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Generalized effects of video modeling on establishing instructional stimulus control in children with autism: Results of a preliminary study.

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Abstract

Video modeling has been suggested as a powerful treatment tool that has mainly concentrated on increasing a variety of skills in children with autism. However, it has rarely been examined as a behavioral procedure for eliminating a kind of behaviors (e.g., noncompliance), a target that is often included in their support plan. Therefore, the present study provides preliminary effects of video modeling to establish instructional stimulus control over a simple behavior (i.e., clean up a toy) that required the termination of an ongoing activity. Three children with autism participated and experimental control was accomplished using a multiple baseline across subjects design. Children viewed a short video in which a typical peer first playing and then putting a toy away in a box upon the experimenter's verbal request 'play is finished'. Afterwards, they were required to demonstrate that modeled behavior in vivo. When this modeled behavior was performed, then programming for generalization across three other toys in the absence of any videotape took place. Results showed that video modeling could be an effective procedure for enhancing instructional stimulus control over a simple behavior for children with autism with lower baseline levels of disruptive behaviors and more developed imitation skills within a play context. Successful responding generalized across three other different toys and another subject and it was maintained after a 1-month follow-up period. Specific guidelines for building video modeling into real teaching situations are also discussed.

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Applied behavior analysis (ABA) has an impressive history of significant research and strategy development in the treatment of autism since the 1960s, with the studies of Ferster (Ferster, 1961; Ferster & DeMyer, 1961), Lovaas (Lovaas, Berberich, & Perloff, 1991; Lovaas, Freitas, Nelson, & Whalen, 1967), Wolf (Baer, Wolf, & Risley, 1968, 1987; Wolf, Risley, & Mees, 1964; Wolf, Risley, Johnston, Harris, & Allen, 1967) and Risley, (Risley & Wolf, 1966). ABA has been regarded as the best empirically evaluated intervention (Simpson, 2001) and therefore, as the treatment of choice for individuals with autism since 1981 (DeMyer, Hingtgen, & Jackson, 1981). All these years, a vast range of instructional strategies incorporating the principles of ABA such as positive reinforcement, stimulus control, and discrimination learning have been developed in an effort to bring out the best in each individual with autism (Dunlap, Kern, & Worcester, 2001). These strategies have focused on producing positive changes in the core deficits of autism by promoting the acquisition and generalization of communication, social, academic, and self-help skills or eliminating the occurrence of problematic, inappropriate or challenging behaviors (e.g., Heflin & Alberto, 2001).

Furthermore, several formats of these instructional strategies have been designed yielding remarkable results; for example, embedded instruction (Johnson, McDonnell, Holzwarth, & Hunter, 2004) or discrete-trial training (Lovaas, 2003; Newman, Reeve, Reeve, & Ryan, 2003; Sarokoff & Sturmey, 2004) to name a few. Integration of a variety of ABA instructional formats is important since more comprehensive programs can be structured and as a result even better learning outcomes can be achieved (e.g., Weiss, 2001, 2005). Learning through observation or modeling constitutes an important component of most instructional formats probably because functioning of children with autism in mainstream educational settings frequently demands skills that have not yet been learned (Buggey, Toombs, Gardener, & Cervetti, 1999). Moreover, visually cued instructions have also increasingly emerged and been incorporated in interventions since children with autism have been suggested to perform particularly well in visual discrimination tasks (Marks et al., 2003; O’Riordan & Plaisted, 2001; O’Riordan, Plaisted, Driver, & Baron-Cohen, 2001; Quill, 1997; Shipley-Benamou, Lutzker, & Taubman, 2002). Hence, considering both modeling and visually-cued instructions as important elements of many instructional packages, the use of video models in the treatment of autism in a variety of different formats was a logical outgrowth (Ayres & Langone, 2005).

Indeed, video modeling as a whole has been proposed as an effective instructional strategy for teaching a variety of skills to children with autism (e.g., Delano, 2007). It can be defined as the occurrence of a behavior by an observer that is the same or similar to the behavior shown by a model on a videotape (e.g., Grant & Evans, 1994) whilst the model can be a peer, a sibling, an adult or even self (Bellini & Akullian, 2007). The list of video modeling achievements is growing fast and includes, for example, teaching of *generalized purchasing skills* (Alcantara, 1994; Haring, Kennedy, Adams, & Pitts-Conway, 1987; Haring, Breen, Weiner, Kennedy, & Bednersh, 1995); *daily living skills* (Shipley-Benamou et al., 2002); *conversational skills* (Charlop & Milstein, 1989; Charlop-Christy, Lee, & Freeman, 2000; Sherer et al., 2001); *social language skills* (Maione & Mirenda, 2006); *generative spelling* (Kinney, Vedora, & Stromer, 2003); *perspective taking* (Charlop-Christy & Daneshvar, 2003; LeBlanc et al., 2003); *socially relevant behaviors and play skills* (Baharav & Darling, 2008; D'Ateno, Mangiapanello, & Taylor, 2003; Dauphin, Kinney, & Stromer, 2004; Gena, Couloura, & Kymissis, 2005; Hine & Wolery, 2006; MacDonald, Clark, Garrigan, & Vangala, 2005; Nikopoulos & Keenan, 2003, 2004a, 2004b, 2007; Parsons, 2006; Reagon, Higbee, & Endicott, 2006; Simpson, Langone, & Ayres, 2004; Sturmey, 2003; Taylor, Levin, & Jasper, 1999); or *reducing disruptive transition behaviors* (Schreibman, Whalen, & Stahmer, 2000).

Significantly, findings suggest that video modeling offers many advantages over traditional teaching methods when it is used in diverse contexts and targeting a wide variety of skills and it can effectively promote generalization across different settings and conditions (e.g., Apple, Billingsley, Schwartz, 2005; Charlop-Christy et al., 2000; Delano, 2007; Nikopoulos, 2007; Nikopoulos & Keenan, 2006; Shipley-Benamou et al., 2002). Potentially, this advanced capability of video modeling for transferring treatment gains in generalized conditions could be explained if it was viewed as an antecedent strategy (Cuvo & Davis, 1998; Heflin & Alberto, 2001), which exerts stimulus control over children's performances. It may be a case that all relevant stimuli are captured close enough together in terms of the two-dimensional TV screen, enhancing the acquisition of the stimulus control of the successful imitative responding

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(Charlop-Christy et al., 2000).

With the exception of Schreibman et al. (2000) who used a video priming procedure to reduce challenging behaviors associated with transition situations, however, research on video modeling has concentrated on increasing a variety of skills. In fact, this has been the only study to suggest that video modeling could be harnessed as an alternative behavioral systematic procedure for eliminating a kind of behaviors (i.e., problematic) in children with autism. Therefore, the present study was designed to provide preliminary data about the effectiveness of video modeling to establish instructional stimulus control over another behavior (i.e., clean up a toy) that required the termination of an ongoing activity. Interestingly enough, it has been suggested that even simple requests such as 'sit down', 'look at me', 'give me a hug', or 'put away your toy' may result in noncompliance accompanied by tantrum or aggressive behaviors (Ducharme, Atkinson, & Poulton, 2000; Smith & Lerman, 1999). It was further assessed whether success using one toy could increase the probability of success with new toys in the absence of any video presentation (i.e., generalization across stimuli; Nikopoulos & Keenan, 2004b).

Method

Participants

Three white British children (Daniel, Jessica, & Lewis; pseudonyms) aged between 7 and 9 years old who were attending a special school for children with severe learning difficulties participated in this study. They all met the DSM-IV TR (American Psychiatric Association, 2000) criteria for autism and an independent diagnosis of autism had been conferred by outside agencies. Furthermore, the Childhood Autism Rating Scale (CARS, Schopler, Reichler, & Renner, 2002) was administered for the adaptive behavior rating of the children. CARS has been suggested as a valid and reliable behavioral rating scale widely used in the diagnosis of children with autism and pervasive developmental disorders (Stella, Mundy, & Tuchman, 1999). In addition, a Likert-type questionnaire (e.g., Sommer & Sommer, 1997) with a specified section for comments was designed and given to the teachers and classroom assistants in order to provide any additional information in relation to the behavioral characteristics of these children. Following a complete description of the study and its objectives, formal written parental consents

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were obtained for all of the participants. An ethical approval had already been granted by the institution of the authors at that time.

Daniel was a verbal boy aged 7 years old with autism. His score on the CARS was 36 points, indicating a moderate range of autism. He displayed a nervous disposition and would have sought attention on a regular basis for reassurance. Also, he rarely initiated any social interaction with other adults or children. He mainly showed interest in only a few toys or games such as computers and his imitation repertoire was at an average level for his age. His teachers reported that although Daniel was often noncompliant to their instructions, he never exhibited any other problematic behaviors such as aggression, disruption, or tantrums. Instead, during any instructional situations, he seemed to ignore any requests delivered to him and carried on with his prior occupation. Finally, he sometimes followed set patterns of behavior since he preoccupied with a few stereotyped interests that were abnormal either in intensity or focus and engaged in a few repetitive motor mannerisms.

Jessica was a partially deaf 8-year-old girl who was classified in the severe range of autism having a CARS score of 41.5 points. Her speech was limited to babbles, vocalizations, crying, and noises but no words. She lacked social or emotional reciprocity with others and peers, preferring solitary activities such as computers or dressing ups. Despite the efforts from her teachers, she experienced difficulties in attending and completing requested tasks and she was often argumentative and noncompliant with such requests. On such occasions she might display aggressive behaviors to others. Aggressive behaviors could also be exhibited by her, infrequently though, when someone (adult or peer) interfered with what she was doing. There were no obvious limitations in her imitation skills. However, an apparently inflexible adherence to specific, nonfunctional routines occupied a major part of her time. Finally, she tended to follow set patterns of interaction during activities and she sometimes engaged in repetitive motor mannerisms or even in self-injurious behaviors when frustrated.

Lewis was a non-verbal 9-year-old boy diagnosed with autism. He was classified within the severe range of autism, scoring 39 points on the CARS. He did not interact with adults and his peers and instead preferred solitary activities (e.g., playing with a limited number of toys such as wooden animals, sand, water, or looking out the window). Also, he rarely used any nonverbal behaviors such as facial expressions, body posture, or gestures to regulate social interaction. Eye contact was minimal and he had a rather lengthy history of noncompliance to task-related requests. As a result he often displayed a variety of challenging or aggressive behaviors towards others. His imitation repertoire was especially limited and he regularly engaged in a few stereotyped behaviors such as wringing of hands or persistent preoccupation with parts of objects.

Setting

One classroom of the school was used throughout this study. That is, children viewed the videotapes and were assessed during all conditions in the same room shown in the videotape. A 17-inch television placed in a locked cupboard was used and a chair was placed approximately 1.5 meters away. All sessions were recorded by a camcorder mounted on a tripod for subsequent analysis.

Stimulus materials

Toys. Toys used across the various conditions were a wooden shape matching board, Lego®, a puzzle, and images to color in (drawings). These toys were chosen from a variety of other toys available in the children's classroom. Thus, children were familiar enough with them and therefore no instructions were needed which could have interfered with the validity of the variables being measured.

Videotape. An unfamiliar typical developing peer was used as the primary model for the construction of a videotape, approximately 30 secs long. In the video, the experimenter was shown switching the television off and then leading the model to a particular toy that was positioned on a table. The model sat on a chair and played with the toy for about 10 seconds. Afterwards, the experimenter, who was sitting a few meters away, gave the verbal instruction 'Play is finished', and the model put the toy away in a box which had been located nearby. The video presentation avoided any exaggeration in the actions of either the model or the experimenter.

Dependent variable

Sessions during all of the conditions were videotaped for the measurement of *toy clean-up behavior* and latency recording system was used throughout (e.g., Nikopoulos & Keenan,

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2007). This behavior was defined as each child initiated the appropriate motor response to experimenter's request, (e.g., Ducharme, Harris, Milligan, & Pontes, 2003) in the same or similar manner to that shown by the model in the previously viewed videotape. Specifically, data were collected for the time taken each child to put a toy away in a box after the experimenter had exhibited the instructional cue 'Play is finished'. This verbal instruction was selected because the teachers reported that this statement was the one used most frequently for the children to terminate their play and therefore the latter were familiar with it. If necessary, the children were further instructed how to put the toys away. Teachers explained that they used this expression in their effort to promote generalization of children's responding irrespectively of who requested it, what toys were involved or in which classroom play was taken place.

Experimental design

A multiple baseline across subjects design was used for the three children (e.g., Barlow, Nock & Hersen, 2008). In all conditions, no specific consequences for behavior or additional instructions were established by the experimenter.

Procedure

No specific training for attending videos was required prior to the video modeling intervention. This was because informal reports from the teachers and classroom assistants of the children indicated that all participants could watch TV or videotapes for at least two minutes.

Baseline. During the baseline sessions both the experimenter and each child entered the experimental setting without previously viewing any videos. The experimenter led the child to sit on a chair opposite a table while one of the four toys and a box had been placed on it. This box was one of the boxes used in the children's classrooms for storing toys. The four toys were randomly alternated across sessions, and therefore each child was assessed in the presence of each toy at least once. After each child had played or manipulated the toy for about 10 seconds, the experimenter said 'Play is finished'.

Each session was scheduled to last up to 100 secs while the experimenter's behavior remained as natural as possible, responding only to the children's requests whenever it was essential. However, if the child put the toy away into the box either before the verbal instruction was given or these 100 secs had elapsed then the session terminated there. In any case, following

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the termination of the session each child was taken into a supervised playground area. Another session began 2-3 minutes later. During that time, the toy was changed and this occurred even if the toy had not been put away in the previous session. Two to three sessions were conducted on any one day for each child.

Video modeling. Prior to each session during the video modeling condition, each child viewed the 30-sec videotape in the experimental room only once. After the experimenter had shut the flaps of the TV cupboard, children were guided to sit on the chair opposite a table on which the toy (the wooden shape board; the same for all children) and the box depicted in the video had already been placed and the session commenced. Following the elapse of about 10 secs, the experimenter gave the verbal instruction 'Play is finished'. No further instructions were provided to the child neither was any reference made to the video just watched.

As in baseline sessions, each session was scheduled for 100 secs, but terminated if the child put the toy away in the box in less time. The procedure of taking the child away from the experimental setting into a supervised playground area for an interval of between 2 and 3 mins following the termination of each session remained exactly the same. Finally, two to three sessions were conducted on any one day for each child.

Criterion performance

When each child succeeded in imitating the modeled behavior of putting the toy away within the first 5 secs (e.g., Cooper, Heron, & Heward, 2007) following the verbal instruction 'Play is finished' in five consecutive sessions, then he or she was transferred to the next condition, generalization across toys (GT). Since the verbal instruction was given after about 10 secs had elapsed, the imitative performance of the child was considered as successful when it was emitted within the first 15 secs of each session. In the GT condition, if a child did not respond to a verbal instruction in three consecutive sessions and within the specified time, then he or she experienced the previous condition (i.e., video modeling) for additional three sessions (Nikopoulos & Keenan, 2007). However, if successful responding occurred in three consecutive sessions then each child was transferred to the next condition in the sequence, generalization across subjects (GS).

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Generalization

Toys (GT) and Subjects (GS). Prior to all generalization assessments there was no video presentation. Thus, the procedure during assessment for generalization across toys (GT) was exactly the same as in baseline, except that the modeled toy was not used. Instead, the other three toys were randomly used; each one for two nonconsecutive sessions. Following six sessions in this condition, assessment for generalization across subjects (GS) took place in which the procedure was exactly the same as in baseline except that another adult, unknown to the participants, replaced the experimenter.

Follow-up

One month after the final measurement had been taken a follow-up assessment was carried out. The procedures were identical to those during baseline, and a total of four sessions across the four different toys were conducted for each child in the same experimental setting.

Interobserver agreement

Interobserver agreement was assessed on 31% of all observations. At least one reliability session was carried out for each participant during all conditions and the secondary observer was entirely unaware of the experimental conditions and objectives of the study. The percentage of the interobserver agreement for latency was calculated by dividing the shorter latency by the longer and then multiplying by 100. Results showed that the percent agreement for the dependent variable was 98% (range, 95% to 100%).

Results

Results for latency to respond to the verbal request 'Play is finished' for all participants can be seen in Figure 1. During baseline there was no evidence of the participants responding to the verbal instruction 'Play is finished'. Instead, they kept on playing, sitting on the chair without doing anything in particular or just manipulating the toys and seldom did they walk away; Lewis, however, exhibited some challenging behaviors as well. However, when video modeling was introduced all of the children met the criterion within 5 to 7 sessions. During the generalization sessions across toys (GT) the results for the three children were rather variable. For example,

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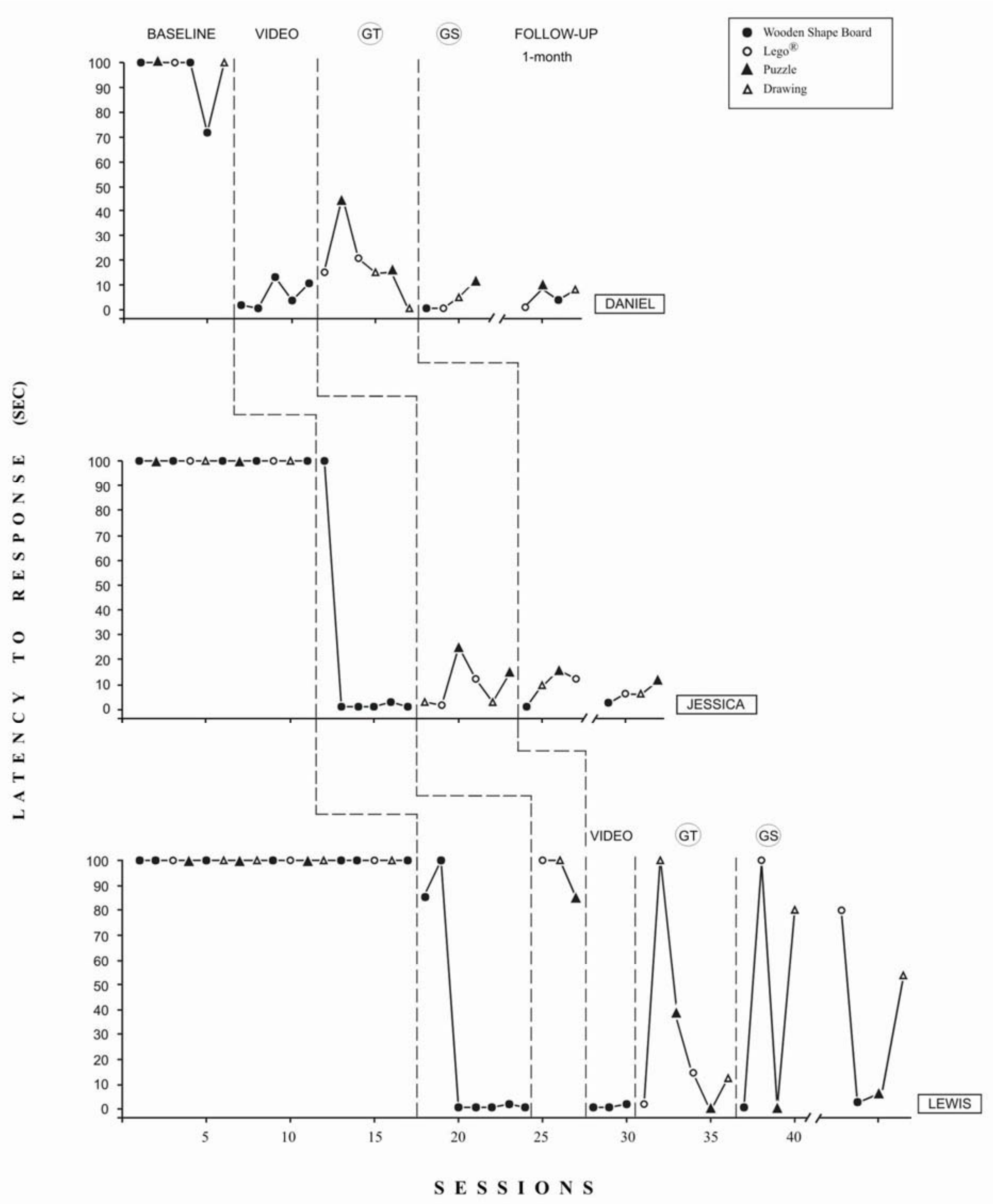

Figure 1. Latency to respond to the verbal request "play is finished" for Daniel, Jessica, and Lewis during the baseline, video modeling, and generalization conditions.

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Daniel on session 13 was playing with the puzzle and he responded to the verbal instruction 'Play is finished' by saying 'I have not finished yet'; the score for this session was recorded as 45 seconds. Jessica failed to meet the criterion with one toy (i.e., puzzle; session 20) as her latency was at 24 secs, whereas Lewis' responding did not generalize across toys in the first instance (i.e., sessions 25-27). However, when video modeling was reintroduced, his latency to imitative response dropped to an average of about 2 secs per session. When generalization across toys (GT) was introduced again, his responding met the criterion for each of the three toys followed by, initially, 3 unsuccessful sessions.

Latency to respond for Daniel and Jessica remained at very low levels across the remaining generalization condition (i.e., GS) and the 1-month follow-up assessment. Lewis' performance, however, was again variable during these conditions while the criterion was met for two only toys.

Discussion

Results from this study showed that video modeling could be an effective procedure for enhancing instructional stimulus control over a simple behavior in children with autism with lower baseline levels of disruptive behaviors and more developed imitation skills. Specifically, it was shown that short video clips (i.e., 30 secs) resulted in rapid changes in behavior within 5 and 6 sessions for Daniel and Jessica, respectively. Successful responding generalized across three other different toys and another subject in the absence of a video display or any explicit consequences and prompts. Moreover, behavior changes were maintained at 1-month follow-up.

The performance of these two children was a significant achievement because deficits in generalization are frequently displayed by them (e.g., Reeve, Reeve, Townsend, & Poulson, 2007; Volkmar, Chawarska, & Klin, 2005). This could be attributed to at least two things. First, it might be the case that all the relevant stimulus elements (i.e., toy, model, & experimenter) had been captured close enough together in terms of the two-dimensional TV screen, which further facilitated the acquisition of the stimulus control over the subsequent successful responding (Rincover & Ducharme, 1987). Second, the fact that the two physical environments presented in the videotapes and in vivo were exactly the same (e.g., Bernard-Opitz, Sriram, & Nakhoda-

Sapuan, 2001) might have contributed to the findings because distractions were minimized (McDonough, Stahmer, Schreibman, & Thompson, 1997). It might be argued, though, that the generalization across subjects condition did not constitute an accurate demonstration of generalized treatment gains for the participants, since respective data were not collected during baseline. Although, this generalization condition differed in a meaningful way from the treatment condition (Cooper et al., 2007) in terms of the presence of another subject, logically this is a probability. However, in reality such an issue is rather highly unlikely, given that participants' responding was still unsuccessful in the presence of the experimenter (also an unknown person to them) during the baseline data collection.

For the third participant, there were some anomalies in the success of the intervention. For example, the successful performance of Lewis during the video modeling condition did not consistently generalize across toys and subjects. This was probably due to his engagement in some challenging behaviors which were evident in nearly any condition of the study, even during watching videos. This in turn might be an evidence of a drawback in using familiar training and testing environments because a variety of challenging behaviors had already been established in that environment. It could also be an indication that Lewis' preferences for the toys used across conditions varied. Unfortunately, any additional effort to eliminate his challenging behaviors failed within the time constraints of the study. In comparison with the other two children, Lewis' performance confirms that the likely success of the generalized effects of video modeling procedures is dependent upon the prior elimination of behaviors that interfere with the development of imitation skills (e.g., Nikopoulos & Keenan, 2003). In fact, the domain of imitation was the one most affected for Lewis according to his scores on the CARS and direct observation assessments. Undoubtedly, formal measurement of those challenging behaviors as an interference variable or as a co-varying variable would have elucidated this issue. Anecdotal evidence showed, though, that there were not any apparent discrepancies in the type, intensity, or frequency of those behaviors amongst the different conditions of the study, except during most video modeling sessions.

It is not clear from the current study what the responsible mechanisms for video modeling leading to decreases in latency to put a toy away were, given that this procedure did not provide any specific contingencies for the emergence of this skill. Therefore, a few explanations can be plausible: a) in the absence of any experimenter-implemented contingencies or prompts, children's responding could be acquired and maintained by naturally occurring contingencies of reinforcement (e.g., Gena & Kymissis, 2001). Hence, video modeling could be viewed as a motivational strategy; b) prior to this study some history of reinforcement for imitative responding might exist for these participants, even irrelevant to the target behavior (Martin & Pear, 2006), providing an instance of generalized imitation (e.g., Young, Krantz, McClannahan, & Poulson, 1994); c) as mentioned before, the two-dimensional TV screen might have also facilitated the children's successful responding coming under the strict control of the verbal discriminative stimulus 'Play is finished' and/or toys, providing a paradigm of a functional equivalence class (Masia & Chase, 1997; McGuigan & Keenan, 2002). Such an explanation was further evidenced by the fact that extinction did not occur in any of the generalization situations (e.g., Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998); d) video presentations of the requested task might have increased participants' following directions behavior serving as a priming procedure (e.g., Schreibman et al., 2000), if its function was based on resistance to change of activities or confusion resulting from unpredictability (Davis, Reichle, & Southard, 2000; Marks et al., 2003); or e) the short breaks followed each session and the design of the research itself created a rhythm that might have made the verbal request less 'aversive' and predictable and thus reducing the establishing operation for escape (Kodak, Miltenberger, & Romaniuk, 2003) Further research is needed to investigate all of the above possibilities.

Certainly, this study is not based on a functional behavior assessment and therefore the intervention is not directly addressing any specific hypothesis about the antecedent and consequences maintaining the participants' behavior. Instead, data demonstrated that a very short video-based intervention can be effective in producing rapid changes in children's with autism behavior related to the termination of an activity. Adding all the other studies which have shown that video modeling is an effective strategy for enhancing (as opposed to terminating) a variety of skills in these children, it could be suggested that this antecedent intervention fit within a multi-component behavior support plan to create predictability and establish stimulus control. Inclusion of children with autism in mainstream school settings has become a considerable option (Gena, 2006; Reiter & Vitani, 2007) and, hence, integration of effective interventions to support a larger intervention effort is critical. Transferring research findings on best practices to school teachers demands careful examination of how teachers can build video modeling into real teaching situations (Ayres & Langone, 2005). An initial step would be a description of the basic guidelines for designing video modeling procedures as adopted in each respective study. Thus, what follows is a brief overview of the general instructions and guidelines that were taken into consideration in the current study. These guidelines are an amalgam of procedures common to much of the previous research:

1. After a task analysis, each component of a specific task should be videotaped. The number of sequences to be shown in the video needs to be gauged for a particular child experimentally.
2. Initially, one model should be used.
3. Simple behaviors demonstrated by the model should be about 30-40 seconds maximum.
4. At the initial stages, the setting viewed in the videotape should be the same as the setting in which the child will demonstrate the imitative behavior. Thereafter, different settings could be used.
5. The treatment provider has to be sure that the videotape shows a close-up of the action he or she wants the child to imitate.
6. The child should be allowed to watch each video clip at least once.
7. Depending on the target behavior, the child has to be allowed to have between one and three minutes to demonstrate the modeled behavior.
8. The child should watch the same modeled sequence again if he or she fails to imitate the behaviors; this should be done at least three times.
9. The treatment provider must keep data for every trial and let the child have at least three successful trials before he or she moves to the next video clip.
10. Programming for maintenance and generalization of the imitative behavior must take place across settings, stimuli, people, and time (Nikopoulos & Keenan, 2006).

An obvious strength of this procedure is that it is relatively straightforward and therefore it seems quite feasible that the teachers could implement it in the classroom setting. In relation to the above guidelines, however, there are two main issues which may need further clarification. First, research has shown that children with autism could learn equally well from both adults and peers as models (McCoy & Hermarisen, 2007). Thus, there should not be rigid adherence to a preconceived notion of the models from which children should learn. Collection of data will certainly determine the right model (peer, adult, or even self) for each child. Second, for better outcomes in real teaching situations, it is important that generalization be incorporated into the treatment procedures (e.g., Stahmer & Schreibman, 1992). In the current study, generalization was measured at the end only because it was an effort to assess the effects of a short video modeling procedure in changing a simple behavior from an experimental viewpoint. In the classroom setting, generalization of treatment gains across conditions, stimuli or people could have been stronger if, for example, a variety of verbal instructions had been used (as people do not always use the same instructions in the natural environment); training in different settings had occurred (as children do not always play in the same classroom); or training with multiple toys in more natural conditions of free play during the children's school day had taken place.

Furthermore, whether this intervention affected the participants' behavior of following directions under more natural conditions such as peer group arrangements remains unclear and needs to be addressed in future studies. Such research may have important implications for further uses of video technologies for children with autism in inclusive school settings. It could also be argued that participants' IQ scores and their general levels of adaptive behavior or even their age might have affected in some way the success of the current study. However, comparisons of performances during baseline with those during experimental conditions stand as a strong counterbalance to this suggestion. Definitely, a prior functional assessment of the behavior under investigation would have enabled the demonstration of clearer relationships between the dependent and independent variables of the study (see Hanley, Iwata, & McCord, 2003 for a review). For example, results from such assessment would have provided more definite conclusions on whether inattention or inability to comprehend the instructions was among the reasons for Daniel to frequently ignore instructions from adults. Therefore, replication with additional children needs to be addressed in future studies.

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It might also be possible that even though the participants were familiar with the verbal instruction 'Play is finished', simply asking them to put the toy in the box might have resulted in the same outcomes as the video modeling intervention. The purpose of the teachers wanting to use this expression was adequately justified and obviously a research study should not be designed against the targets set up by the educators of the participants. However, a more thorough assessment of whether these children, for example, responded to other more clear instructions would have benefited the current study. Thus, future research is needed to evaluate and compare the effects of video modeling over verbal requests alone. Future research should also consider an extensive experimental analysis of the role of imitation in establishing behavior change using video modeling, especially when this treatment has been demonstrated remarkably effective in the absence of any experimenter planned contingencies or prompting. Finally, research that evaluates video modeling to promote typical academic and classroom skills is definitely worth being pursued.

Undoubtedly, video modeling is a procedure that shows great promise as an efficient and effective instructional tool for those who educate individuals with developmental disabilities, including autism. Videotapes can become individualized for any child and since their use in treatment can encourage a structured teaching style, they may become an important means for parents and educators to enhance their children's functional skills that does not require extensive training (Bernard-Opitz, Ing, & Kong, 2004; Corbett & Abdullah, 2005).

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