EFFECTS OF MULTIPLE AND SINGLE EXEMPLAR VIDEO MODELING ON SCRIPTED AND UNSCRIPTED PLAY ACTIONS

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Applied Behavior Analysis—Master of Arts

2020

ABSTRACT

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Preschool aged children with autism spectrum disorder (ASD) have noticeable deficits in play skills that impede the development of gross and fine motor skills, language and communication skills, thinking and problem-solving skills, and social skills. This study aimed to teach three preschool-aged children with ASD to engage in solitary pretend play behaviors. An adapted alternating treatments design embedded in a multiple probe design across participants was used to evaluate the effects of multiple exemplar video modeling on scripted and unscripted play actions of children with ASD. In the current study, video modeling led to the acquisition of play skills for children with ASD. Additionally, the current study has the potential to extend existing video modeling research by incorporating multiple exemplar video models to demonstrate the emergence of unscripted play actions during pretend play in the natural environment.

Keywords: autism, pretend play, multiple exemplar instruction, video modeling

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INTRODUCTION

Autism spectrum disorder (ASD) is defined by significant impairments in social communication and repetitive or stereotyped behaviors that are evident in the early years of life, although the presentation of symptoms and degree of impairment is variable (American Psychiatric Association, 2013). Beyond the social impairments and restricted interests, children with ASD demonstrate deficits in play skills relative to typical peers (Jarrold, 2003). In particular, children with ASD might not engage in symbolic or pretend play (Rutherford & Rogers 2003). For example, compared to the frequency and spontaneity displayed by typically developing children, children with ASD may not use toys such as dolls as agents (or actors) or substitute one object for another object in play (Rutherford & Rogers). Further, in unsupported play situations, children with ASD display higher rates of manipulation or sensory play with objects than either symbolic-pretend play or functional play (Dominguez, Ziviani, & Rodger, 2006).

Video modeling is an intervention that has been successful in teaching a range of play skills to individuals with ASD. It is an evidence-based practice that integrates a powerful learning modality for children with ASD, visually cued instruction, with a frequently studied intervention strategy – modeling (Bellini & Akullian, 2007). It is a practice that involves the viewing of videos that display the target behaviors or skills that individuals are then requested to imitate (Alberto, Cihak, & Gama, 2005). The visual nature of video modeling could be highly motivating and naturally reinforcing for children with ASD (Quill, 1997). In addition, video modeling capitalizes on strengths often associated with individuals with ASD in the areas of perception, attention, language, memory, and general intelligence (Quill, 1997). Furthermore, using video modeling is beneficial because of the procedural reliability of each demonstration of

the steps that could be reviewed with as many repetitions as needed to master target skills (Bellini et al., 2007).

Despite the many benefits of video modeling, researchers have also identified areas in need of future research. Early research on video modeling lacked evidence demonstrating generalization, which is a known area of difficulty of children with ASD (Bellini et al., 2007). D'Ateno, Mangiapanello, and Taylor (2003) examined effects of a video modeling intervention in teaching play behaviors to a child with ASD. The child first watched a video depicting a model playing alone with a toy and was then given an opportunity to play with the same toy. Although video modeling led to rapid acquisition of both scripted vocalizations and play actions, results indicated that gains were not generalized to vocalizations or play actions that were not explicitly shown in the video (i.e. novel responding). D'Ateno and colleagues attributed this limitation to the fact that only one video exemplar was used in the study for the play sequence. They suggested that multiple video vignettes may produce greater generalization effects across behaviors.

MacDonald, Clark, Garrigan, and Vangala (2005) extended the work of D'Ateno and colleagues (2003) by teaching children to engage in longer play sequences involving pretend play. Similar to the D'Ateno et al. study, participants watched an adult model act out scripted sequences of pretend play and requested to play with the same play set as shown in the video. The procedure led to rapid acquisition of both scripted vocalizations and play actions. However, similar to the results of D'Ateno and colleagues, the intervention did not lead to an emergence of unscripted play behaviors. MacDonald and colleagues (2005) discussed that this limitation should be addressed in future research and researchers should focus on strategies to systematically increase unscripted, but contextually appropriate play, in children with ASD.

Overall, teaching pretend play using video modeling leads to acquisition of scripted play, but minimal to no gains in unscripted play (D'Ateno et al., 2003; Kim, 2016; MacDonald et al., 2005).

Although a number of variations of video modeling procedures have been evaluated and used to teach learners with autism, an important aspect relevant to the current study is the number of video exemplars shown prior to the learner engaging in the response. Researchers that have been successful in teaching scripted play behaviors suggest that using multiple video exemplars might improve unscripted responses of participants (D'Ateno et al., 2003; MacDonald et al., 2005). In multiple exemplar training, generalization to untrained stimulus conditions and to untrained responses is programmed by teaching sufficient exemplars of relevant stimuli to each of those stimulus conditions or responses (Stokes & Baer, 1977). Using multiple exemplars within video modeling might involve showing multiple videos of the similar general behavior while strategically varying aspects in the video exemplars. For example, researchers might vary the materials in the video models from instructional session to session (Marzullo-Kerth, Reeve, Reeve, & Townsend, 2011). Alternatively, researchers may vary models, social partners, materials, and vocal statements a child in a video makes while playing with toys (Plavnick & Dueñas, 2018; Stauch, Plavnick, Sankar, & Gallagher, 2018). Programming multiple exemplars is an instructional design strategy that provides a range of examples so that learners acquire repertoires as opposed to rote responses—which is an essential component of effective instruction designed to promote generalization (Stokes & Baer).

Marzullo-Kerth et al. (2011) examined the use of multiple-exemplar training in a treatment package that included video modeling, prompting, and reinforcement to teach children with ASD to share. Each of the four participants in the study were exposed to a different set of

six video exemplars that incorporated three different verbal offers to share and six different stimuli sets. Each video exemplar depicted two 7-year old boys sharing an activity and one verbal offer to share a set of materials. Researchers incorporated four different stimulus categories (art materials, snack foods, toys, and gym materials) and in each of the categories, five different materials served as multiple exemplars.

After teaching, all four participants demonstrated stimulus generalization for materials within the same category. Additionally, one participant showed stimulus generalization with materials in untaught stimulus categories. In addition, three participants exhibited offers to share in novel settings, with a novel instructor and peer, and in the presence of novel and familiar materials. Finally, all four participants demonstrated some response generalization by emitting a variable number of unscripted vocal offers to share (Marzullo-Kerth et al., 2011).

Recent studies examining video modeling have used multiple exemplars to teach unscripted vocalizations and play actions to children with ASD. MacManus, MacDonald, and Ahearn (2015) examined the effects of combining video modeling and matrix training to teach children with ASD to engage in sequences of play with 30 vocalizations and 40 actions. Matrix training was used in an attempt to enhance generalization, specifically in recombining elements of play across play scenarios by creating video models that arranged three play scenarios with three play sets in varied combinations. After training, all participants learned vocalizations and actions depicted in videos, and combined vocalizations and actions across videos to demonstrate a specific type of response generalization called recombinative generalization (Goldstein & Mousetis, 1989).

Dueñas, Plavnick, and Bak (2019) evaluated the effects of a multiple exemplar joint video modeling intervention on pretend play behavior (i.e., unscripted/scripted vocalizations and

play actions) of children with ASD with their typically developing peers in an inclusive early childhood setting. The video exemplars varied in modeled play actions, modeled vocalizations, and stimuli. Upon introducing joint video modeling, all participants with ASD demonstrated increased levels of scripted and unscripted vocalizations during pretend play. In addition, all participants also demonstrated an increase in scripted play actions with varied outcomes in unscripted play actions.

Despite the efficacy of video modeling for teaching scripted play behaviors to children with ASD researchers haven't developed procedures that reliably teach generalized play behavior using video modeling. Therefore, the purpose of the study was to extend video modeling research to teach pretend play in a natural setting to young children with ASD by incorporating multiple exemplar video models. This study will address the following research questions:

- To what extent does the implementation of multiple exemplar video modeling produce scripted and unscripted play actions for children with ASD?
- To what extent does the implementation of single exemplar video modeling produce scripted and unscripted play actions for children with ASD?
- What are the differential effects of multiple exemplar and single exemplar video modeling on scripted and unscripted play actions for children with ASD?

METHOD

Participants and Setting

Three children participated in this study. At the time of the study, Arthur was 5 years old, Dean was 5 years old, and Greta was 4 years old. All participants had an ASD diagnosis and attended an early intensive behavioral intervention (EIBI) program. Participants spent approximately 30 hr per week at the EIBI center. The majority of their time was spent in a behavioral therapy room with other children with ASD and behavior technicians, with a smaller portion of their day spent in an inclusive early childhood setting.

Participants were required to demonstrate the following prerequisites to participate in this study: (a) attend to a screen for at least one min, (b) follow the direction 'go play' and go play with an item in the play area (i.e., go to the play area, pick up a toy, and move it in some way without needing to be functional play), (c) perform motor skills necessary for the study (e.g., making a character walk or jump), (d) imitate the movements of a model (e.g., after seeing an adult clap their hands, the child claps their hands together), (e)and imitate verbal statements of at least three word phrases. The child's ability to perform the prerequisite skills was informally assessed by the experimenter prior to the start of the study through observation and was confirmed in an interview with the Board Certified Behavior Analyst (BCBA).

All procedures were conducted in the therapy room at the EIBI center. The therapy room consists of 8 children and their respective behavior technicians and an onsite BCBA. The therapy room has a play area, a group table (where lunch and snack typically occur), and a TV where various imitation or reading groups occur. The first author, a second year Master's student in an Applied Behavior Analysis program, was the primary implementer of the procedures.

Materials

Video exemplars of an adult model performing pretend play skills, two different play sets, an iPad, and a video camera were used to teach the target pretend play skills. The play sets were selected by the researcher and the children were not previously exposed to these play sets.

The play sets consisted of a circus and fire station scene that were matched to have an equivalent number of characters and parts so the play sets could be randomly assigned to the two intervention conditions and counterbalanced across participants. To increase the likelihood that the play materials assigned to each condition were similar to one another, play sets were purchased from the same company. In addition, the two play sets had two different characters (e.g., the circus had animals and circus performers and the fire station had emergency responders and an injured person) and setting pieces (e.g., circus equipment and emergency vehicles, respectively). See Table 1 for a complete description of play set pieces.

Assignment of play sets to conditions was counterbalanced across participants to increase the likelihood that differential effects could be attributed to video modeling procedures rather than characteristics of a particular play set. Arthur and Dean were assigned the fire station for the multiple exemplar condition and the circus play set for the single exemplar condition. Greta was assigned the circus play set for the multiple exemplar condition and the fire station play set for the single exemplar condition.

Video Exemplars. Three video exemplars were created for each play set – for a total of six video exemplars across the two play sets used in the study. In the video exemplars, an adult model was recorded acting out scripted play actions and vocalizations. The six exemplars depicted the adult's hands manipulating toy characters and the play set. Each video was approximately 30 s long. Sample scripts are in Table 2 and 3. The video exemplars varied from

one another in order to incorporate varied responses and stimuli (e.g., characters). Vocalizations and play actions were matched across play sets and video exemplars to be equal length and difficulty. There were 10 play actions and five vocalizations with a total of 21 syllables in each of the video exemplars.

Play sequences and play scripts depicted in the videos were created from observations of typically developing peers playing with the play sets used in the current study. Children were given the play set and instructed to engage with the toy. The play behaviors were then simplified for the current study.

Measurement

All sessions were video taped and scored later for the occurrence of the following responses: unscripted play actions and scripted play actions. For unscripted play behaviors, a second observer was trained to write down the time in the video of when the play action occurred and what play action occurred (Dueñas et al., 2019). For scripted play behavior, the second observer was trained to record occurrence or nonoccurrence of the behaviors in the order of which the behaviors were shown in the scripts (Dueñas et al.). Although scripted play actions were unlikely during baseline, we isolated this as a dependent measure to assess the direct impact of presenting a scripted play sequence via video model during intervention.

Unscripted Play Actions. Unscripted play actions were defined as any play actions not explicitly shown in the video exemplars observed by the participant in a particular intervention session. To be scored as an unscripted play action, an event needed to be appropriate to the context of the play and had to be a functional play action involving the character as agent (main character) or a play action directed to the toy character. Unscripted play included the same actions as seen in the video model but completed with a different

character (MacDonald et al., 2005). Play actions were considered as unscripted if they were from a different video exemplar that was not shown immediately before the session (Dueñas et al., 2019). For example, if the participant was shown video exemplar two for the fire station but the participant engaged in a play action from video exemplar one for the fire station, that would be considered unscripted. The play actions were counted as unscripted if an action did not have one-to-one correspondence with the video model and were only scored once for a particular interaction, unless the same play action was produced under new or different circumstances. For example, if the action was repetitive or involved motor stereotypies, such as making a character jump up and down repeatedly, the action would be counted only once for that particular interaction. But if the child were to make a character jump off a bench and later in the duration of the session jump off a building, each instance would count as an occurrence (Dueñas et al.). Motor stereotypies with the toys were not considered unscripted play actions (e.g., lining up all the toys and making them fall down like dominoes). Unscripted play actions were coded by recording the time to the second in which they occurred, and a frequency of occurrences per session was recorded.

Scripted Play Actions. Scripted play actions were defined as motor responses that matched the actions of the video models observed by the participant and resulted in the same change in the environment as seen in the video model (e.g., if the model picked up two plates at the same time and placed them on the table, this would be scored the same as if the participant were to place plates one at a time on the dinner table; D'Ateno et al., 2003). Scripted play actions were not counted if they occurred more than once or occurred out of sequence (Dueñas et al., 2019). Play actions that occurred out of order were not counted. Play actions needed to occur with the same corresponding character that was depicted in the video

exemplar. For example, if the lion jumped through the flaming hoop in the video, the child needed to put the lion through the hoop for it to be counted as a scripted play action. Scripted play actions were recorded as the number of correct scripted play actions per session (n=10).

During the post-intervention phase, video exemplars were not shown. Therefore, the script that play sessions were scored on was based on the first play action that a participant demonstrated. If the first play action they engaged in was the first play action from a script they had seen during intervention that was the corresponding script that scripted play actions were scored. For example, during this phase if Arthur engaged in putting the performer on the stand as is presented in the third circus exemplar, the third circus exemplar is the script that subsequent play actions were scored on. Similar to the intervention phase, scripted play actions needed to still occur in the order of the script to be considered a scripted play action.

Inter-Observer Agreement

Inter-observer reliability data was collected for at least 30% of baseline, intervention, and post intervention sessions for each participant. A secondary observer was trained to code the dependent variables from training videos. The training consisted of the researcher explaining the coding procedures to the observer, practicing coding events from videos obtained from a prior investigation, and comparing their results until the observer met 90% reliability with the researcher. The observer was given a full list of all the scripted play actions associated with each video exemplar.

Researchers used point-by-point agreement for free operant behaviors measured with timed event recording. A behavior was marked as an agreement if the behavior was noted within 1 s of the primary investigator. Percentage of agreement was calculated for each dependent variable by dividing the number of agreements within 1 s by the number of

agreements plus disagreements, and multiplying by 100 to obtain a percentage of agreement (Gast & Ledford, 2018). For scripted behaviors, inter-observer agreement was calculated separate from unscripted behavior using a point-by-point agreement formula wherein the number of agreements were divided by the number of agreements plus disagreements and multiplied by 100 (D'Ateno et al., 2003).

Experimental Design

An adapted alternating treatments designs (AATD) embedded within a concurrent multiple probe across participants design was used to assess the extent to which single video exemplar and multiple exemplar video modeling effect unscripted and scripted play actions (Gast & Ledford, 2018). The AATD consists of a baseline phase followed by a treatment phase where two treatments are rapidly alternated to compare their effects. Experimental control is demonstrated when sufficient internal validity is present and when there are differences in the performance of the dependent variables between the two interventions (Gast & Ledford, 2018).

The AATD allows a direct comparison between the two interventions: single exemplar intervention and multiple exemplar intervention. The AATD is similar to an alternating treatments design, except that independent variables are applied to different behavior sets that are of equal difficulty to acquire and the stimuli of the two interventions are functionally similar yet topographically distinct (Gast & Ledford, 2018). To ensure that each intervention is being applied on distinctly different behavior sets, two different play sets were used – one play set for single exemplar intervention and another play set for multiple exemplar intervention. In addition, the difficulty of scripted vocalizations and play actions were

carefully matched to ensure that the same number of words and motor movements were modeled in each of the experimental conditions.

The multiple probe design across participants allowed the researcher to establish experimental control over acquisition of dependent measures in both conditions by demonstrating prediction, verification, and replication (Carr, 2005). The multiple probe design across participants is similar to a multiple baseline across participants, except that the researcher conducts intermittent probes during baseline rather than continuous measurement of the dependent variable (Gast & Ledford, 2018). In this study, using a multiple probe design minimized the amount of time children were exposed to the play sets during baseline without intervention while still allowing for a demonstration of a functional relation between the two interventions and the dependent variables.

The combination of the two designs allows for the analysis of demonstration of effects and increases the possibility of multiple direct replications. Using both designs allows for the assessment of both interventions on dependent variables differentially while controlling for maturation and history effects on internal validity.

Sessions were conducted Monday through Thursday and each participant was exposed to both conditions up to twice in one day, for a total of up to four sessions per day. The conditions were counterbalanced so if a multiple exemplar condition was randomly chosen first, then a single exemplar condition would automatically follow. The first and third condition of a given day was randomly selected using a random number generator, followed by the administration of the other condition. There was at least 30 minutes between sessions to minimize multi-treatment interference. Once a participant demonstrated five consecutive

sessions with stable responding that was higher than baseline mean within any of the two intervention conditions, the subsequent participant was transitioned into intervention.

Procedures

General Procedures. Prior to the start of baseline sessions, play sets were randomly assigned to conditions for each participant. Each session began with the researcher setting up the video camera towards the play set and starting the recording before the child was brought to the play set. The play set was setup on a table in the EIBI therapy room. Each session was 1 min long, and started after the researcher directed the participant to play. Participants were verbally and physically prompted back to the play set if they left for longer than 5 s during the session or looked away from the play set (Dueñas et al., 2019). Additionally, participants were also redirected back to the play set if the participants attempted to interact with the researcher. If participants did not engage with the play set for 30 s or if problem behavior (e.g., tantrums, aggression, noncompliance) occurred then sessions were terminated. No reinforcement was given during the session contingent on the play behaviors (D'Ateno et al., 2003). Reinforcers were chosen from a reinforcer list compiled by the researcher for each participant and was only given at the end of the session for unrelated behaviors (e.g., "Good following directions", "Nice job playing.").

Baseline. For baseline conditions, the children were exposed to a play-set without video models. The researcher brought the child to the table the play set was on and gave the direction "Play with the toy."

Single Exemplar Video Modeling. For single exemplar video modeling only one video exemplar was shown. Once in the room, the researcher sat the child down at the table and the researcher oriented the iPad in the child's line of sight. The researcher then gave the instruction

'Watch this.' The video was shown two times (Dueñas et al., 2019). The researcher provided gestural or verbal prompts if the child did not attend to the video (Dueñas et al.). Attending was defined as the child looking at the video on the iPad and not looking away from the screen for more than three consecutive seconds. After the video exemplar finished, the researcher moved the play-set closer to the child and delivered the instruction "Play with the toy".

Multiple Exemplar Video Modeling. During the multiple exemplar condition, three different videos with different play sequences were developed for the play set that each child was assigned to for this condition. The researcher alternated between the three video exemplars across video modeling sessions (Dueñas et al., 2019; MacManus et al., 2015; Maione & Mirenda, 2006). Videos were randomly alternated using a random number generator (Haahr, 2020). Once the child viewed the video twice, the child was directed to the play set, and told "Play with the toy."

Post-Intervention. Participants were returned to baseline conditions after approximately 30 sessions of intervention. The purpose of the post-intervention phase was to analyze responding after exposure to the video exemplars during intervention. Researchers hypothesized for those participants that engaged in higher levels of scripted play actions their unscripted play actions were being suppressed. Data collection was terminated due to the suspension of clinical services due to the COVID-19 pandemic (Cox, Plavnick, & Brodhead, 2020). Therefore, two participants did not complete this phase.

Procedural Fidelity

Procedural fidelity data was collected for at least 30% of sessions across baseline, intervention, and post-intervention conditions for each participant. The researcher created a checklist that specified each of the steps in the procedure required for each phase. An

observer was then trained with 90% accuracy to code if each step on the checklist was correctly or incorrectly followed. Implementation accuracy was then measured by calculating the total number of steps implemented correctly divided by the total steps on the checklist (Gast & Ledford, 2018).

The mean percentage of steps implemented accurately during baseline was 98% (range 83-100%). The mean percentage of steps implemented accurately during intervention was 99% (range 89–100%). The mean percentage of steps implemented accurately during post-intervention was 99% (range 86-100%).

RESULTS

Unscripted Play Actions

The left panel of Figure 1 depicts frequency of unscripted play actions for both multiple exemplar and single exemplar conditions during baseline, intervention, and post-intervention for Arthur, Dean, and Greta.

Arthur was assigned the circus play set for the single exemplar intervention and the fire station play set for the multiple exemplar intervention. Arthur demonstrated low levels of unscripted play actions during baseline for both the multiple exemplar play set (*M*=1.7, range 0 to 5) and the single exemplar play set *(M*=1.9, range 0 to 3). During intervention, his unscripted play actions in the multiple exemplar condition slightly increased (*M*=2.25, range 1 to 5) and during the single exemplar condition his unscripted play actions remained at about the same level as in baseline (*M*=1.6, range 0 to 6). During the post-intervention phase, Arthur demonstrated unscripted play actions at higher levels than baseline mean, for the multiple exemplar play set (*M*=6.5, range 2 to 13). In addition, he demonstrated unscripted play actions higher than baseline mean with the single exemplar play set (*M*=7.9, range 4 to 10).

Dean was assigned the circus play set for the single exemplar intervention and the fire station for the multiple exemplar intervention. He demonstrated low levels of unscripted play actions during baseline for both the multiple exemplar play set (*M* =2.7, range 1 to 4) and the single exemplar play set (*M*=1.7, range 1 to 4). During intervention, Dean demonstrated higher levels of unscripted play actions than baseline average. He increased to a mean of 3.2 play actions per session (range 1 to 6) during the single exemplar condition and increased to a mean of 5.4 (range 1 to 8) play actions per session during the multiple exemplar condition. During post-intervention, Dean began to demonstrate similar levels of responding as the intervention

condition with a mean of 4 play actions per session (range 1to 7) for the single exemplar play set and 3.2 play actions per session (range 0 to 5) for the multiple exemplar play set. However, due to the termination of EIBI clinical services during the COVID-19 pandemic, Dean was not able to finish the post-intervention phase of the study.

Greta was assigned the fire station play set for the single exemplar intervention and the circus play set for the multiple exemplar intervention. She demonstrated some unscripted play actions during baseline for both the multiple exemplar play set (M =3.6, range 2 to 5) and the single exemplar play set (M=4.9, range 3 to 10*)*. During intervention, she exhibited lower levels of unscripted play actions than baseline average in both the multiple exemplar condition (M=0.81, range 0 to 2) and single exemplar condition (M =2, range 0 to 8). Due to the termination of EIBI clinical services during the COVID-19 pandemic, Greta was not able to finish the post-intervention phase of the study. There is only one data point in this phase so researchers were unable to determine a pattern of responding. However, it is hypothesized the Greta would show higher levels of unscripted play actions in the post-intervention phase similar to Arthur's pattern of responding as she demonstrated similar levels of responding during the intervention phase.

Scripted Play Actions

The right panel of Figure 1 depicts scripted play actions for both multiple exemplar and single exemplar conditions during baseline, intervention, and post-intervention for Arthur, Dean, and Greta. There were a total of ten scripted play actions possible for each script and the frequency of correct scripted responses is displayed on the y-axis.

During baseline, Arthur engaged in zero scripted responses. In intervention Arthur's scripted play actions increased to a mean of 4.8 play actions (range 0 to 10) for the single

exemplar intervention and 3.5 play actions (range 0 to 7) for the multiple exemplar intervention. Arthur demonstrated a steep increase in scripted responses for the single exemplar condition by the fifth session, where he performed 7 out of the 10 scripted responses, and a gradual increase for multiple exemplar session by the fifth session, where he performed only 4 of the 10 play actions. During the post-intervention phase of the study, Arthur engaged in lower levels of scripted play actions than during intervention phase. He demonstrated a mean of 1.1 scripted play actions (range 0 to 3) for the single exemplar play set and a mean of 2 scripted play actions (range 0 to 7) for the multiple exemplar play set.

During baseline, Dean engaged in zero scripted responses. During intervention, Dean continued to engage in near zero levels of scripted responses in both the single exemplar condition (M =0.3, range 0 to 1) and zero scripted responses in the multiple exemplar condition. During the post-intervention phase, Dean demonstrated similar levels of scripted play actions for both play sets as baseline and intervention conditions.

During baseline, Greta engaged in zero scripted responses. During intervention, Greta's total scripted play actions increased to a mean of 3.6 (range 0 to 10) for the single exemplar condition and a mean of 4 (range 0 to 8) for the multiple exemplar condition. She demonstrated an immediate response after the first session in scripted play actions in both the single exemplar and multiple exemplar conditions. Due to termination of data collection due to COVID-19, Greta was unable to finish the post-intervention phase of the study, but it is hypothesized that she would have lower levels of scripted play actions as compared to baseline – similar to Arthur's pattern of responding.

DISCUSSION

The purpose of the study was to extend video modeling research by incorporating video modeling and multiple exemplar training to identify the extent to which young children with ASD are taught solitary pretend play skills. All three participants demonstrated an increase in play behaviors during the video modeling condition. Additionally, all participants allocated responding to either scripted or unscripted play. Furthermore, for two out of three participants multiple exemplar video modeling resulted in higher levels of unscripted play actions than single exemplar video modeling during intervention. Finally, in the absence of video models during post-intervention, Arthur displayed high levels of unscripted play actions and Dean began to demonstrate persistent levels of unscripted play actions as during intervention condition. Each result will be analyzed in greater detail in the discussion that follows. The current study has the potential to extend existing video modeling research by incorporating multiple exemplar video models to demonstrate the emergence of unscripted play actions during pretend play in the natural environment.

All three participants demonstrated a potential interaction between unscripted and scripted play actions after the introduction of video modeling. For example, if participants demonstrated high levels of unscripted play, they would display low levels scripted play or the opposite occurred. Unlike prior studies that only saw allocation towards scripted responding (D'Ateno et al. 2003; MacDonald et al. 2005), the current study had some participants demonstrate allocation to scripted responding and others to unscripted responding. One possible explanation for this contrast in responding, is that participants had a limited amount of time to engage in play sessions, and time spent engaging in scripted play actions meant less time to engage in unscripted play actions or vice versa. The outcomes of all participants taken together

suggest there is potential for children with ASD to differentially respond to video modeling interventions, where some children will adhere to the script and others may generate novel behavior after watching several video exemplars.

It is beyond the scope of the present investigation to empirically state why there may be differential responding across participants, but prior research on individuals with ASD suggests some children have a tendency to repetitiously act out the same play scenarios and have a higher likelihood to adhere to a script (Boyd, McDonough, & Bodfish, 2012). Therefore, the contrast in low levels of unscripted play actions versus the high levels of scripted play actions allows the researcher to draw the conclusion that some participants allocated a majority of their time to scripted play actions in the one min session rather than in engaging in unscripted play actions. And based on the observed interaction in the present study, we predict that children with ASD that have a tendency to engage in highly routinized behaviors may allocate more time to scripted play actions, in which case unscripted play actions would be lower. Therefore, practitioners might consider to carefully programming video modeling interventions to focus on novel responding for children with ASD that have a tendency to engage in highly routinized behaviors.

For Arthur and Greta, researchers hypothesized that during intervention the video exemplars were suppressing novel responding during play sessions because of their strong adherence to scripts. Therefore, a decision was made to include a post-intervention phase to take participants back to baseline conditions. However, this analysis is preliminary because Dean and Greta did not finish post-intervention due to the COVID-19 pandemic. In this phase, Arthur demonstrated higher rates of unscripted play actions with both play sets as compared to baseline and intervention. The intervention phase was teaching Arthur how to play with a particular play set by showing the video exemplars associated with each one. By removing the video exemplars

that had stimulus control over play behaviors in the play sessions, Arthur was able to engage in novel play actions not seen before. The emergence of higher rates of unscripted play actions with the removal of the video modeling condition might be important for clinicians to consider when programming for teaching pretend play to clients. Clinicians might consider interspersing sessions without video exemplars, so clients may engage in unscripted play actions in addition to scripted play actions. By doing this, clinicians can assess the independent and naturalistic play behaviors of clients in the absence of video models.

In the current study, two out of three participants demonstrated gains in unscripted play actions after the introduction of video modeling. This outcome differed from some previous video modeling research studies where participants engaged in little to no unscripted play actions (D'Ateno et al. 2003; MacDonald et al. 2005), but supported other research where participants displayed increases in unscripted play actions after multiple exemplar joint video modeling (Dueñas et al. 2019). While video modeling led to greater increases in unscripted play actions for Dean and Arthur, it did not produce the same results for Greta. Dean produced the most immediate high levels of unscripted play actions, and demonstrated a separation of responding between multiple exemplar and single exemplar video modeling. Arthur had a slight increase in unscripted play actions as compared to Dean, but even this is of note because there was about a 0.5 increase in play actions per minute. Theoretically, if play sessions were longer he may engage in more unscripted play actions. For example, if play sessions were 5 minutes there could have been an increase 2.5 unscripted play actions. This has important implications for implementing multiple video exemplars because novel, varied, and flexible responding is optimal for children with ASD since they display higher rates of manipulation or sensory play with objects than either symbolic-pretend play or functional play (Dominguez et al. 2006).

Therefore, the present investigation suggests that multiple exemplar video modeling can lead to the emergence of unscripted play actions, among children who demonstrated very low levels of play actions during baseline.

The variability of scripted responses in the present investigation deviated from previous research (D'Ateno et al. 2003; MacDonald et al. 2005). One possible explanation for the variability of scripted play actions in the multiple exemplar condition, is that the rotation of the three video models may have led to insufficient presentation of the video exemplars. Displaying multiple video models meant participants in the current study had less exposure to each of the video models, compared to studies that used only a single video model. However, lack of spontaneous pretend play is concerning for children with ASD (Rutherford & Rogers, 2003), so emphasizing unscripted responding may be a more important step for clinicians.

The present study potentially also extends previous video modeling studies by demonstrating implementation in the natural settings of the EIBI center. Several prior studies assessing play behaviors have conducted their studies in rooms outside of the natural settings of participants, without noise and visual distractions (D'Ateno et al. 2003; MacManus et al. 2015; Nikopoulos & Keenan, 2007). The outcomes of the present investigation appeal to the broader efficacy of video modeling to be used to teach play behaviors to children with ASD in common educational or therapeutic environments and to possibly achieve similar results as when the intervention is administered in an analog setting. Multiple exemplar video modeling was implemented successfully despite confounding variables that could have interfered with the procedures, such as distracting noises or other peers or adults in the therapy room. The outcomes suggest that this procedure can be generalized to a wide range of settings.

Participants in the current study engaged in similar ways to participants in the Marzullo-

Kerth et. al study, in which participants engaged in stimulus generalization with different sharing materials than what was depicted in video exemplar. In the current study, participants were observed to engage in several stimulus generalizations with the different characters in the play set. For example, if a participant had seen a lion run around the circus in the video exemplar the participant would make the horse run around the circus. While the number of unscripted play actions that would be considered stimulus generalization was not recorded in this study, future research could examine different types of generalized play actions.

This study had a number of notable limitations that could be addressed in future research. Our measurement system conservatively counted scripted responses only if performed in the correct sequence, which may have scored less scripted behavior than actually occurred. All participants in the intervention and post-intervention phase engaged in scripted play actions that were out of order, but were unable to be counted as per the conservative scripted play action definition. Therefore, participants may have engaged in more overall scripted play behavior that was not captured simply because of a brief deviation. For example, if the participant engaged in an unscripted play action before engaging in any scripted actions that entire session would be scored as a zero for scripted play actions, since the participant did not follow the script in order. Or if a participant did the first two scripted play actions and then did an unscripted play action but later completed more of the script, only the first two play actions would be counted towards the data point for that session. Future research could examine measures of scripted play behavior that allow for deviation in sequence from the script. It is possible that such play is more functional and capturing deviations in sequence may be more representative of skills learned.

Next steps for the current study will be to adjust the measurement system for scripted play actions to include play actions that occur out of order. In addition, recording the frequency

of total play actions (i.e. both scripted and unscripted) may provide a more comprehensive depiction of the effects of multiple exemplar video modeling on pretend play.

The current study had experimental design flaws. For an AATD demonstration of experimental design is achieved by having differentiation between conditions (i.e., multiple exemplar and single exemplar; Byiers, Reichle, & Symons, 2012). For two out of three participants there was not a clear differentiation between the two conditions since the data paths overlapped. One possible solution to this limitation of single case experimental design, would be to consider using a between group design to evaluate the effects of single and multiple exemplar video modeling interventions in future research.

Continuous exposure or repeated exposure to the play sets over time or multiple times in one day may have led to satiation and a decrease in motivation to play with the play sets for some participants. For Dean the last two data points in the maintenance phase are lower than previous sessions. During the final two sessions, Dean attempted to leave the play area and needed to be prompted back to play with the play set. The last two sessions were the second time the play sets had been presented that day, so it is possible that Dean may have satiated on the play sets. This is an important consideration that clinicians should account for when programming for teaching pretend play. For example, clinicians could possibly alternate more than two play sets to create a state of deprivation.

The present investigation showed that multiple exemplar video modeling may be an effective intervention for increasing pretend play actions among children with ASD. The use of video modeling may be an effective way to increase novel responding without the use of contingent reinforcement. Consistent with previous investigations, multiple exemplar video

modeling may be an effective intervention to encourage novel responding in children with ASD in the natural environment.

APPENDIX

Table 1: Play Set Pieces

	Circus	**Fire Fighters**
1	Lion	Firefighter
2	Elephant	Doctor
3	Horse	Policeman
4	Monkey	Injured Person
5	Circus Performer	Fire Dog
6	Ball	Fire Truck
7	Circus train	Ambulance
8	Lion stand	Police Car
9	Flaming Hoop	Fire Flame
10	High Wire	Ladder
11	Circus Background Set	Fire Scene Background Set

Table 2: Fire Station Video Exemplar Scripts

Fire Station Play Set		
Video Exemplar	**Vocalizations**	**Play Actions**
1	"Ouch I'm hurt" "I will help you" "I need a hospital" "Let's go get help" "There's the doctor"	Lay man on the ground Put police man on top of police car Drive police car to man Police man gets off car Put dog on the ambulance Ambulance drives to man Dog next to man Man on top of ambulance Put doctor outside of Hospital Drive to the hospital
2	"I am stuck" "Please save me" "We are coming" "Careful, step on ladder" "Thanks for saving me"	Put the man on Hospital Man walks on Hospital Jump the man up and down Put Firefighter in the fire truck Drive fire truck to Hospital Setup ladder on the Hospital Fire fighter stands next to ladder Man walks down ladder Fire fighter and man facing each other Man walks away
3	"There's a fire" "I got the water" "I need help" "Put out the fire" "Here's a band aid"	Lay man down on fire station Put the flame on the fire station Put fire dog in the Fire truck Put doctor in the ambulance Drive the ambulance to the fire station Doctor gets out of ambulance Dog sways back and forth Raise the fire ladder (attached to the FT) Man comes down the fire ladder Doctor walks to man

Table 3: Circus Video Exemplar Scripts

Circus Play Set		
Video Exemplar	**Vocalizations**	**Play Actions**
1	"We're at the circus." "Here's the Elephant" "Catch me please" "I'll catch you" "Thanks, for catching me"	Performer jumps up and down Put Elephant on the stand Elephant twirls around Elephant on the ball Elephant lands upside down Put monkey on high wire Monkey rides high wire back and forth Performer stands below the high wire Monkey jumps off the high wire Monkey rides off
2	"Let's go to the Circus" "I am here" "Jump through the hoop" "I'm riding the horse" "Look at this"	Put train cars together Put performer on train Drive train to the circus Performer gets off train Put flaming hoop on top of stand Monkey through the hoop Performer on the horse Galloping the horse around the circus Performer on the horse on top of high wire Performer + horse jump down
3	"Welcome to the Circus" "My pet lion" "He's not scary" "Roll away" "Thanks for coming"	Put performer on the stand Performer jumps up and down Lion comes next to performer Lion and performer walk together Lion jumps on performer Lion jumps off Performer pushes ball Lion runs around the circus Lion on high wire Performer stands next to lion

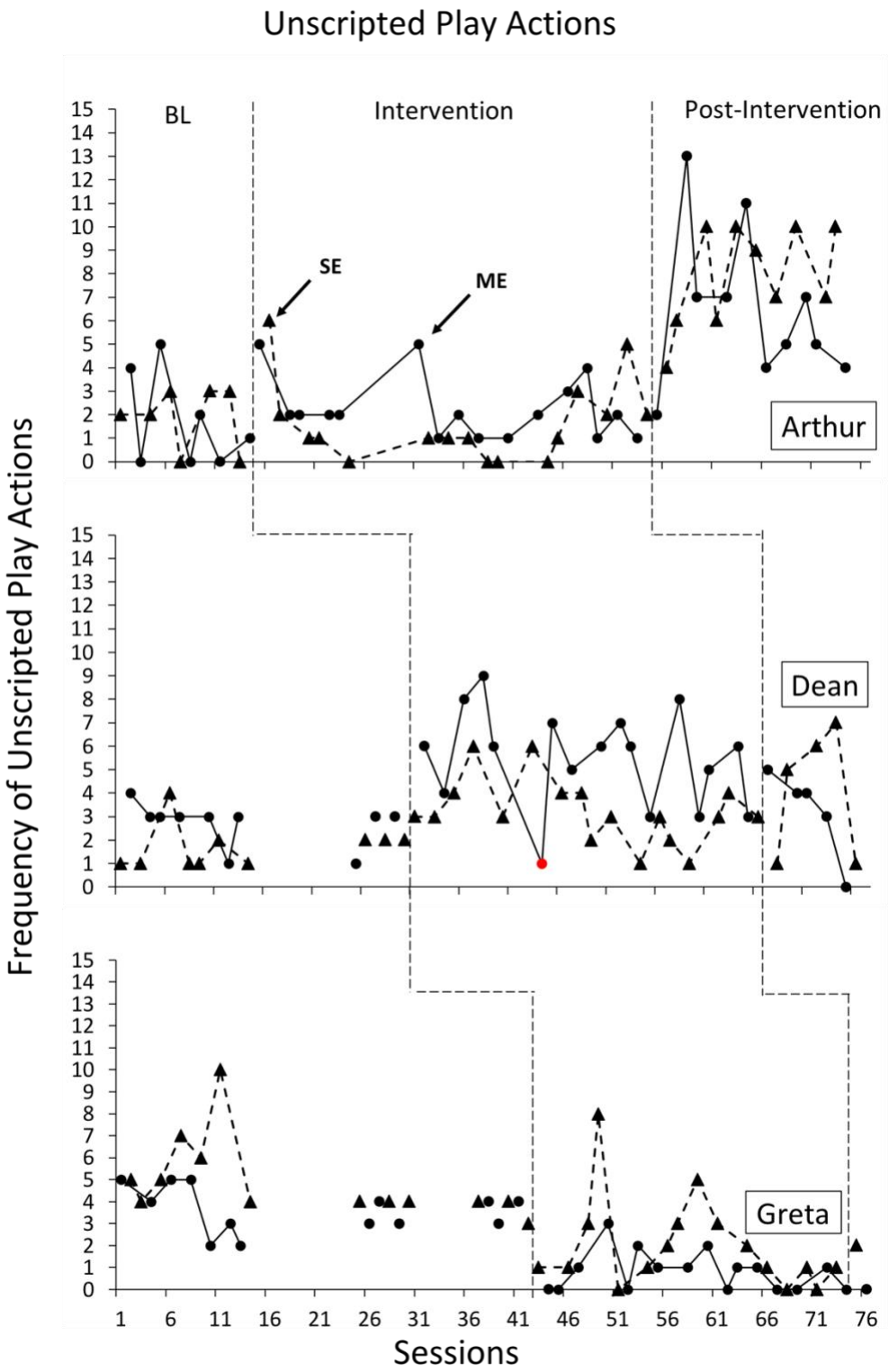

Figure 1. Graphical display of total unscripted play actions per session during baseline (BL), intervention, and post-intervention. The solid line with closed circles represent the multiple exemplar (ME) play set and the dashed line with closed triangles represent the single exemplar (SE) play set for each respective participant. The data point in red (session 41) for Dean indicates that the session needed to be terminated, he was later sent home due to illness after that session.

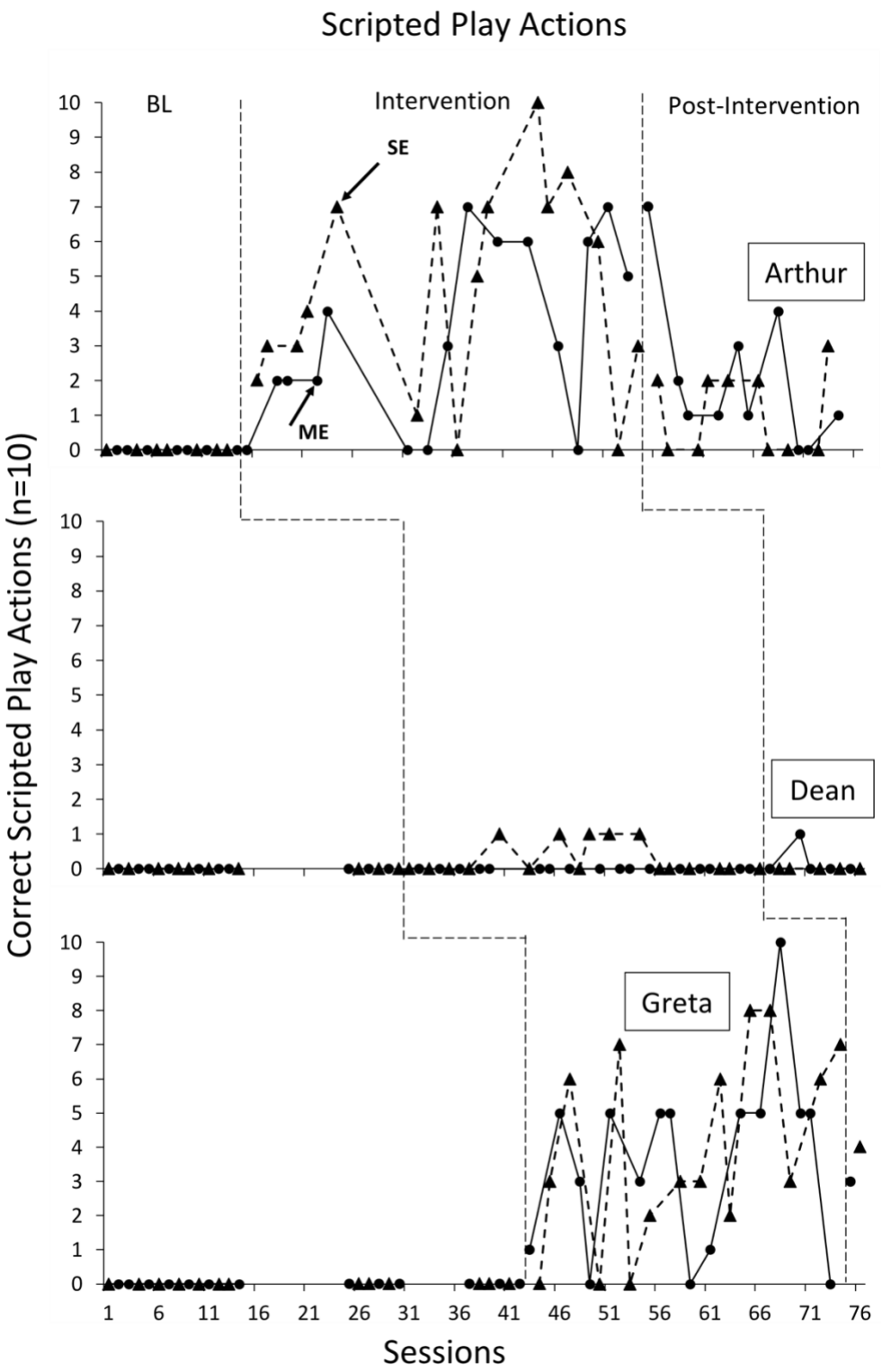

Figure 2. A graphical display that displays the number of correct scripted play actions per session (n=10) during baseline, intervention, and post-intervention. The solid line with closed circles represent the multiple exemplar (ME) play set and the dashed line with closed triangles represent the single exemplar (SE) play set for each respective participant.

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