelated toys. During baseline with Toy 1, repetitive verbal behavior occurred only in the first session (*M* = 17%, range = 0% to 66%), whereas repetitive motor behavior occurred at higher levels (*M* = 58%, range = 55% to 66%). With Toy 2, repetitive verbal behavior was also at low levels (*M* = 4%, range = 0% to 22%), whereas repetitive motor behavior was high and relatively stable (*M* = 59%, range = 44% to 77%). With Toy 3, both repetitive verbal and motor behaviors were variable, but on this occasion repetitive verbal behavior was at higher levels (verbal and motor behaviors, respectively: *M* = 32%, range = 0% to 55%; *M* = 52%, range = 22% to 77%).

With the introduction of video modeling, Luke showed rapid decreases in repetitive motor play across Toy 1 (*M* = 8%, range = 0% to 44%), Toy 2 (*M* = 12%, range = 0% to 22%), and Toy 3 (*M* = 2%, range = 0% to 11%). Effects were not so clear with verbal repetitive behavior during play with Toys 1 and 2, which earlier had been associated with low baseline levels. Levels of Toys 1 and 2 were at means of 6% and 12%, ranging from 0% to 22% and from 0% to 22%, respectively. With Toy 3, repetitive verbal behavior decreased to a mean of 6%, ranging from 0% to 11%.

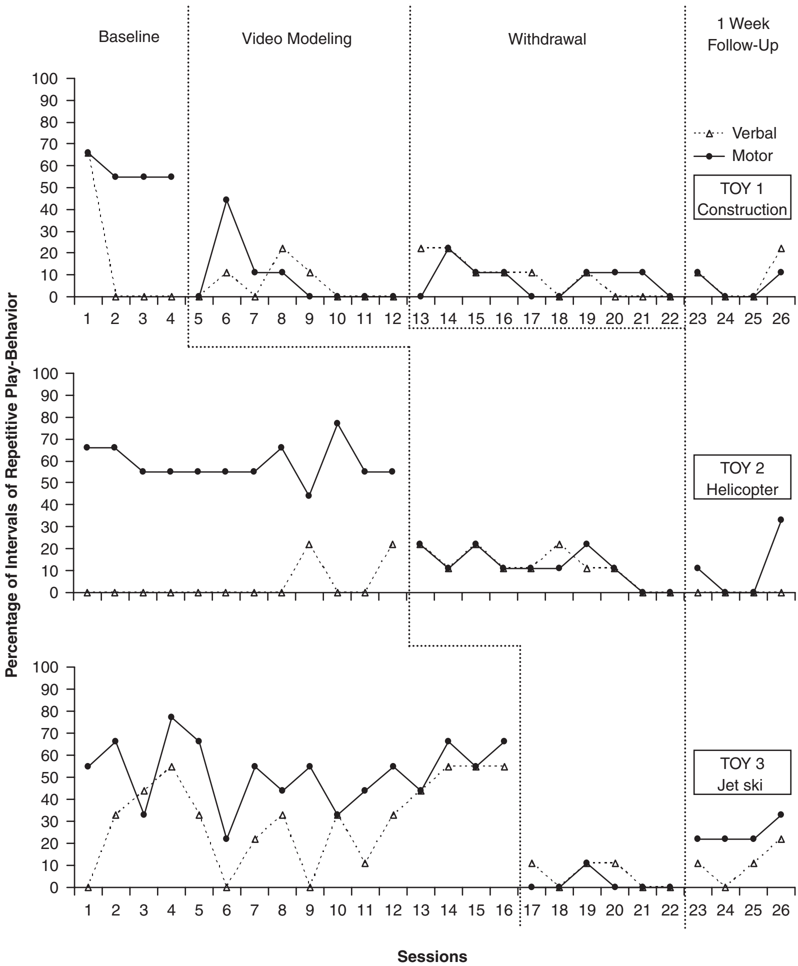
During withdrawal with Toy 1, levels of repetitive behavior remained unchanged (verbal and motor, respectively: *M* = 9%, range = 0% to 22%; *M* = 8%, range = 0% to 22%).

During the 1-week follow-up, decreases in repetitive verbal and motor behavior appeared to have been maintained across Toy 1 (*M* = 8%, range = 0% to 22%; *M* = 6%, range = 0% to 11%), Toy 2 (*M* = 11%, range = 0% to 33%), and Toy 3 (*M* = 11%, range = 0% to 22%; *M* = 25%, range = 22% to 33%).

Play Behavior With Related Toys

Figure 3 shows percentages of intervals of John's appropriate verbal and motor play behavior across phases and the three related toys. With Toy 1,

Figure 2
Percentage of Luke's Repetitive Verbal and Motor Play Behavior During Baseline, Video Modeling, Withdrawal of Video Modeling, and Follow-Up Across Toys



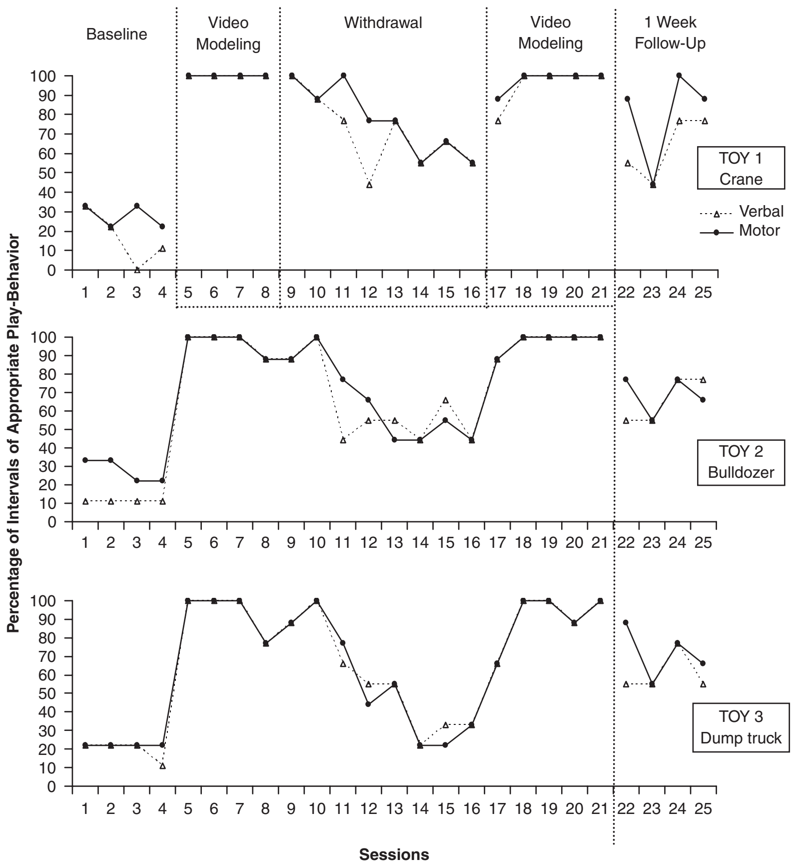
baseline observations showed verbal and motor behavior at low levels, with verbal behavior more variable than motor behavior (verbal and motor behavior, respectively: $M = 17\%$, range = 0% to 33%; $M = 28\%$, range = 22%

to 33%). Following video modeling, both verbal and motor behavior rapidly increased to, and stabilized at, 100%. During the withdrawal phase, behavior decreased with a downward trend (verbal and motor behavior, respectively: *M* = 70%, range = 44% to 100%; *M* = 77%, range = 55% to 100%). With the reintroduction of video modeling, both verbal and motor behavior increased to and stabilized at levels observed during the first phase of video modeling (*M* = 95%, range = 77% to 100%; *M* = 98%, range = 88% to 100%, respectively). During the 1-week follow-up, verbal and motor behaviors were variable and at lower levels but higher than those observed during baseline (*M* = 63%, range = 55% to 77%; and *M* = 80%, range = 44% to 100%, respectively).

Although video modeling was not applied to Toys 2 and 3, changes in behavior with these toys appeared to correspond with changes in Toy 1 behavior. During the first four sessions, play behavior was at similar levels to those of Toy 1 (Toy 2 verbal and motor behavior: *M* = 11%, range = 11% to 11%; *M* = 28%, range = 22% to 33%, respectively; Toy 3: *M* = 19%, range = 11% to 22%; *M* = 22%, range = 22% to 22%). During Sessions 5 to 8, which corresponded with video modeling with Toy 1, verbal and motor behavior rapidly increased with Toy 2 (*M* = 97%, range = 88% to 100%; *M* = 97%, range = 88% to 100%) and Toy 3 (*M* = 94%, range = 77% to 100%; *M* = 94%, range = 77% to 100%) to levels similar to those observed with Toy 1. From Sessions 9 to 16, verbal and motor behavior decreased with downward trends similar to those observed with Toy 1 during the same sessions (Toy 2, verbal and motor behavior: *M* = 62%, range = 44% to 100%; *M* = 65%, range = 44% to 100%, respectively; Toy 3: *M* = 57%, range = 22% to 100%; *M* = 55%, range = 22% to 100%). During Sessions 17 to 21, verbal and motor play behavior rapidly increased with Toy 2 (*M* = 98%, range = 88% to 100%; *M* = 98%, range = 88% to 100%, respectively) and Toy 3 (*M* = 91%, range = 66% to 100%; *M* = 91%, range = 66% to 100%). Again, increases were similar to those observed with Toy 1 during the second video modeling phase. During the 1-week follow-up, as with Toy 1, verbal and motor behavior were variable and at lower levels but higher than baseline levels (Toy 2: *M* = 66%, range = 55% to 77%; *M* = 69%, range = 55% to 77%, respectively; Toy 3: *M* = 61%, range = 55% to 77%; *M* = 72%, range = 55% to 88%, respectively).

Figure 4 shows percentages of intervals of John's repetitive verbal and motor play behavior across phases and related toys. Decreases in the levels of repetitive verbal and motor play behavior occurred across all three toys throughout the study. With Toy 1, baseline observations showed repetitive verbal behavior at low and variable levels (*M* = 17%, range = 0% to 33%) and repetitive motor behavior at high and stable levels (*M* = 69%, range = 66%

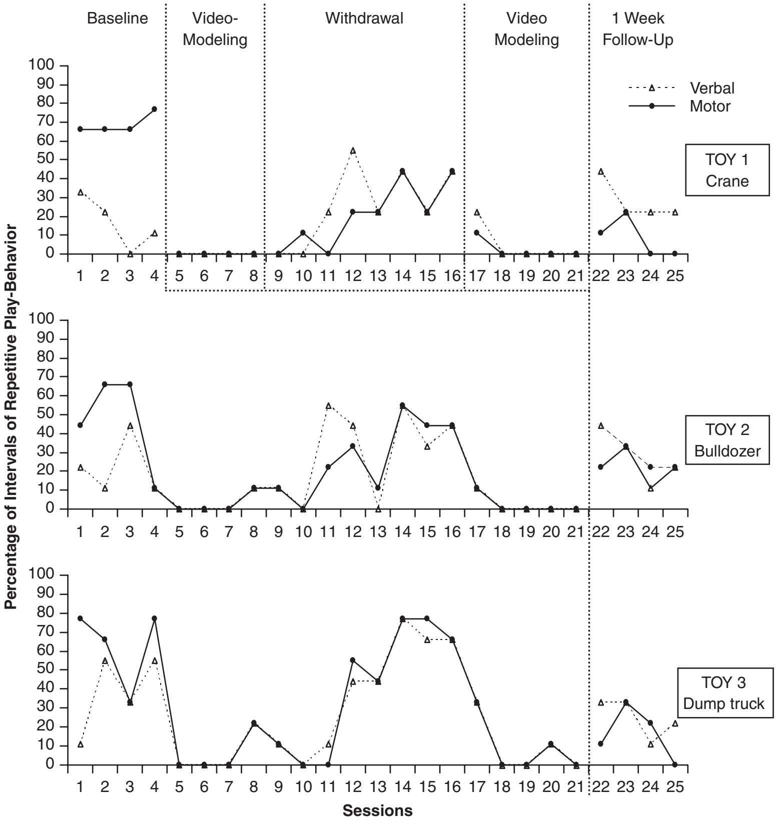
Figure 3
Percentage of John's Appropriate Verbal and Motor Play Behavior During Baseline, Video Modeling, Withdrawal of Video Modeling, Reintroduction of Video Modeling, and Follow-Up Across Toys



to 77%). Following video modeling, repetitive verbal and motor behavior rapidly decreased to 0% and remained at 0% throughout the phase.

During withdrawal, repetitive verbal and motor behavior gradually increased (M = 26%, range = 0% to 55%; M = 21%, range = 0% to 44%,

Figure 4
Percentage of John's Repetitive Verbal and Motor Play Behavior During Baseline, Video Modeling, Withdrawal of Video Modeling, Reintroduction of Video Modeling, and Follow-Up Across Toys



respectively). However, with the reintroduction of video modeling, repetitive verbal and motor behavior decreased to stable levels of 0% (M = 4%, range = 0% to 22%; M = 2%, range = 0% to 11%). During follow-up, repetitive behavior increased from levels observed during the previous two video modeling phases (M = 28%, range = 22% to 44%; M = 8%, range = 0% to 22%, respectively).

During the first four sessions with Toys 2 and 3, repetitive verbal and motor behaviors were variable. With Toy 2, means were 22% (range = 11% to 44%) and 47% (range = 11% to 66%), and with Toy 3, means were 39% (range = 11% to 55%) and 63% (range = 33% to 77%), respectively. From Sessions 5 to 8, during which play with Toy 1 received video modeling, repetitive verbal and motor behavior decreased to near 0%, levels similar to those observed with Toy 1 (Toy 2: *M* = 3%, range = 0% to 11%; *M* = 3%, range = 0% to 11%, respectively; Toy 3: *M* = 6%, range = 0% to 22%; *M* = 6%, range = 0% to 22%, respectively).

During Sessions 9 to 16, there was a variable increasing trend in repetitive verbal and motor behavior with both Toy 2 (*M* = 30%, range = 0% to 55%; *M* = 28%, range = 0% to 55%, respectively) and Toy 3 (*M* = 40%, range = 0% to 77%; *M* = 41%, range = 0% to 77%, respectively). Increases were similar to those observed with Toy 1 during reversal. During Sessions 17 to 21, repetitive verbal and motor behavior rapidly decreased to near-zero levels for Toy 2 (*M* = 2%, range = 0% to 11%; *M* = 2%, range = 0% to 11%, respectively) and Toy 3 (*M* = 9%, range = 0% to 33%; *M* = 9%, range = 0% to 33%, respectively). Again, decreases in repetitive behavior were similar to those observed with Toy 1 during the second video modeling phase. During the 1-week follow-up, as with Toy 1, repetitive behavior increased from levels observed during video modeling (Toy 2: *M* = 28%, range = 11% to 44%; *M* = 25%, range = 22% to 33%; Toy 3: *M* = 25%, range = 11% to 33%; *M* = 17%, range = 0% to 33%, respectively).

Discussion

The results show that increases in appropriate play were a function of video modeling. This relationship is evident in the observations of play with the unrelated toys, which showed that increases in verbal and motor play did not increase until video modeling was introduced. Furthermore, effects slightly diminished during the withdrawal and follow-up conditions, thus strengthening the functional relationship. However, most important, and from a pragmatic point of view, the diminished effects remained at substantially higher levels than those observed prior to video modeling. Generalized appropriate play was observed with John, who was presented with related toys. Again, a functional relationship between video modeling and increased appropriate play was demonstrated with a withdrawal condition that was associated with decreased play across all three related toys.

These results support earlier findings that showed efficacy of video modeling for increasing appropriate play behavior such as toy play (D'Ateno et al., 2003), social initiation and toy play (Nikopoulos & Keenan, 2003, 2004), and toy-related conversational skills (Charlop & Milstein, 1989; Taylor et al., 1999). Furthermore, the results show decreases in repetitive motor play, but effects on repetitive verbal play were unclear because of generally low levels of verbal behavior prior to intervention. Conversely, when withdrawal or follow-up conditions prevailed, repetitive motor play behavior slightly increased but remained substantially lower than prevideo levels. These results extend earlier research by demonstrating not only increased appropriate play but also decreased repetitive play.

Most notably, the current findings extend earlier studies by demonstrating, first, generalized motor play with the three related toys and, second, maintained play, albeit slightly decreased, after video modeling was terminated with all the toys. Generalized, including maintained, behavior is assumed to result from effective transfer of stimulus control from teaching situations to situations in which teaching did not occur or to situations in which, if teaching did occur, it was less intensive. Many variables can produce generalization, but in the present study the following three appear pertinent (see Dunlap, 1993; Kirby & Bickel, 1988; Stokes & Osnes, 1986). First, John's three sets of toys presented with common physical components and stimuli such as figurines of workers, a common play mat, and vehicles each with four wheels, driver cabins, and so on. The common components may have served as functional mediators (i.e., stimuli present in the nonteaching situations, but similar to those during teaching, that evoke the desired behavior), which made the toys less discriminable and evoked similar (i.e., generalized) behavior across the toys.

Second, the selected toys for Luke and John may have had potential intrinsic or natural reinforcement. For example, consider a toy car designed to be pushed with prolonged and consistent effort along the floor before its flashing lights and sounds switch on. If a child's behavior with the toy lacks effort or competence, then, most likely, the toy's automatic properties will not reinforce continued or expanded play. This type of problem arises with many children with developmental disabilities who struggle to connect with naturally reinforcing activities, mainly because of their limited behavioral repertoires. However, once a child is taught to competently play with the toy, then the flashing lights and sounds should naturally reinforce play. Increasing competent behavior is viewed as a critical variable for generalization. The present results show that appropriate play dramatically increased to high levels with the introduction of video modeling, indicating that play occurred more competently and supposedly with more natural reinforcement.

It should be noted, though, that appropriate play did not generalize from zero levels prior to video modeling. During baseline, play occurred at low or moderate levels, indicating that the children showed basic play skills and that the selected toys were engaging to some degree. These observations raise some interesting questions: If baseline had shown zero levels of play, would the video modeling have been as effective? Are some toys more naturally reinforcing than others? Future studies investigating such questions may highlight relationships between antecedent behavioral repertoires and intrinsic properties of toys. Future studies could test and classify natural reinforcement properties of toys (e.g., build on Haring's [1985] study) and subsequently investigate effects with or without video modeling. If video modeling were to enhance generalized toy play with reinforcing toys, it may lead to more effective toy sharing as an approach for developing social and communicative behavior.

Third, the video modeling condition appeared to produce a convergence between verbal and motor play behavior. Convergence and interaction between the verbal and motor aspects of play may have produced a verbal–nonverbal correspondence effect (see Baer, 1990; Paniagua, 1997). Verbal–nonverbal correspondence occurs when a child's talk of past or future actions corresponds or accords with the child's actions. Children's verbal–nonverbal correspondence has been shown to increase when adults, such as teachers or researchers, reinforce contingencies between saying and doing (and vice versa). Increasing correspondence appears to enhance generalization to other actions, not by direct reinforcement but by evoking children's talk of those actions. For example, a teacher praises and materially reinforces a child's talk and play with a particular toy until a stable pattern of correspondence is demonstrated. The teacher then prompts the child to talk about drawing pictures of the toy; subsequently, the child generalizes his or her behavior by corresponding his or her talk with actual drawing but without further reinforcement from the teacher. That is, as children develop their verbal control, which essentially is the aim of correspondence training, the probability of linking play with new natural reinforcers is increased. This extends children's play behavior and, logically, their interactions with other children's play.

In the present study, the video modeling and the researchers' accompanying social praise for appropriate play increased and converged verbal and motor play behavior to high levels and may have inadvertently reinforced the correspondence between them and, in turn, enhanced a natural positive contingency between talking about play and doing it. Appropriate talk such as "Get on," "Push jet ski," and "Get the barrel" may have added to the natural reinforcement of play, with verbal behavior evoking and reinforcing actions, and vice versa. The children's behavior may have connected a natural source of reinforcing play that would not have occurred without interactions between verbal and motor play. On the other hand, repetitive talk and actions decreased to zero levels, especially with John. The absence of video modeling of and praise for repetitive play may account for this observation.

Links between correspondence effects and play's natural reinforcement, as pointed out by Lloyd (2002), have yet to be researched. It may be fruitful to examine interactive effects among video modeling, correspondence training, and natural reinforcing properties of toy play. For example, increasing correspondence between verbal and motor play may enhance the instructional effects of video modeling and may more efficiently connect the child's behavior to play's natural reinforcement.

The withdrawal and follow-up conditions permitted a limited evaluation of postvideo effects. With Luke, withdrawal showed maintained toy play, although with slight decreases in appropriate play and increases in repetitive play. Although desirable, the lack of a clear loss of effect during withdrawal compromises interpretation of results. Luke's research design was limited in that it did not adequately control several potentially confounding effects, including the toys' natural reinforcement and verbal–nonverbal correspondence and also effects related to the multiple baseline strategy. After termination of video modeling with Toy 1, Luke was exposed to video models of Toys 2 and 3, which may have attenuated the loss of effect with Toy 1. Without the video models of Toys 2 and 3, Luke's play with Toy 1 may have decreased to lower levels. On the other hand, during John's withdrawal, decreases in appropriate play and increases in repetitive play were more pronounced, which may have been related to the absence of a multiple baseline design. Furthermore, loss of effects was evident during follow-up of both children. Whether appropriate and repetitive play would have returned to baseline levels is not known as observations were limited, but such an outcome should be considered. The overall evidence so far suggests that video modeling can be effective, but for as long as children remain exposed to it. However, the required durations, and other parameters of exposure, are not known. Further research could investigate postvideo effects in conjunction with variables, such as those discussed here, that enhance generalization and minimize loss of teaching effects. Most likely, some degree of continued exposure to video modeling, for example, in the form of periodic viewings, is necessary for developing and generalizing toy play.

Finally, anecdotal observations in the present study also showed that generalized play did not simply consist of repetitions of similar play behavior (e.g., driving the crane and subsequently driving the bulldozer or dump truck) but also included novel play behavior, that is, new behavior that was dissimilar to that shown in the video model. For instance, John's video model of Toy 1 showed the crane picking up and moving the barrel with the hook and collecting a second passenger in a second seat, among other actions. However, subsequent play with Toys 2 and 3 included putting the barrel and the second passenger in the scoop of the bulldozer and the back of the dump truck. Although such novel behavior was not measured in the present study, these observations nevertheless lend support to earlier systematic observations of their occurrence (D'Ateno et al., 2003). Future research may find that toys with common physical components and natural reinforcement properties, and interventions that promote verbal–nonverbal correspondence, should generate higher levels of novel behavior. Research that supplements video modeling with such variables may lead to more practical teaching technologies and alternatives to more common but laborious methods such as intensive teacher prompting (see Charlop-Christy et al., 2000; Pierce & Schreibman, 1995).

In conclusion, the present study adds to our knowledge of video modeling by demonstrating instances of generalized toy play with toys of similar physical characteristics that supposedly evoked generalization. The study measured undesirable repetitive play as well as appropriate play and also included measures of verbal and motor aspects of play.

References

Ayres, K. M., & Langone, J. (2005). Intervention and instruction with video for students with autism: A review of the literature. *Education and Training in Developmental Disabilities, 40,* 183-196.

Baer, R. A. (1990). Correspondence training: Review and current issues. *Research in Developmental Disabilities, 11,* 379-393.

Barlow, D. H., & Hersen, M. (1984). *Single-case experimental designs: Strategies for studying behavior change* (2nd ed.). New York: Plenum.

Barrios, B. A., & Hartmann, D. P. (1988). Recent developments in single-subject methodology: Methods for analyzing generalization, maintenance, and multicomponent treatments. In M. Hersen, R. M. Eisler, & P. M. Miller (Eds.), *Progress in behavior modification* (Vol. 22, pp. 11-47). Newbury Park, CA: Sage.

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.

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

Dunlap, G. (1993). Promoting generalization: Current status and functional considerations. In R. Van Houten & S. Axelrod (Eds.), *Behavior analysis and treatment* (pp. 269-296). New York: Plenum.

Haring, T. G. (1985). Teaching between-class generalization of toy play behavior to handicapped children. *Journal of Applied Behavior Analysis*, *18*, 127-139.

Howes, C. (1985). Sharing fantasy: Social pretend play in toddlers. *Child Development, 56,* 1253-1258.

Ihrig, K., & Wolchik, S. A. (1988). Peer versus adult models and autistic children's learning: Acquisition, generalization and maintenance. *Journal of Autism and Developmental Disorders*, *18*, 67-79.

Kirby, K. C., & Bickel, W. K. (1988). Toward an explicit analysis of generalization: A stimulus control interpretation. *The Behavior Analyst, 11,* 115-129.

Krantz, P. J., MacDuff, G. S., Wadstrom, O., & McClannahan, L. E. (1991). Using video with developmentally disabled learners. In P. W. Dowrick (Ed.), *Practical guide to using video in the behavioral sciences* (pp. 256-266). New York: John Wiley.

Lloyd, K. E. (2002). A review of correspondence training: Suggestions for a revival. *The Behavior Analyst, 25,* 57-73.

Mueller, E., & Brenner, J. (1977). The origins of social skills and interaction among playgroup toddlers. *Child Development, 48,* 854-861.

Newsom, C. (1998). Autistic disorder. In E. J. Mash & R. A. Barkley (Eds.), *Treatment of childhood disorders* (2nd ed., pp. 416-467). New York: Guilford.

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

Nikopoulos, C. K., & Keenan, M. (2004). Effects of video modeling on social initiations by children with autism. *Journal of Applied Behavior Analysis*, *37*, 93-96.

Paniagua, F. A. (1997). Verbal–nonverbal correspondence training as a case of environmental antecedents. In D. M. Baer & E. M. Pinkston (Eds.), *Environment and behavior* (pp. 43-48). Boulder, CO: Westview.

Pierce, K., & Schreibman, L. (1995). Increasing complex play in children with autism via peer-implemented pivotal response training. *Journal of Applied Behavior Analysis*, *28*, 285-295.

Schreibman, L., & Charlop-Christy, M. H. (1998). Autistic disorder. In T. H. Ollendick & M. Hersen (Eds.), *Handbook of child psychopathology* (3rd ed., pp. 157-179). New York: Plenum.

Sherer, M., Pierce, K. L., Paredes, S., Kisacky, K. L., Ingersoll, B., & Schreibman, L. (2001). Enhancing conversation skills in children with autism via video technology: Which is better, "self" or "other" as a model? *Behavior Modification, 25,* 140-158.

Stephens, W. E., & Ludy, I. E. (1975). Action-concept learning in retarded children using photographic slides, motion picture sequences, and live demonstrations. *American Journal of Mental Deficiency, 80,* 277-280.

Stokes, T. F., & Osnes, P. G. (1986). Programming the generalization of children's social behavior. In P. S. Strain, M. J. Guralnick, & H. M. Walker (Eds.), *Children's social behavior: Development, assessment, and modification* (pp. 407-443). New York: Academic Press.

Sturmey, P. (2003). Video technology and persons with autism and other developmental disabilities: An emerging technology for PBS. *Journal of Positive Behavior Interventions*, *5*, 3-4.

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*, 253-264.

Thelen, M. H., Fry, R. A., Fehrenbach, P. A., & Frautschi, N. M. (1979). Therapeutic videotape and film modeling: A review. *Psychological Bulletin, 86,* 701-720.

Wolfberg, P. J., & Schuler, A. L. (1993). Integrated play groups: A model for promoting the social and cognitive dimensions of play in children with autism. *Journal of Autism and Developmental Disorders*, *23*, 467-489.

Claire R. Paterson is studying for her master's of psychology (clinical) at Edith Cowan University and is employed as a psychologist with Disability Services Commission, Western Australia. Her research interests include developmental disabilities, behavioral family interventions, and positive behavior support.

Lucius Arco is a clinical psychologist and lecturer at Edith Cowan University. He received his PhD from Murdoch University. His research interests include neurobehavioral rehabilitation, child and family behavior therapy, and caregiver coaching and support.