A Preliminary Analysis of Procedures to Teach Children with Autism to Report Past Behavior

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Abstract Deficits in reporting past behavior may have implications for a child's social development and safety. Behavioral interpretations of memory and research on do/say correspondence provide valuable strategies to teach reporting past behavior when deficits are observed. The current study examined procedures to teach accurate reporting of past behavior following a delay for two children diagnosed with autism. During baseline, both participants accurately reported past behavior when immediately probed. Neither participant emitted accurate reporting following a delay during end-of-day probes. Treatment procedures included prompting, reinforcement, and fading procedures designed to maintain stimulus control across the delay. Both participants demonstrated accurate reporting of past behavior on delayed probes, including when conducted by a caregiver.

Keywords Autism · Memory · Reporting past behavior · Remembering · Stimulus control

Children are expected to report past behavior such as whether they brushed their teeth or completed their homework. Accurately reporting past behavior plays a role in the development of relationships and may be critical for a child's safety or the well-being of others. For example, the inability to report past behavior would impede telling a friend about your weekend or telling an adult if someone was hurt. The reliability of such reports has long been an area of interest in psychology (e.g., Ceci, Ross, & Toglia, 1987). Deficits in accurate reporting have been attributed to impairments in storage, processing, or retrieval of memory by cognitive psychologists (see Goodman & Melinder, 2007). Conversely, behavioral conceptualizations of memory and difficulties

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with accurate reporting have focused on the development of, or errors in, stimulus control (see Delaney & Austin, 1998; Palmer, 1991; Skinner, 1957; White, 1985).

Skinner (1957) contended that responding to past behavior was acquired through a history of explicit reinforcement in the presence of available stimuli, both public and private, generated by the question. Thus, deficits in reporting past behavior may be the result of failure of the relevant stimuli to evoke the response or insufficient reinforcement history. Several factors may influence stimulus control including the complexity of the antecedent stimulus (Sundberg & Sundberg, 2011) and the schedule of reinforcement (Hausman, Ingvarsson, & Kahng, 2014). Incorporating factors such as these into treatment procedures may facilitate accurate reporting.

When reporting past behavior occurs in typical interactions, the verbal community provides a variety of supplemental information that may increase accurate reporting in that moment and, overtime, may promote accurate reporting of past behavior without the need for such supplemental information on future occasions (Skinner, 1957). For example, the verbal community provides clarifying stimuli to promote accurate responding (Palmer, 1991), such as when a caregiver asks, “What did you do at school today?” The child’s silence may be followed by an additional stimulus to clarify the expected response, such as, “Did you play on the swing at recess?” In this example, the complexity of the antecedent verbal stimulus is reduced, and serves as a prompt for the child to report about activities at recess, when asked about school in the future. These naturally occurring “prompts” may not be sufficient for this skill to develop in children with autism. Further, social interaction may not function as a reinforcer for some children with autism (Call, Shillingsburg, Bowen, Reavis, & Findley, 2013). Thus, consequences (i.e., social approval) that increase accurate reporting in typical development may not function as reinforcers for children with autism, which may explain deficits in this repertoire.

Previous research has referred to correspondence between nonverbal and verbal behavior as “do-say correspondence” (e.g., Israel & O’Leary, 1973; Risley & Hart, 1968). When correspondence between nonverbal behavior and the verbal report of the behavior is not observed, reinforcement for correspondence has been shown to improve accuracy (e.g., Israel & O’Leary; Risley & Hart). Naoi, Yokoyama, and Yamamoto (2006) taught three children with autism to report past behavior. Participants were taught to view a stimulus beyond a partition (1 m away), return to the experimenter, and report what was observed using prompting and reinforcement. This work demonstrates teaching reporting past behavior when the opportunity to report occurs in close temporal proximity to the nonverbal behavior. No past research has evaluated methods to promote accurate reporting of behavior following a delay with children with autism. Thus, the current study explored procedures to promote accurate reporting of past behavior following a delay for two participants diagnosed with autism. The behaviors were activities that occurred naturally throughout the day.

Method

Participants and Setting

Two five-year-old females with autism (Beth and Annie) who were enrolled in a behavioral intervention clinic for approximately six months participated in the study. Performance on the Verbal Behavior Milestones Assessment and Placement Program

(Sundberg, 2008) indicated that Beth was an emerging level-3 learner and Annie was a level-2 learner. Both participants learned new mands readily, manded using phrases and sentences, emitted over 200 tacts using phrases and sentences, and answered a variety of wh- questions. Sessions were conducted in three separate locations in the clinic that were given unique names that corresponded with a specific feature (e.g., “book corner” in the corner of a room with bookshelves).

Response Measurement, Interobserver Agreement, and Experimental Design

A nonconcurrent multiple baseline design across participants was used to evaluate the treatment. Paper-and-pencil data were collected. Correct reporting of past behavior consisted of the participant emitting the name of the activity completed in the location within 5 s of the presentation of the question (e.g., “What did you do in the book corner?”). Correct responses included variations of the activity (e.g., “We read a book,” “We read Mary Had a Little Lamb”). Complete sentences were not required; however, all participants reliably provided verb-noun (e.g., “Built a puzzle”) or subject-verb-noun responses (e.g., “We built a puzzle”). If the participant engaged in additional activities in the specified locations during the course of the day and reported the other activity accurately it was scored as a correct response. This occurred three times for Beth only.

A second, independent observer collected data during an average of 30.73% of sessions for both participants. We calculated trial-by-trial interobserver agreement (IOA) by dividing the number of agreements by the number of agreements and disagreements and converting the ratio to a percentage. Mean IOA was 100% for Beth and 97.62% (range, 66.67%–100%) for Annie. Treatment integrity data were collected during 35.14% and 24.62% of sessions for Beth and Annie, respectively. The mean percent of protocol components with integrity was 99.17% (range, 94.44%–100%) for Beth and 99.82% (range, 97.14%–100%) for Annie.

Procedures

Pretraining The participant was taken to a target location and required to tact the location and activity when asked, “Where are we?” and “What are we doing?” If incorrect, an echoic prompt (Beth) or a tact prompt (Annie) was provided, followed by an error correction procedure that included presenting another opportunity to independently respond, then the presentation of a previously mastered task, and a final opportunity for an independent response. Tact prompts consisted of a digital photo taken of the participant completing the activity. Error correction trials continued until correct responding occurred on both independent opportunities. Correct responses produced praise and an edible item. The mastery criterion were 100% correct responding to all activities and locations across three consecutive days (data available upon request).

Probe Procedures A single activity to be completed in a location was assigned at the beginning of the day (Table 1). Three and nine activities were included in Beth and Annie’s evaluations, respectively. Three locations were included for each participant. The participant was taken to the identified locations and completed the assigned activity in that location. Thus, a single activity was completed in a location each day and the activity completed in a location varied across days.

Table 1 Target locations and activities for participants

Participant	Locations	Activities
Beth	O.T. room	Build a puzzle
	Book corner	Play monkeying around™
	Ms. Jacqueline's room	Read a book
Annie	Yellow table	Coloring
	Playroom	Painting
	Life skills room	Play-doh™
		Biking
		iPad™
		Shaving cream
		Pictures
		Bowling
		Stickers

Immediate Probes Immediate probes were presented after an activity was completed in the assigned location. After the participant left the location, she was immediately asked, “What did you do in [location]?” Correct responses produced praise and an edible reinforcer. If the participant was not attending to the question, the experimenter re-presented it as recommended by Green (2001). The same procedures were implemented until all three locations and activities were completed.

End-of-Day Probes Following a 1- to 2.5-h delay since the last activity was completed, the experimenter conducted an end-of-day probe. During this probe, the participant was asked to report which activities she completed in each location. That is, the experimenter asked, “What did you do in [location 1]; [location 2]; [location 3]?” Each correct response resulted in praise and an edible. Incorrect responses were ignored.

Caregiver Probes Probes were conducted by the participant's caregiver using identical procedures to end-of-day probes. On days when caregiver probes were conducted, the experimenter did not conduct an end-of-day probe.

Baseline During the baseline phase, immediate, end-of-day, and caregiver probes (Annie only) were conducted as described above. Praise and edible reinforcers were delivered for correct responses during probes. No prompts were delivered during this phase.

Treatment Prompting and reinforcement for correct responding during immediate probes was utilized. Following an incorrect response to the immediate probe the experimenter presented an echoic prompt or tact prompt and the error correction procedure described in Pre-training. Echoic or tact prompts were selected based on past prompting history (Coon & Miguel, 2012). No prompts were ever provided on the end-of-day probes. Phase changes were made using visual analysis (Horner et al., 2005).

Error Correction and Delay Fading If consistently correct responses occurred on immediate probes but not on the end-of-day probes, an Error Correction and Delay

Fading (ECDF) procedure was introduced. In this procedure, additional practice opportunities were presented in the interval between the immediate and end-of-day probes. Practice trials for each location and activity were initially conducted every 15 min between the immediate and end-of-day probes. Once a single end-of-day probe occurred with 100% correct responding, the time between these probes was gradually lengthened (20, 25, 30, 35, 40, 45, and 60 min). Therefore, the number of practice opportunities decreased and time between opportunities increased.

End-of-Day Probe Practice Trials (Beth Only) We introduced End-of-Day Probe Practice Trials (EPPT) if the correct activities were being reported but in response to the wrong locations on the end-of-day probes. Once all three activities were completed, the experimenter presented all three locations using the same format as end-of-day probes with the addition of prompting and error correction as needed. Given that all other treatment procedures described presented questions about activities in each location separately, yet the end-of-day probe presented the three questions consecutively, this procedure was designed so that the treatment procedure mimicked the end-of-day probe procedure.

End-of Day Probe Only In the final phase, immediate probes were removed and End-of-Day Probes Only (EDPO) and caregiver probes were conducted to ensure that the immediate probe was not necessary for reporting to occur on the end-of-day probes. Mastery criteria were 100% correct responding for three consecutive EDPO and one caregiver-conducted probe.

Immediate Probe Fading (Annie Only) If responding on end-of-day probes was inconsistent following removal of the immediate probe, a procedure to gradually remove the immediate probe was used, whereby the immediate probe was no longer conducted immediately after completing each activity. Instead, the probe was presented following a 5-min delay. Once 100% correct responding occurred on the end-of-day probe, the latency to this probe was lengthened to 10, 15, 20, 30, 40, and 45 min and then removed.

Results and Discussion

The number of trials with a correct report of past behavior on immediate, end-of-day, and caregiver probes are shown in Fig. 1. Treatment data (i.e., responses to error correction and practice trials) are not shown. Beth responded correctly during most immediate probes in baseline, however, her responding during end-of-day probes was variable. Following implementation of ECDF, correct responses on end-of-day probes improved after 3 sessions. When baseline procedures were reintroduced, responding on end-of-day probes again became inconsistent. Following implementation of the EPPT procedure 100% correct responding on end-of-day probes occurred. When EPPT were discontinued and the EDPO condition was implemented, correct responding continued during end-of-day probes, including when conducted by Beth's caregiver.

Annie's responding on end-of-day probes was variable during baseline despite consistent correct responding on immediate probes. The ECDF phase was introduced resulting in increases in correct responding to end-of-day probes. Baseline procedures

Fig. 1 Number of trials with a correct report of past behavior for Beth and Annie during immediate and end-of-day probes. *ECDF* Error Correction and Delay Fading, *EPPT* End-of-Day Probe Practice Trials

were reintroduced with correct responding on all trials during the last four sessions of this phase, including when conducted by the caregiver. The EDPO condition was introduced and inconsistent responding on end-of-day probes occurred. The Immediate Probe Fading procedure resulted in consistently high correct responding on end-of-day probes. Responding remained high during the final EDPO condition, including when conducted by Annie's caregiver.

The current study used differential reinforcement, prompts, and probe fading procedures with two children with autism and language delays to improve reporting past behavior following a delay to both therapists and caregivers. Both participants accurately reported activities completed in the natural environment 1 to 2.5 h following completion of the last activity. Although variations in the procedures were needed for the two participants, all of the strategies incorporated prompts, differential reinforcement, and practice trials that were gradually faded. The current study demonstrates how training procedures can be modified to promote accurate reporting of past behavior following a delay for children with autism. Additionally, these procedures were incorporated into naturally occurring activities and may be easily implemented by therapists and caregivers.

Accurate reporting occurred on immediate probes during baseline; however, responding on end-of-day probes was variable even though correct responding produced reinforcement. Thus, reinforcing correspondence was not sufficient to increase accurate reporting on end-of-day probes. These data highlight that correct reporting closely following an event does not ensure correct reporting after a delay, necessitating intervention to promote that skill. Previous research has found similar outcomes regarding the adverse effect of time on

say-do correspondence (e.g., Jans & Catania, 1980; Luciano, Barnes-Holmes, & Barnes-Holmes, 2002). Although the current study demonstrates a multi-component treatment approach that potentially ameliorates this adverse effect by promoting accurate reporting following a 1-to-2.5-h delay, it is unclear which treatment procedure was responsible for the acquisition of this repertoire for Beth and Annie. Additionally, we did not assess whether the participants were then able to report following greater delays (e.g., over the weekend). Future research regarding the effect of delays on accurate reporting should be guided by basic research in the area (see Harnett, McCarthy, & Davison, 1984; Jans & Catania, 1980; McCarthy & Davison, 1991; White, 1985).

Previous research has identified impairments in memory for individuals with autism compared to typically developing peers (e.g., Boucher, 1981; Jones et al., 2011). Additional research might identify the repertoires necessary to accurately report past behavior. Future research might also determine what antecedents, such as the complexity of the questions, may influence responding in children with autism.

Due to the limited number of replications and the variations in the treatment approach employed across participants, the current study is preliminary and results should be interpreted cautiously. For example, it is unclear whether the varied timing of the end-of-day probes or the differing number of activities included affected responding. Beth's evaluation included only three pre-specified activities, while Annie's included nine. Given that both participants engaged in 100% correct responses across four days during the final phase it is possible that this variation had no effect. Future research should more carefully evaluate the effect of the number of activities and locations on acquisition and generalization of responding.

We did not assess generalization across novel activities or settings, though we did see generalized reporting to caregivers. We also did not assess responding when participants were asked less specific questions (e.g., "What did you do today?") or when no question was asked. Spontaneous reporting may come under the control of the setting in which this repertoire has been prompted and reinforced previously (e.g., car ride, dinner table) and an individual may report past behavior based on a previous history with the listener. That is, a child may report playing basketball to a peer who also enjoys basketball and report another behavior when the listener is not a basketball fan. Further, a child may be more likely to spontaneously report events that were enjoyable or unique (e.g., winning a race at field day). Future research should examine methods to promote spontaneous and differential reporting of past behavior in children with autism.

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Compliance with Ethical Standards

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional review board and with the 1964 Helsinki Declaration and its later amendments.

Conflicts of Interest All of the authors declare that there are no conflicts of interest related to the current study.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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