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BRIEF PRACTICE

Sibling-Implemented Script Fading to Promote Play-Based Statements of Children with Autism

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Abstract

We trained three typically developing children to implement a script-fading procedure with their younger siblings with autism. The number of contextually appropriate statements made by the children with autism increased once treatment was initiated. Participants continued to emit higher levels of contextually appropriate statements after the scripts were completely faded and at a 4- or 11-week follow-up. The typically developing siblings were able to implement the script-fading procedure with high levels of fidelity.

Keywords Script fading · Autism · Sibling · Play · Language

One of the diagnostic criteria of autism spectrum disorder (ASD) is deficit in the area of social communication (DSM-5; American Psychiatric Association [APA], 2013). Script fading is a procedure that has been shown to increase the number of appropriate vocalizations emitted by children with ASD (Krantz & McClannahan, 1993). Script fading consists of the following steps: (a) first, children are taught to emit the scripted phrase using a textual (e.g., typed) or auditory (e.g., recorder) script and (b) the script is systematically faded such that the child with ASD continues to emit the scripted phrase in the absence of the script. Once script fading is initiated, children often emit untaught phrases in addition to those that were directly taught. While script fading has been shown to be effective, researchers or instructors have served as implementers in the majority of studies (Akers, Pyle, Higbee, Pyle, & Gerencser, 2016). One notable exception is the implementation of script fading by parents (Reagon & Higbee, 2009). The parents in this study developed three scripted statements and systematically faded the scripted statements based on their child's performance during play sessions. The scripted statements (e.g., "Look, the car is going!") were related to one toy set, and two other toy sets were used to assess for generalization. Results showed that play initiations increased with both the target and generalization toy sets.

The results reported by Reagon and Higbee (2009) are promising; however, it may be important to identify if these results could be replicated with a more age appropriate play partner. For many children with ASD, a common play partner might be a typically developing sibling. Given the effectiveness of script-fading procedures with parents delivering and fading scripts, we sought to systematically replicate these results with siblings serving as play partners. We measured the effects of the script fading procedure on the number of contextually appropriate statements made by children with ASD.

Implications for practice
- Young children with ASD often do not emit appropriate play statements while playing with toys.
- Script fading is an effective intervention for teaching children with ASD to emit play-based statements.
- Typically developing siblings can implement script fading with fidelity.

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Method

Participants and Setting

Three children with ASD, who had previously attended or were currently attending a university-based behavioral

preschool, participated in the study along with a typically developing sibling. We recruited participants who (a) could emit at least three-word phrases, (b) had a generalized imitation repertoire, (c) engaged in low levels of destructive behavior, and (d) played with toys appropriately but rarely commented during play. Sadie (5) participated with her sister Melissa (14), Cameron (7) participated with his brother Landon (10), and Hank (4) participated with his sister Mandy (6). A parent of each participant served as a research assistant for sessions. We conducted sessions in participants' homes in an open area that was cleared of distracting items.

Materials

Each sibling dyad was assigned three toy sets to interact with during sessions (see Table 1). These toy sets were purchased by the researcher and access was restricted outside of sessions. We designated one toy set to be used for the script fading intervention (hereafter called the "target toy") and used the other two toy sets to assess generalization. The parents developed three 3–4-word scripts which were recorded on Mini-Me ™ voice recorders. Siblings wore MotivAider timers to signal 30-s intervals.

Measurement

Parents transcribed all statements made by participants during sessions, and the transcription was then reviewed by the researcher to total the number of contextually appropriate statements. Statements were not scored if they were (a) not contextually appropriate (e.g., "I need gas," when playing with the playground), (b) one-word statements, (c) immediate repetitions of statements, (d) excessive repetitions of statements, defined as using the same statement more than four times, (f) stereotypic phrases, individually identified for each participant (e.g., "good job"), or (g) completely unintelligible.

A second coder collected data for 33% of sessions to assess interobserver agreement (IOA). The second coder transcribed and recorded the number of comments via recorded video. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and converting the result to a percentage. An agreement was defined as both coders (i.e., the first and fourth authors) recording the same statement as contextually appropriate. Mean agreement was 95% (range from 75 to 100%) for Sadie, 96% (range from 75 to 100%) for Cameron, and 97% (range from 50 to 100%) for Hank. During the session with 50% agreement, Hank only made two comments; therefore, one disagreement leads to this low percentage.

We assessed treatment fidelity for 50% of sessions. We assessed for the following components, whether the sibling (a) oriented to the participant, (b) presented a script every 30 s, (c) responded to the participant's initiations, (d) used the prompting procedure (described below), (e) did not ask questions or provide directions, and (f) only made comments about his/her own behavior. Treatment fidelity was calculated by dividing the number of correctly implemented components by the total number of components and converting the result to a percentage. Mean fidelity of implementation was 93% (range from 87 to 100%) for Sadie, 93% (range from 82 to 100%) for Cameron, and 88% (range from 62 to 100%) for Hank.

Experimental Procedures

An adapted alternating treatment design embedded within a multiple baseline design across participants was used to assess the effects of the script-fading procedure on the number of comments emitted by the participants. Prior to the study, a brief multiple-stimulus without replacement preference assessment (Carr, Nicolson, & Higbee, 2000) was conducted to identify the top three toy sets.

Pretraining We trained the siblings to implement the script-fading procedure using Behavioral Skills Training (BST). Parents served as the role-play partner and provided

Table 1 Session materials

	Toy sets	Scripted statements
Sadie	Fisher-Price Little People® Playground (target)	1. Go down slide
	Fisher-Price Little People® Happy Sounds Home (GS1)	2. I want swing
	Fisher-Price Little People® Wheelies Airport (GS2)	3. Cross the bridge
Cameron	Fisher Price World of Little People® Emergency Fire Station (target)	1. Go get the hose
	Fisher-Price Little People® Playground (GS1)	2. To the rescue
	Fisher-Price Little People® Wheelies Airport (GS2)	3. Let us save them
Hank	Hot Wheels® City Tow and Tune Car Shop Play Set (target)	1. Fix the car
	Play-Doh® Brick Mill and Grinding Gravel Yard (GS1)	2. Down the hill
	Vtech® Go! Go! Smart Wheels Airport Playset (GS2)	3. Pick up car

Target target toy set, *GS* generalization toy set

feedback to the sibling in conjunction with feedback provided by the researcher. We specifically trained the siblings to (a) orient to the participant during play, (b) refrain from asking questions or giving directions, (c) respond to all of the participant's verbalizations, and (d) to comment on their own play actions. Siblings were instructed to present an auditory script every 30 s and wait for participant to emit the scripted phrase. If he or she did not repeat the scripted phrase, the sibling first physically guided him or her to press the voice recorder button. If this prompt was ineffective, the sibling provided a verbal prompt (e.g., "say, here comes the car"). Training ended when the sibling correctly implemented each component with their parent with 95% or better accuracy. During pretraining, the most common error was failing to respond to comments made by the parent. The siblings met mastery after one session that took approximately 30 min.

Baseline and Generalization Sessions We conducted three 3-min sessions per day (i.e., one for each toy set). Prior to each session, the parent cleared the environment to remove possible distractions and provided the sibling with the appropriate materials. The researcher video recorded sessions while the parent simultaneously transcribed statements. The sibling began sessions by saying, "let us play." Throughout the sessions, the siblings responded to all comments emitted by the child with ASD, and there were no other programmed consequences for commenting.

Script Fading The script-fading procedure was only implemented with the target toy. These sessions followed the same procedures as baseline and generalization sessions with the exception of the presence of the scripts. The sibling retained access of the recorders (i.e., scripts) and every 30 s presented one of the three scripts by holding the recorder in the participant's line of vision and proceeding through the prompting steps when necessary. We did not require play actions to match play statements (e.g., the participant could say "cross the bridge" while going down the slide); therefore, the sibling presented scripts in a quasi-random order, unrelated to the child's play behavior. We initiated script fading once the child with ASD independently followed the three scripts at 100% accuracy for two consecutive sessions. We faded scripts one word at a time from the end to the beginning with the final fading step being complete removal of the script (i.e., including the recorder).

Follow-up We assessed for maintenance 4 weeks after the completion of training for Cameron and Hank. Sadie's follow-up sessions occurred 11 weeks after the completion of training due to an unforeseeable family incident. These sessions followed baseline procedures and the scripts were not present.

Results

Figure 1 displays the number of contextually appropriate statements emitted by the three participants. The closed data path denotes sessions for the target toy; this is the only data path that includes scripted statements. The large closed squares denote fading steps for the scripts. Scripts were completely faded, including the removal of the recorders, for all participants. Once we introduced the script-fading procedures with the target toy, participants' responding increased for the generalization toy sets, as well as the target toy, indicating that commenting behavior generalized across toy sets.

Sadie's statements for the three toy sets greatly increased from baseline ($M = 6$, target toy; $M = 4.2$, GS1; and $M = 4.4$ GS2) to treatment ($M = 17.77$, target; $M = 15.22$, GS1; and $M = 17.27$, GS2). Scripts were completely faded for Sadie in 17 sessions. We conducted one booster session, denoted by the asterisk, before session 46 because she was having a difficult time responding appropriately to the scripts at the second fading level. During the booster session, Sadie was required to accurately emit each scripted statement (without the toy present) for five consecutive trials. After this booster session, scripts were completely faded in seven sessions. We conducted a follow-up session 11 weeks after the final treatment session, and Sadie's responding remained at levels consistent with treatment even after this extended period of time.

Cameron's statements for the three toy sets also increased from baseline ($M = 5.87$, target toy; $M = 7$, GS1; and $M = 5.62$, GS2) to treatment ($M = 14.29$, target; $M = 15.16$, GS1, and $M = 13.87$, GS2). We completely faded the scripts for Cameron in 17 sessions. When playing with the target toy set, Cameron emitted siren sound effects (e.g., "weeeoooeee") at a high rate, which adversely effected his commenting. Therefore, at session 66 Landon began presenting scripts every 15 s instead of every 30 s in order to interrupt these competing responses. After implementing this modification, Cameron emitted more comments and continued to do so when the scripts were completely faded. Cameron continued to emit higher levels of contextually appropriate statements during the 4-week follow-up session.

Hank's statements also increased from baseline ($M = 0.8$, target toy; $M = 0.9$, GS1; and $M = 0.4$, GS2) to treatment ($M = 9.95$, target; $M = 6.17$, GS1, and $M = 8.26$, GS2). We observed the most moderate treatment effect for Hank; however, he also emitted the fewest number of comments during baseline. We completely faded scripts for Hank in 16 sessions. Hank continued to emit higher levels of appropriate comments at the 4-week follow-up session.

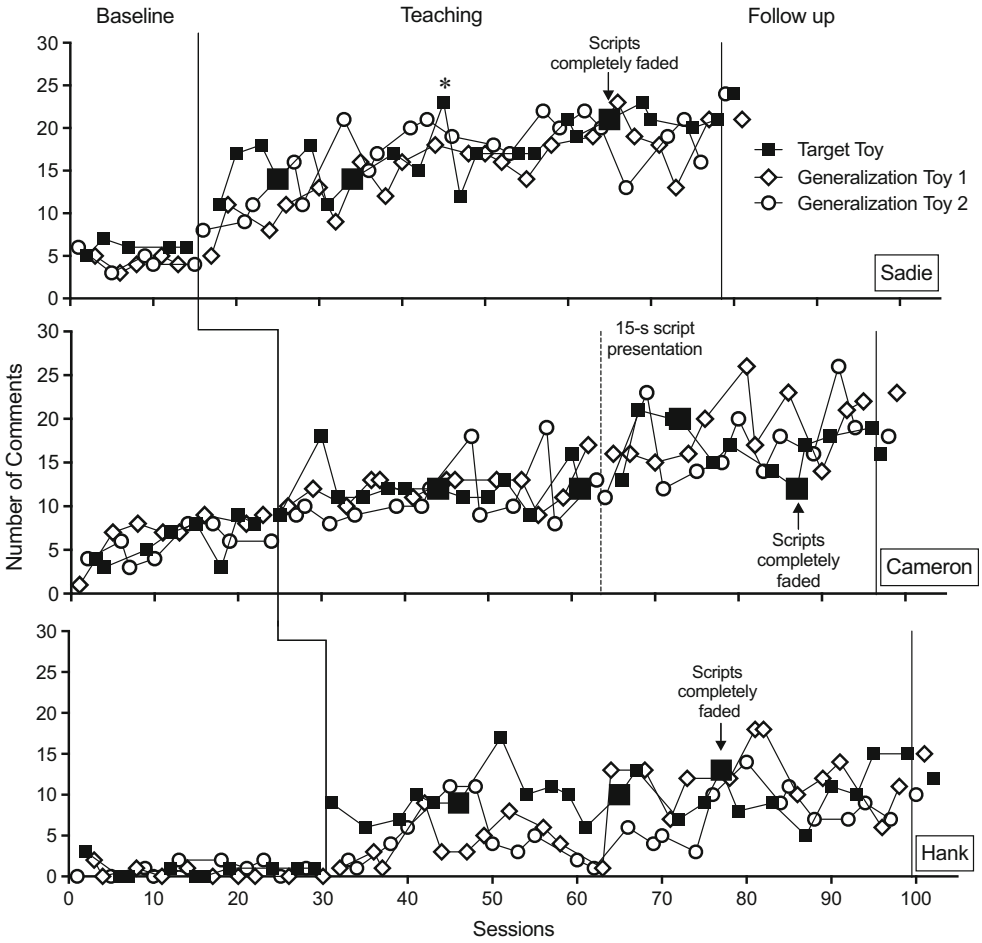

Fig. 1 The results for Sadie (top), Cameron (middle), and Hank (bottom). The large closed squares represent script-fading steps. *booster session

Discussion

The number of contextually appropriate statements increased after the treatment was initiated for all three participants. It is important to note that these increases in commenting were observed in the absence of any artificial reinforcement. Many social skill interventions include additional reinforcers, which are necessary for behavior change. However, within this intervention, we observed a change in behavior when the only consequence that followed the emission of comments was a verbal response from the sibling. We cannot state with any certainty that the response functioned as a reinforcer, but it is possible. Future researchers could directly assess whether social responses function as reinforcers after implementing script fading. We were able to completely fade the scripts for participants without introducing any additional fading steps. It is unlikely that this finding would be replicated across studies as previous researchers have reported that complete fading was not achieved (Akers et al., 2016). Future researchers should consider investigating conditions which promote successful fading.

This study extends the script-fading literature as it includes naturalistic change agents (i.e., siblings) as the primary implementer of the intervention and was conducted in the natural environment (i.e., participants' home). Siblings were selected to implement this intervention because we determined that it was likely that they would serve as a play partner for the child with ASD in the home environment. Despite the young age of some of the siblings, all three implemented procedures with fidelity, for which we recorded data during 50% of the sessions. Future researchers could assess whether typically developing peers could serve as implementers of the script-fading procedure and to what extent this implementation would lead to a subsequent increase in commenting by the child with ASD.

There are limitations of this study that are worth noting. First, we did not specifically code for the complexity of the statements. While the overall number of statements increased, it is unknown whether there was an improvement in the quality of the comments. Future researchers could develop more sensitive measures to identify the effects of script fading on increasing comments with more advanced grammar and/or content. In addition, coding statements as novel, delayed imitation, and variations of previously emitted statements may provide useful information for future studies. Second, the session duration was relatively short. We arbitrarily selected

3-min sessions because we felt the short session length would reduce the risk of participants' losing motivation to play with the toys. However, it is unknown whether participants' responding would maintain during longer play sessions. Future researchers may wish to investigate this further. Third, the change in level between Cameron's baseline and initial treatment phase was less robust than for the other two participants. Although the lack of an immediate effect is concerning, the shift in level following the modification of script presentation does provide a clear change from baseline to treatment. Fourth, we did not require play statements to match play actions (e.g., saying "down the ramp" while driving up). However, participants rarely, if ever, engaged in mismatched responses. While this did not become an issue for our participants (likely because of our inclusion criteria), future researchers could investigate procedures to increase correspondence between play and language, as this may be a skill deficit for many children with ASD.

A final limitation was our decision to train the siblings to comment about their own behavior. This is a deviation from the Reagon and Higbee study, and it is possible that the siblings' modeling appropriate comments had an effect on participants' commenting. Although siblings commented about their own behavior across baseline and treatment, we did not specifically hold the number of comments constant; therefore, we cannot rule out the possibility that this alone led to an increase in participants' responding. We included this deviation because we determined that due to the age of the siblings, it was likely they would engage in some vocal verbal behavior during play; therefore, we decided the best way to ensure they refrained from asking questions or giving directions was to teach them to comment about their own behavior. In addition, we believed that training the siblings to refrain from speaking unless they were responding to a participant comment would have been a detriment to the social validity of the study as this would not likely occur in the natural environment.

The results of this study further support the use of script fading to increase play statements for children with ASD in the home environment. In addition, this study demonstrates the utility of incorporating siblings as play partners to promote play-based commenting. These results again highlight the generative effects of script-fading procedures in that all three participants learned to initiate both scripted and unscripted play statements as a result of being taught three scripted statements with a single toy set.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional committee and with the 1964 Helsinki Declaration and its latter amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from the parents of the children included in the study.

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