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The Implemetation of Interventions for Problem Behavior Based on the Results of Precursor Functional Analyses in the Early Childhood Setting

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THE IMPLEMENTATION OF INTERVENTIONS FOR PROBLEM BEHAVIOR BASED ON THE RESULTS OF PRECURSOR FUNCTIONAL ANALYSES IN THE EARLY CHILDHOOD SETTING

by

Hayley Halversen

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ABSTRACT

The Implementation of Interventions for Problem Behavior

Based on the Results of Precursor Functional Analyses

by

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Young children with problem behavior sometimes engage in precursor behaviors that belong to the same response class as the problem behavior. Assessment and treatment of precursor behavior could minimize risks associated with assessment and treatment of more serious problem behavior, and subsequently produce reduction of the problem behavior. This project evaluated the use of a functional analysis of precursor behaviors to determine the function of precursor behavior in four young boys who engaged in problem behavior. We then examined the effects of reinforcement-based interventions developed using the results of a precursor functional analysis on occurrence of problem behavior. During the precursor functional analysis, the participants engaged in little or no problem behavior. The intervention, based on the results of the precursor functional analysis, decreased problem and precursor behavior and increased an alternative behavior. These results have implications for the field of early childhood education, as practitioners may be able to conduct precursor functional analyses and interventions that result in decreasing more serious problem behavior.

(48 pages)

PUBLIC ABSTRACT

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This study consisted of three parts. We first used a video observation method and statistical analysis to identify benign behaviors that occurred before the problem behavior. These benign behaviors are known as precursor behaviors. We then used a precursor functional analysis to identify the function of the precursor behaviors. Lastly, we developed and implemented an intervention based on the results of the precursor functional analysis. The interventions effectively reduced problem behavior for the participants in the study. The participants engaged in minimal instances of problem behavior throughout the study. The results of this study may be useful to teachers and caregivers of children who engage in severe problem behavior that would be unsafe to reinforce in an assessment. Results may also help when working with children whose caregivers are concerned with their children engaging in excessive problem behavior. Further research is needed to look at modifying the precursor analysis. Future research should also look at the social validity of the precursor assessment.

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INTRODUCTION

Behavior analysts use Functional Analyses (FA) to identify contingencies that influence and maintain problem behavior (Hanley, Iwata, & McCord, 2003). The results of an FA are used to create an intervention that reduces problem behavior by altering the relevant consequences, discriminative stimuli and establishing operations. During FA conditions, therapists manipulate the antecedents and consequences for each condition. When problem behavior occurs, it is reinforced with the specific consequence for that condition. Due to the high probability that the problem behaviors will occur during some or all of the conditions, the risks associated with that problem behavior are present during the FA.

FAs are typically comprised of up to four test conditions and a control condition. The test conditions are designed to determine whether problem behavior is sensitive to one of four sources of reinforcement (attention, access to tangible items, escape from demands, or automatic sources of reinforcement). In each condition, the therapist creates the relevant antecedent conditions (e.g., no attention, removal of a tangible, presence of continuous demands) and delivers the relevant consequence contingent on occurrence of problem behavior. For example, in the attention condition, the therapist provides attention contingent on the problem behavior. In the tangible condition, the therapist provides the participant with preferred items contingent on the problem behavior. During the contingent escape or demand condition a 30-s break is given if the participant engages in problem behavior. During the alone condition, the participant is placed in the assessment room without items or materials with which he or she could interact. The therapist

observes from a different room and there are no programmed consequences for behavior. During the control, or play, condition, the therapist and participant are in the room. No instructions are presented and tangibles and attention are continually available. There are no programmed consequences for problem behavior.

During each condition, the frequency of problem behavior is recorded. When an FA is completed, the frequency (or rate) of problem behavior in each test condition is compared to the frequency (or rate) of problem behavior in the play condition. When analyzing FA data, test conditions in which problem behavior occurred more frequently (or at higher rates) as compared to the play-condition suggest the function of the problem behavior. The results of the FA are used to develop a specific function-based intervention to reduce problem behavior.

Some individuals engage in problem behavior that is so severe it cannot be allowed to occur during the assessment. These severe problem behaviors are often reliably preceded by precursor behaviors. Precursor behaviors are benign members of the same response class as the problem behaviors, meaning that precursor and problem behavior have the same function. For example, instances of aggression might reliably and immediately be preceded by moaning and clenching fists. Smith and Churchill (2002) hypothesized that placing contingencies on precursor behaviors during the FA may provide information about the problem behavior without the individual actually engaging in the targeted problem behavior. For example, during the attention condition of a precursor FA, the therapist provides attention when the participant engages in the precursor and provides no programmed consequences for the problem behavior. Dracobly and Smith (2012) hypothesized that an intervention based on the FA of the precursor

behavior would affect the problem behavior, because the precursor and problem behavior are members of the same response class. Research on FAs conducted on the precursor of a problem behavior, or precursor FAs, is needed for individuals who engage in severe behavior that can cause harm to themselves or others to minimize the need to evoke the problem behavior during assessment. Research also needs to look at interventions based on the results of precursor FAs, and evaluate the effectiveness of these interventions to reduce the more serious problem behavior. Researchers should consider the application of precursor FAs and interventions to young children who engage in problem behavior, as doing so might allow for effective early intervention, while minimizing risks associated with evoking problem behavior.

LITERATURE REVIEW

Smith and Churchill (2002) conducted FAs on problem behaviors and on reported precursor behaviors to see whether problem behavior and the related precursor behaviors belonged to the same response class. These researchers hypothesized that problem behavior would occur less frequently when reinforcement was contingent on precursor behaviors. The participants in the study were adults diagnosed with significant intellectual disabilities that did not exhibit expressive language and had limited receptive language. All participants lived in a residential facility for individuals with disabilities. Precursors were identified through caregiver reports and direct observations.

An FA was conducted on the problem behavior for each individual. The FA was conducted in a multi-element design with rate of problem behavior as the dependent variable. The conditions of the FA (access to attention, access to tangibles, escape from demands, play, and alone) functioned as the independent variables. The researchers conducted a second precursor FA in the same manner as the FA on problem behavior, this time with rate of precursor behavior as the dependent variable. Researchers determined the function of the problem behavior and the function of the precursor behavior based on the results of the FAs. Researchers then compared the functions of the precursor and problem behaviors to determine whether precursor and problem behaviors belong to the same response class. Smith and Churchill (2002) identified a common maintaining contingency for both precursor and problem behaviors for all participants. In addition to the findings that problem behaviors and reported precursor behaviors belong to the same response class, Smith and Churchill found problem behavior occurred less

frequently during the precursor FA. This finding may aid in the assessment and analysis of severe behaviors without putting the individual or others at risk. One limitation of Smith and Churchill's study in 2002 was that the researchers did not include a systematic method to assess the relationship between precursors and problem behavior.

Borrero and Borrero (2008) addressed this limitation of precursors and severe problem behavior. Using a descriptive assessment and lag sequential analysis, the researchers identified precursors for the problem behavior of the participants of the study. They conducted FAs for precursor behavior and problem behavior separately to evaluate whether precursor behavior and problem behavior belonged to the same response class.

The participants in this study were two males with autism, 11 and 12 years old, who engaged in severe aggression, self-injurious behavior (SIB), and property destruction. Researchers began by conducting a descriptive assessment of potential reinforcers, problem behavior, potential precursors and potential establishing operations. The descriptive observations were conducted during regularly scheduled activities at the private school attended by both participants. Observations lasted at least an hour, or until at least 45 instances of problem behavior and 45 instances of potential precursors occurred. The data from the precursor analysis were then analyzed in two ways. First, researchers calculated the conditional probability of precursors given problem behavior and the conditional probability of problem behavior given a precursor. They also recorded the unconditional probability of both problem behavior and precursors. The probability of a precursor given problem behavior was found by looking within 10 s before each instance of problem behavior to see if a precursor occurred. The probability of problem behavior given precursors was found by looking within 10 s after each

occurrence of precursor behavior to see if problem behavior occurred. The unconditional probability of both problem behavior and precursor behavior was calculated by dividing the total number of instances of each by the total number of opportunities to engage in each. To determine a correlation between precursor and problem behavior, researchers reasoned that the conditional probabilities should exceed the unconditional probabilities. This was the case for both participants, demonstrating a correlation between the precursor and problem behaviors.

In the second analysis, Borrero and Borrero (2008) used a lag-sequential analysis to assess the probability of potential precursors during the 50 s before and 50 s after an instance of problem behavior. The lag-sequential analysis involved observing the participant and recording instances of problem behavior and instances of potential precursors. The observation sessions were divided into intervals and observers recorded whether problem behavior and potential precursors occurred during each interval. Data were graphed to show the probability of a potential precursor occurring 50 s before and 50 s after an instance of problem behavior. An increase in the probability of a potential precursor immediately prior to an instance of problem behavior and subsequent decrease in the potential precursor immediately following the problem behavior showed that precursors reliably preceded problem behavior. The same method was used to assess the probability of problem behavior before and after a precursor. An increase in problem behavior immediately following the precursor showed a response that reliably followed the precursor. Results of the lag-sequential analysis show "that the probability of a precursor increased markedly immediately preceding an instance of problem behavior" (Borrero & Borrero, 2008, p. 89). In addition, the probability of problem behavior

increased following an instance of precursor behavior; thus, showing that the potential precursors were actual precursors to problem behavior for both participants.

After the precursor analysis, Borrero and Borrero (2008) replicated Smith and Churchill (2002), performing FAs on the problem behaviors and the precursor behaviors for both participants. The FAs included attention, tangible, escape, no-consequence, and play conditions. Borrero and Borrero's findings were similar to those in Smith and Churchill (2002), demonstrating that problem behavior and precursor behavior belong to the same response class. Borrero and Borrero's results advanced the use of precursors by systematically assessing the relationship between precursors and problem behavior, and identifying precursor behaviors.

Dracobly and Smith (2012) designed a series of experiments through which they systematically identified precursor behavior and determined the function of the precursor behavior in a manner similar to Borrero and Borrero (2008). In addition, Dracobly and Smith created an intervention based on the results of the precursor FA. They hypothesized that if the precursor behavior was in the same response class as the problem behavior, then an intervention based on the FA of the precursor behavior would affect the problem behavior.

The participant was a 29-year-old-man with mild intellectual disability. He engaged in SIB that occurred relatively infrequently but with high intensity, resulting in tissue damage and property destruction. The study occurred at a residential and training facility for adults with developmental disabilities. The first experiment was conducted to identify a behavior that reliably preceded SIB. Through observations, Dracobly and Smith (2012) identified a possible precursor to problem behavior. Using lag-sequential

analyses similar to those described in Borrero and Borrero (2008), Dracobly and Smith observed the participant's behavior in his apartment and work place. The results indicated that the precursor and the problem behavior were related, and possibly part of the same response class.

The purpose of the second experiment was to conduct an FA of the identified precursor behavior. The precursor FA was conducted in an observation room located on the campus of the residential facility. Therapists conducted no-interaction, attention, tangible, play, and demand conditions in a multi-element format. Results of the precursor FA showed that the precursor behavior was maintained by social positive reinforcement in the form of attention. Dracobly and Smith (2012) also note that the problem behavior only occurred during the first attention session of the precursor FA and remained at zero throughout the remainder of the analysis.

For the third experiment, Dracobly and Smith (2012) provided attention to the precursor behavior while placing the problem behavior on extinction. Results from the third experiment show the rate of the precursor increased during intervention, decreased during reversal, and increased upon return to intervention. The problem behavior decreased to, and remained at, zero during the initial intervention phase, increased during reversal, and immediately ceased upon return to intervention. Dracobly and Smith found that the reduction in SIB generalized to the participant's home environment without formal training.

Fritz, Iwata, Hammond, and Bloom (2013) identified two limitations to previous studies on precursor behavior. The initial identification of potential precursors was based on caregiver report or informal observation. Fritz et al. explained that (a) caregivers may

not identify all existing precursors, (b) there may be precursors different than those reported, or (c) informal observation may not detect precursors. Fritz et al. also found that in previous studies, such as Borrero and Borrero (2008) and Dracobly and Smith (2012), numerous instances of the problem behavior occurred before the relation between the precursor and problem behavior was identified. This made the procedures difficult to use in the assessment of severe problem behavior. Fritz et al. conducted a study consisting of three sequential experiments to address these limitations and expand on the use of precursor FA technology.

In their first experiment, Fritz et al. (2013) identified precursor behavior using a method based solely on direct observation. This method also minimized the occurrences of problem behavior needed to identify precursor behaviors. Fritz et al. identified target problem behavior for each of the 16 participants by asking each participant's caregiver to identify the most severe class of problem behavior in which the participant engaged. The researchers also asked caregivers if they had observed any behaviors that preceded the problem behaviors identified. The researchers then began the precursor assessment which consisted of discrete trials during which antecedent conditions that might serve as establishing operations for the problem behavior were presented. Each trial lasted 5 minutes or less and resembled the attention and demand conditions of an FA. A tangible condition was only included if caregivers reported that problem behavior was likely to occur when access to items was denied or preferred items were removed. All trials were recorded for subsequent data collection. Each trial was terminated after the consequence was delivered and the next trial did not begin until the participant had not engaged in

problem behavior for 30 s. If the participant did not engage in the problem behavior in 5 min, the trial was ended and the next trial was conducted.

During the attention trial, the therapist did not interact with the participant unless the participant engaged in the problem behavior. If the participant engaged in the problem behavior, the therapist delivered a statement of concern and gentle physical contact. The demand trial was conducted following the attention trial. During the demand trial, the therapist presented instructions using a three step prompting procedure. The instructional sequence was terminated and the therapist moved away if the participant engaged in the problem behavior. If applicable, the tangible trial was conducted following the demand trial. During the tangible trial, the participant had access to preferred items for 1 to 2 min. The therapist then removed the items. The items were returned to the participant contingent on problem behavior and the trial was terminated. The precursor assessment was considered complete after ten trials in which the problem behavior occurred. If the problem behavior occurred in the first ten trials of the assessment, play trials were conducted in which the participant had noncontingent access to attention and preferred items in the absence of demands. This procedure was put in place to ensure there were a significant number of nontarget trials during which precursors could occur. The duration of the trials without the target behavior was equal to or greater than the duration of trials with the problem behavior for all participants.

The videos of the trials were scored using a checklist, which grouped responses topographically. Two observers watched the videos and marked potential precursor topographies during the trials in which the problem behavior occurred. The observers compared the topographies marked, and developed operational definitions of all potential

precursors. The observers watched the videos again and recorded the occurrence of precursors and problem behavior in each trial. After each trial, the observers compared their data records and resolved any discrepancies by watching the video of that trial again, clarifying the operational definitions, and rescoring the trial.

Once the trials were scored, several probabilities were calculated. The probability of the problem behavior given each potential precursor was compared to the probability of the problem behavior given the absence of each precursor and the unconditional probability of the problem behavior. Then the probability of each precursor given the problem behavior was compared to the probability of each precursor given the absence of the problem behavior and the unconditional probability of each precursor. Behaviors were selected as precursors if they met two criteria. The probability of the problem behavior given the precursor must have been higher than the probability of the problem behavior given the absence of the precursor and the unconditional probability of the problem behavior. In addition, the probability of the precursor given the problem behavior must have been higher than the probability of the precursor given the problem behavior and the unconditional probability of the precursor. If several precursors met the criteria, some of the similar response topographies were combined.

The precursor assessment showed that all 16 participants engaged in precursor behaviors. The precursor assessment required 11 to 30 trials to observe 10 instances of problem behavior. The shortest assessment lasted 10 min and the longest assessment lasted 150 min. Through this experiment, Fritz et al. (2013) found that a relatively brief direct assessment could be used to identify precursor behaviors.

For the next experiment, Fritz et al. (2013) conducted a precursor FA and a problem behavior FA for eight of the participants from the first experiment to determine the functional relation between the precursor and problem behaviors. The precursor FA was conducted first to determine whether the functions of precursor and problem behavior matched when the participants had not previously been exposed to the FA conditions and as an attempt to limit the occurrences of the problem behavior. Procedures for both FAs were similar to those described in Iwata, Dorsey, Slifer, Bauman, and Richman (1994) with sessions lasting 10 min. For the precursor FA, consequences were delivered following occurrences of precursor behaviors, but not occurrences of problem behavior. For the problem behavior FA, consequences were delivered following occurrences of problem behavior, but not following occurrences of precursors. All FAs included attention, play, and demand conditions. Ignore or alone conditions were included if the problem behavior was not aggression. A tangible condition was only conducted if caregivers indicated that the problem behavior occurred when preferred items were removed or access to preferred items was denied.

Fritz et al. (2013) found that the precursor behaviors and problem behaviors of seven of the eight participants were maintained by the same sources of reinforcement. For the eighth participant, one of the two sources of reinforcement that maintained the problem behavior maintained the precursor behavior. Fritz et al. also found that the precursor FA eliminated instances of problem behavior for three subjects and resulted in low rates of problem behavior for four subjects.

The purpose of the third experiment conducted by Fritz et al. (2013) was to determine whether the results of the precursor FA could be used to design an effective

intervention. Two participants from the first experiment participated in the third experiment. The treatments implemented consisted of noncontingent reinforcement (NCR), NCR thinning, and DRA. The alternative response for both participants was a signed request for the reinforcer. Intervention was conducted using a reversal design. Fritz et al. found that the interventions effectively reduced problem behavior and increased the alternative response.

Using FAs, researchers have shown that problem behavior and identified precursors to the problem behavior frequently have the same function (Smith & Churchill, 2002). This finding has important implications for the treatment of severe problem behavior. When therapists conduct an FA on precursor behaviors, they can create an intervention from the results of that FA without the participant engaging in problem behavior that can put themselves and others at risk.

Further study is needed with regard to FAs of precursor behaviors. Dracobly and Smith (2012) and Fritz et al. (2013) examined designing an intervention around a functional analysis of precursor behaviors. Further studies should be designed to replicate these studies and to evaluate interventions derived from the function of precursor behavior. Lag-sequential analysis is time consuming and involves the participant engaging in the problem behavior multiple times. Fritz et al. (2013) developed a precursor assessment that is relatively brief and requires the that participant engage in the problem behavior few times. Research is needed to replicate the findings of Fritz et al. (2013).

Previous research on precursor FAs was conducted primarily with adolescents and adults (Borrero & Borrero, 2008; Dracobly & Smith, 2012; Smith & Churchill, 2002).

Fritz et al. (2013) had one three-year-old participant for whom they identified precursors through their first experiment. However, she did not participate in the precursor FA or an intervention. Replicating the research done by Fritz et al. (2013) with young children may help determine whether interventions based on the results of precursor FAs reduce problem behavior in the early childhood population. This research is important to teachers and interventionists of young children, as it may help them in working with children with severe problem behavior for whom a standard FA may not be safe, ethical, or practical.

Purpose

The purpose of the current study was to extend the current literature by implementing a precursor assessment, similar to the method used in Fritz et al. (2013), with very young children. In addition, we sought to evaluate the use of a precursor FA to determine the function of the precursor behaviors identified and then assess the effects of an intervention for problem behavior from the results of the precursor FA.

Research Questions

1. Would a precursor analysis identify precursors for problem behavior of young children in an early childhood population?
2. Would an intervention for problem behavior, based on the function of that behavior's precursor, decrease problem behavior of young children in an early childhood population?

METHODS

Participants and Settings

We sent information out to special education preschools and Up to 3 programs in the area to distribute to the parents of their students. Parents contacted us when they wanted more information about the study. We recruited four participants for the study and three of those participants completed the study. Arthur was a four-year-old boy with Autism who attended a specialized preschool for children with Autism in the mornings and a special education preschool in the afternoon. Arthur was referred to the study for aggression, in the form of hitting, throwing, biting, and scratching. Alex was a five-year-old boy with developmental delay who attended a special education preschool three times a week. Alex was referred to the study for aggression, in the form of hitting, kicking, and biting. Thomas was a three-year-old boy with developmental delay who attended a special education preschool twice a week. Thomas was referred to the study for aggression in the form of hitting and property destruction in the form of throwing.

Christopher was a two-year-old boy with developmental delay who was referred to the study for engaging in tantrums, including crying, flopping, and aggression in the form of hitting. The precursor analysis required at least 30 s of no problem behavior before each session. Christopher engaged in tantrums whenever his mother was not visible to him. To mitigate this, we had his mother act as the therapist for the precursor analysis. Due to her involvement in the precursor analysis, it would be necessary for Christopher's mother to continue acting as therapist in subsequent portions of the study in order to decrease threats to validity. During the precursor analysis, we explained to

Christopher's mom what would be required for subsequent portions of the study. She chose to withdraw Christopher from the study at that point.

For all participants, the descriptive analyses and precursor FAs were conducted in a university based behavior clinic. The observation room was equipped with a table and two chairs. Data collectors observed sessions using one-way audio-visual equipment. Interventions were conducted in the common rooms of each individual's home. The room in Arthur's home had two couches and a television. The room in Alex's home had two couches, a television, a table, and a bed. The room in Thomas's home had a couch and a chair.

Preference Assessment

We conducted brief multiple stimulus without replacement preference assessments (MSWO) as described by Carr, Nicolson, and Higbee (2000) using leisure items to determine preferred items for use in subsequent phases. We assessed preference for seven leisure items using the brief MSWO procedures. For each participant, a brief MSWO was conducted prior to the precursor analysis to identify stimuli to be used throughout the precursor analysis. Prior to the assessment, we provided participants access to each of the items for 30 s to ensure prior exposure to all items used in the assessment. The therapist then placed the seven items in an array equidistant from the participant and gave the instruction "pick one." The participant selected an item by making contact with the item with one or both hands. The therapist removed the remaining items. The participant interacted with the item for 30 s. After 30 s, the therapist said "my turn" and removed the item. The therapist then re-presented the six remaining

items in an array and gave the direction "pick one." We repeated the process until the participant had selected all items or no longer interacted with the items. This entire process was repeated three times and items were ranked as most to least preferred. If the participant attempted to select more than one item, the therapist blocked the attempt, removed the items, and re-presented the items. There were no programed consequences for problem behaviors or precursor behavior during the preference assessment. A brief MSWO was also conducted for each participant prior to the precursor FA to identify stimuli used for the precursor FA and the intervention. In the case of Thomas, a third MSWO was conducted in his home prior to the intervention. This was conducted with items from Thomas's home to identify items to be used during the intervention.

Precursor Analysis

Prior to the precursor analysis, we asked each participant's caregiver to identify the problem behavior to be targeted for intervention. The purpose of the precursor analysis was to identify precursors of the problem behaviors. We then conducted a precursor assessment similar to the one described by Fritz et al. (2013). This assessment consisted of discrete trials in which antecedent conditions that may serve as establishing operations (EOs) for the target behavior were presented. Trials were videotaped for subsequent data collection. Trials lasted 5 min or less and resembled the attention, tangible, and demand conditions of a functional analysis (FA). Consequences were provided contingent on problem behavior. Trials were terminated immediately after a consequence was delivered or after 5 min, whichever came first. The next trial began only when the participant had not engaged in the target behavior for 30 s. The precursor

assessment was complete after 10 trials in which the target behavior occurred. If the first ten trials of the precursor analysis included problem behavior, play trials were conducted until the total duration of trials without problem behavior equaled or was greater than the total duration of trials with problem behavior. The play trials consisted of free access to highly preferred items, attention at least every 30 s, and no demands or instructions. For Arthur and Thomas, their mothers participated in the last two trials of the precursor analysis. Following at least 10 sessions without problem behavior we opted to include their mothers in assessment trials to decrease unnecessary time in assessment and to increase the likelihood that problem behavior would occur (given participant history of problem behavior in the presence of their mothers).

Sessions were videotaped and scored later by trained observers. When the precursor assessment was complete, two independent observers watched the videos of the trials in which problem behavior occurred, recorded the topographies of precursor behaviors observed, and operationally defined each precursor behavior. Observers then recorded topographies in the same manner as Frtiz et al. (2013), grouping responses as follows; (a) vocalizations, (b) facial expressions, (c) postures, (d) repetitive motor movements, (e) locomotion, (f) object manipulation, and (g) other problem behaviors. Examples were given of response topographies in each category and space provided for the observers to record additional behaviors. The observers watched all the trials and marked occurrences of potential precursors and occurrences of problem behavior. The observers collected data separately and then met to compare. If there was disagreement, the observers re-watched the sessions and re-coded the data. Data collection was complete when observers reached 100% IOA. These data were used to calculate the

probability of the target behavior given each potential precursor, compared to the probability of the problem behavior given the absence of precursor behaviors and the unconditional probability of the problem behavior. The probability of each precursor, given the problem behavior, was then compared to the probability of each precursor given the absence of the problem behavior, and the unconditional probability of each precursor. Behavior was identified as precursor behavior if (a) the probability of the problem behavior given the precursor was higher than the probability of the problem behavior given the absence of the precursor behavior and the unconditional probability of the problem behavior and (b) the probability of the precursor behavior given the problem behavior was higher than the probability of the precursor given the absence of the problem behavior and the unconditional probability of the precursor behavior.

Functional Analysis of Precursor Behaviors

Previous studies (Borrero & Borrero, 2008; Smith & Churchill, 2002; Fritz et al., 2013) have shown that problem behaviors and precursors to problem behaviors are part of the same response class. Based upon this previous literature, an FA was not conducted on both problem behavior and precursor behaviors. A precursor FA was conducted on the precursor behavior of each participant. This was done to minimize the risk that participants would engage in problem behavior.

The precursor FA was conducted using procedures described in Dracobly and Smith (2012). Cycles of 10 min *attention, demand, tangible,* and *play* sessions were conducted in a multi-element format. Throughout the precursor FA, there were no programmed consequences for problem behavior.

Inter Observer Agreement (IOA) was collected for at least 30% of sessions for each participant. For Arthur, IOA was 97% ranging from 88% to 100%. For Alex, IOA was 95% ranging from 91% to 99%. IOA for Thomas was 96%, ranging from 87% to 100%.

Intervention

The purpose of the intervention phase was to examine if the results of the precursor FA could be used to develop an intervention that would reduce precursor and problem behavior. Interventions for all participants were compared to baseline conditions using a reversal design (Cooper, Heron, & Heward, 2007) to demonstrate experimental control and the effectiveness of the intervention. Each participant's intervention was developed individually based on the results of the participant's precursor FA and input from caregivers. Sessions included highly preferred tangible items identified in previous preference assessment (Arthur and Thomas) and instructional materials used in the precursor FA (Alex).

Baseline

For all participants, baseline sessions were 10 min in duration. For Arthur and Thomas, sessions were similar to the tangible condition of the precursor FA. Before each session, participants were given access to their highly preferred item for at least 2 min. When the session began, the therapist removed the item, turned away from the participant, and interacted with the item. If the participant engaged in any of the precursor behaviors identified by the precursor analysis, the therapist provided the preferred item

and attention for 30 s. After 30 s, the therapist removed the item and turned away again. There were no programmed consequences for problem behavior or the alternative behavior as defined.

For Alex, baseline procedures were similar to the demand condition of the precursor FA. During sessions, the therapist provided continuous instructions using a three-step least-to-most prompting procedure to ensure that Alex did not escape instructional demands. At the beginning of the session, the therapist provided an instruction to Alex. If Alex complied with the instruction within 3 to 5 s, the therapist provided neutral praise and presented another instruction. If Alex did not comply with the instruction, the therapist re-presented the instruction with a model prompt. If Alex complied with the model prompt, the therapist provided neutral praise and provided a new instruction. If Alex did not comply with the model prompt, the therapist re-presented the instruction again while using a full physical prompt to guide compliance to the instruction. If Alex engaged in precursor behavior, the therapist would turn away and he was given a 30-s break from instructions. There were no programmed consequences for problem behavior.

For all participants, criteria for moving from baseline sessions to intervention implementation included three components: (1) at least three baseline sessions with rates of precursor behavior remaining stable or showing an increasing trend, (2) rates of alternative behavior and aggression at or near zero, and (3) rates of alternative behavior not showing an increasing trend. For Alex we included the additional criterion of decreasing compliance during baseline sessions.

Intervention

For all participants we implemented a differential reinforcement of alternative behavior (DRA) intervention using individualized procedures. Sessions were 10 min in duration and included the therapist prompting participants to engage in an alternative response. When participants engaged in either independent or prompted alternative responses, they were provided the functional reinforcer for 30 s. There were no programed consequences for precursor or problem behavior. For all participants, the criteria for reversing to baseline conditions were: (1) three consecutive sessions including 80% or more reduction of precursor behavior from baseline levels, (2) problem behavior occurring at levels less than the precursor behaviors, (3) and more than 50% of the alternative responses were independent.

Following reversal to baseline conditions, we remained in baseline until precursor behavior returned rates similar to initial baseline with little to no instances of the alternative behavior. We then reversed conditions and implemented intervention procedures again. We implemented prompt-delays and prompt fading criteria per participant as described below. We completed the intervention when 50% or more of the alternative responses were independent, there was an 80% or more decrease in the precursor behaviors, and there were fewer instances of problem behavior than precursor behaviors. For each participant, individualized alternative responses and prompting methods are described below.

Arthur. We provided Arthur with at least 2 min access to the preferred item before sessions began. Sessions began with the therapist removing the preferred item. For the first session, Arthur was immediately prompted using a verbal prompt to engage in

the alternative response (e.g., “iPad please”) upon the removal of the preferred item. Starting in the second session, the prompt-delay was increased by 5 s (e.g., 5, 10, 15, 20 s, etc.). The criteria for increasing the prompt-delay were occurrence of more independent alternative responses than prompted alternative responses, and rates of precursor and problem behavior at or below rates from the previous session.

Alex. Sessions began with the therapist presenting Alex with an instruction. The alternative response for Alex was complying with instructions. Similar to baseline sessions, if he did not comply with the instruction, the therapist followed the three-step least-to-most prompting procedure described above to teach Alex to comply with instructions. If Alex complied with the instruction, he was given a 30 s break from instructions.

Thomas. We provided Thomas with at least 2 min access to the preferred item before the session began. When the session began, the item was removed and the therapist used an immediate full physical prompt to guide Thomas to engage in the alternative behavior (e.g. signing PLEASE). Starting with the second session, the prompt-delay increased by 5 s (e.g., 5, 10, 15, 20 s, etc.). Due to increasing instances of precursor and problem behavior, the intervention was modified to include both a prompt-delay and a systematic decrease in the intensity of the prompt. This procedure began with a full physical prompt immediately after the preferred item was removed. Next, we moved to a model prompt delivered 3 s after the preferred item was removed. Then a verbal prompt 5 s after the preferred item was removed. The criteria to fade prompts and increase the prompt-delay were more independent alternative responses than prompted alternative

responses and rates of precursor and problem behavior at or below rates from the previous session.

We assessed IOA and treatment integrity by having a second observer independently take data for at least 30% of sessions for each participant. We calculated percentages by comparing the recorded frequencies for the two observers for all responses in each 10 min session. We divided the smaller number of responses by the larger number of responses in each session and multiplied the result by 100 to get a percent. Mean IOA for Arthur was 95% ranging from 71% to 100%. IOA for Alex was 95% ranging from 86% to 100%. Agreement for Thomas was 96% ranging from 90% to 100%. Treatment integrity for all participants was 100%.

RESULTS

Preference Assessment

Graphs of the results for each participant are shown in the appendix. We conducted multiple MSWOs throughout the study to account for change in preference. We conducted a MSWO before the precursor analysis and precursor FA for each individual. Due to unavailability of some items, we conducted a third MSWO for Thomas in his home before the intervention. Figure 1, page 38, depicts the results of the MSWOs. Items ranked one and two were selected as highly preferred items. Items ranked three and four were selected as the moderately preferred items.

For the MSWO prior to the precursor analysis, Arthur's highest preferred items were the iPad and the fidget toys. His moderately preferred items were the frogs and snakes and the puzzle. For the MSWO prior to the precursor FA, his highest preferred items the iPad and the toy car. His moderately preferred items were the snakes and frogs and the puppet.

The data for Alex's first MSWO show that his highest preferred items were the cars and coloring book and his moderately preferred items were the snakes and puppets. The second MSWO showed that Alex's highest preferred items from this assessment were the iPad and the coloring book. We used only the iPad during the precursor FA and the intervention because when Alex had access to the iPad he did not interact with any other items. His moderately preferred items were the snakes and the cars.

The MSWO prior to Thomas's precursor analysis showed that his highly preferred items were cars and Spiderman and his moderately preferred items were Buzz

Lightyear and the snakes. The MSWO prior to the precursor FA showed that Thomas's highest preferred items were the cars and the fidgets. His moderately preferred items were the snakes and the coloring books. We completed a third MSWO at Thomas's home prior to the intervention. From this MSWO, we identified the iPad as the high-preferred item and the car tower and cars as moderately preferred items. For Christopher, we completed an MSWO prior to his precursor analysis. This MSWO showed that his highly preferred items were the cars and snakes and his moderately preferred items were the puzzle and coloring book.

Precursor Analysis

The precursor analysis was completed for Arthur, Alex, and Thomas. The precursor analysis was initiated with Christopher, but was not completed for reasons detailed above. To determine the probabilities of the problem behavior and the precursor behavior, ten instances of the problem behavior needed to be observed. Because Christopher's precursor analysis was ended prematurely, probabilities cannot be calculated and reported.

Figure 2, page 39, depicts the results of the precursor analysis for Arthur, Alex, and Thomas. The top graph for each individual shows the conditional probabilities of the problem behavior. The bottom graph for each individual shows the conditional probabilities of each precursor behavior. The data show that all three participants engaged in precursor behaviors. Whine, glare, and chew fingers were identified as precursors for Arthur. Crumpling materials, swiping materials, stacking materials, feet tapping, and facial expression were identified as precursor behaviors for Alex. Happy

face, object manipulation, yelling, rocking, sad face, jumping, SIB, pointing, and pushing were all identified as precursors for Thomas.

Precursor Functional Analysis

Figure 3, page 40, shows the results of Arthur, Alex, and Thomas's precursor FAs. During the precursor FA, consequences were delivered contingent on the precursors. The top graph for each individual shows the rate of precursors during each condition. Though no programed consequences were given if the participant engaged in the problem behavior, data were collected to track the occurrence of problem behaviors during the precursor FA. The bottom graph for each participant depicts the rate of problem behavior during each condition.

For Arthur, precursors were maintained by both attention from the therapist and access to tangibles. Arthur did not engage in aggression during the precursor FA. Data shows that Alex's precursors were multiply maintained by escape from demands, attention from the therapist, and access to tangibles. Thomas's precursor FA indicates that his precursor behaviors were maintained by escape from demands, access to tangibles, and access to attention from the therapist. For both Alex and Thomas, problem behavior occurred, to some degree, during the precursor FA. This may be due to adventitious reinforcement. Though there were no programed consequences for problem behavior during the precursor FA, problem behavior may have contacted reinforcement if it occurred as the therapist was providing reinforcement for the precursor behaviors, resulting in increased levels of problem behavior.

Intervention

Figures 4 through 6 depict the interventions for each individual. Results from Arthur's precursor FA, depicted in Figure 4 on page 41, show that his precursors were maintained by access to tangibles and attention from the therapist. The alternative behavior for Arthur was any appropriate request for the iPad. Most commonly, this was the verbal request "iPad please," but also included "please," "want iPad," and "I want the iPad." We selected this because it was already in Arthur's repertoire. When Arthur engaged in the alternative behavior, prompted or independent, he was given 30 s access to the iPad and attention from the therapist. The results of Arthur's intervention show a reduction in precursor behaviors and problem behavior to zero. Independent alternative behavior was stable at 1.8 instances per minute.

The precursor FA for Alex showed that his precursor behaviors were multiply maintained by escape from demands, attention from therapist, and access to tangibles. Alex's parents reported that escaping instructions was the most significant function for them at home and for Alex at school. Therefore, the intervention developed for Alex addressed the escape from demand function of the precursor behavior. Alex was provided with a 30 s break from demands when he independently complied with the demand presented to him. Figure 5, page 41, depicts the intervention implemented for Alex. We graphed aggression and precursor behaviors as rate of behavior. Compliance was graphed as percent of opportunities because compliance is opportunity bound. The high percentage of compliance in baseline conditions may be due to Alex complying with one to two instructions before engaging in precursor behaviors. This may have been because

the EO to escape from demands might not have existed until after multiple demands were placed. Alex's intervention was effective in reducing both problem behavior and precursor behaviors to zero.

The results of Thomas's precursor FA show that his precursors are multiply maintained by escape from demands, access to tangibles, and access to attention from the therapist. His parents reported that they were most concerned about his engaging in the problem and precursor behaviors to access items. Thomas's intervention was developed to help him appropriately request an item. The alternative response of signing PLEASE was selected because his parents reported that he had been previously taught it and it is how they would like him to request. As intervention began, Thomas would independently say "please" vocally. Both the signing of PLEASE and saying "please" were counted as an appropriate request. Thomas's intervention first consisted of a full physical prompt presented on a time delay. In sessions five through seven, during the 5 s before the full physical prompt, Thomas engaged in precursor behaviors and aggression until the prompt was provided and he was given access to the iPad. At session eight, we modified the intervention to include a time delay and a decrease in prompt intensity. We began with an immediate full physical prompt, and then went to a model prompt after 3 s, and then a verbal prompt after 5 s. The modified intervention reduced precursor behaviors and problem behaviors to zero. The alternative behavior was stable at 1.7 instances per minute.

It is also important to note that Thomas's mother informed us that he began taking a medication for his aggression at session 13, indicated by the asterisk on the graph in Figure 6 on page 42. At session 13, the data show a significant increase in independent

requests and a significant decrease in precursor behaviors. This may be due to the medication change. However, the reverse to baseline shows an increase in precursors to near initial baseline levels and a decrease in independent requests to zero. The subsequent return to intervention from baseline resulted in an increase in independent requests and a decrease in precursor behaviors demonstrating an effective treatment.

DISCUSSION

In this study, we demonstrated that descriptive analyses could identify precursor behaviors in young children. We also demonstrated that an effective treatment for problem behavior could be designed and conducted based on the results of the precursor FA. For all participants, identifying precursor behaviors, conducting a precursor FA, and implementing an intervention were all done with few instances of problem behavior.

A limitation to this study may be that, for three participants, their mothers had to participate in all (Christopher) or part (Arthur and Thomas) of the precursor analysis. Furthermore, Christopher's mother would have had to be involved in the precursor FA and the intervention had he remained in the study. In many cases, it would not be possible for a caregiver to participate in some or all of the precursor analysis. However, it may be possible that caregiver involvement could produce less time in assessment or better treatment adherence. Future research should look at the effects caregiver involvement has on time in assessment, treatment fidelity, adherence to treatment, and latency to skill acquisition.

Another limitation to the precursor analysis is the length of time required for assessment. Arthur and Thomas spent more than 50% of the precursor analysis in sessions not containing problem behavior. In the case of Thomas, the precursor analysis spanned 44 sessions across five days. Caregivers and teachers may be less likely to conduct the precursor analysis, as conducted in this study, as it may be a lengthy process. Future research might look at modifying the precursor analysis to reduce the time in assessment. Future researchers could explore recording the participant in their natural

environment as a possible way to capture the needed instances of problem behavior in less time. Further research could also investigate methods that could be used to train caregivers and teachers to conduct the precursor analysis, precursor FA, and intervention. This could avoid reactivity to therapists and may be more relevant as the common EOs will be in place. This may also make the procedures more accessible and increase validity of implementation.

A limitation to the precursor FA is the nature of the precursors identified by the precursor analysis. Though there were clear definitions of the precursor behaviors, data collectors found it difficult to record all of the precursor behaviors throughout the sessions. All three individuals who participated in the precursor FA engaged in at least one facial expression precursor (e.g., Arthur's glare, Thomas's happy face). If the participant was turned away from the data collectors or the therapist, these precursors may have been missed. This may have resulted in the therapist not responding to all instances of precursor behaviors and fewer recorded instances of precursors than actually occurred. Researchers could avoid this if they removed difficult to observe behaviors, such as facial expressions, from the list of precursor behaviors they react to and take data on. Future research could compare precursor FAs conducted on all identified precursors to precursor FAs conducted on one selected precursor behavior. This may make data collection easier, increase validity of the precursor FA, and decrease the time in assessment.

The results of the precursor analysis identified multiple precursor behaviors for all three participants who completed the precursor analysis. This demonstrates that a precursor analysis can be used with young children to determine precursors to problem

behavior. The precursor FAs for the three participants indicated the maintaining functions of the identified precursors. For Arthur, zero rates of problem behavior occurred and for both Alex and Thomas, lower levels of problem behavior than precursor behavior occurred during the precursor FA, thus limiting the risks associated with the problem behavior. An intervention was implemented for each individual based on the results of the precursor FA. All three interventions resulted in a decrease to zero of both precursor and problem behaviors. Interventions for all participants successfully taught an alternative behavior.

This study demonstrates that assessment and intervention of precursor behavior can be completed with the participant engaging in few instances of problem behavior, and reduction of the problem behavior. Given that the participants engaged in few instances of problem behavior, the assessment and intervention process implemented in this study might be used when working with children who engage in severe or dangerous problem behavior. If a participant engages in severe, harmful, or dangerous behavior, it may be unethical to conduct an FA in which the problem behavior will occur if behavior analysts cannot provide appropriate safeguards. Descriptive analyses, precursor FAs, and precursor-based interventions can help teachers and interventionists develop an intervention to reduce problem behavior and increase alternative behaviors in situations where it is unsafe, or unadvisable, to allow the participant to engage in the problem behavior. Caregivers and teachers of children with severe problem behavior may also be more likely to allow a precursor FA to be conducted rather than a standard FA. Future research should assess social validity of descriptive analyses and precursor FAs.

In summary, the current study demonstrates a method to identify precursors, assess the function of the precursors, and complete a treatment for problem behavior in young children. We identified multiple functions for the precursors using a precursor FA and were able to reduce problem behavior while minimizing the risks to the participants.

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Appendix

Figures

Figures

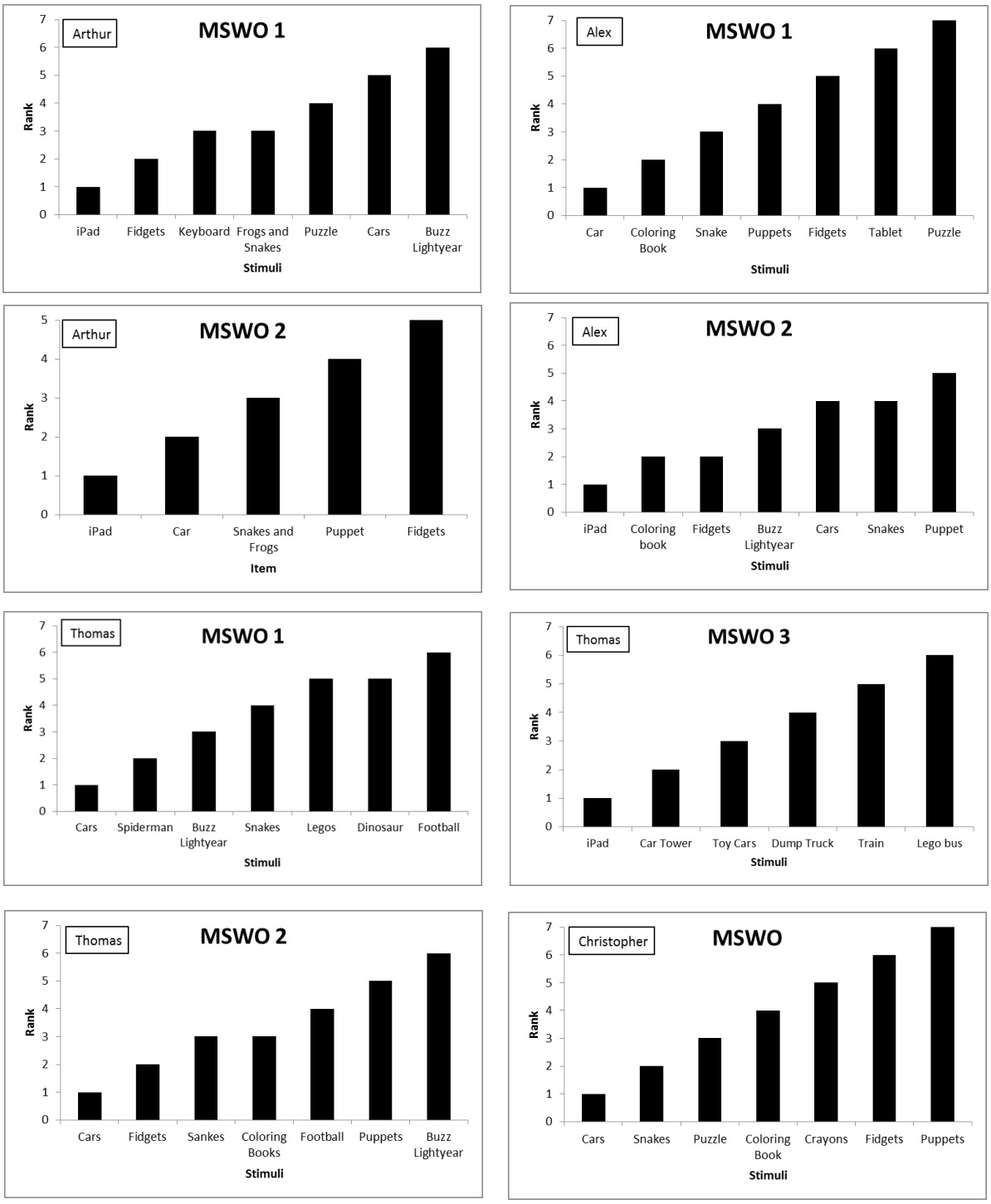

Figure 1. Preference assessment. The bars indicate the rank of each item selected during the brief multiple stimuli without replacement preference assessment.

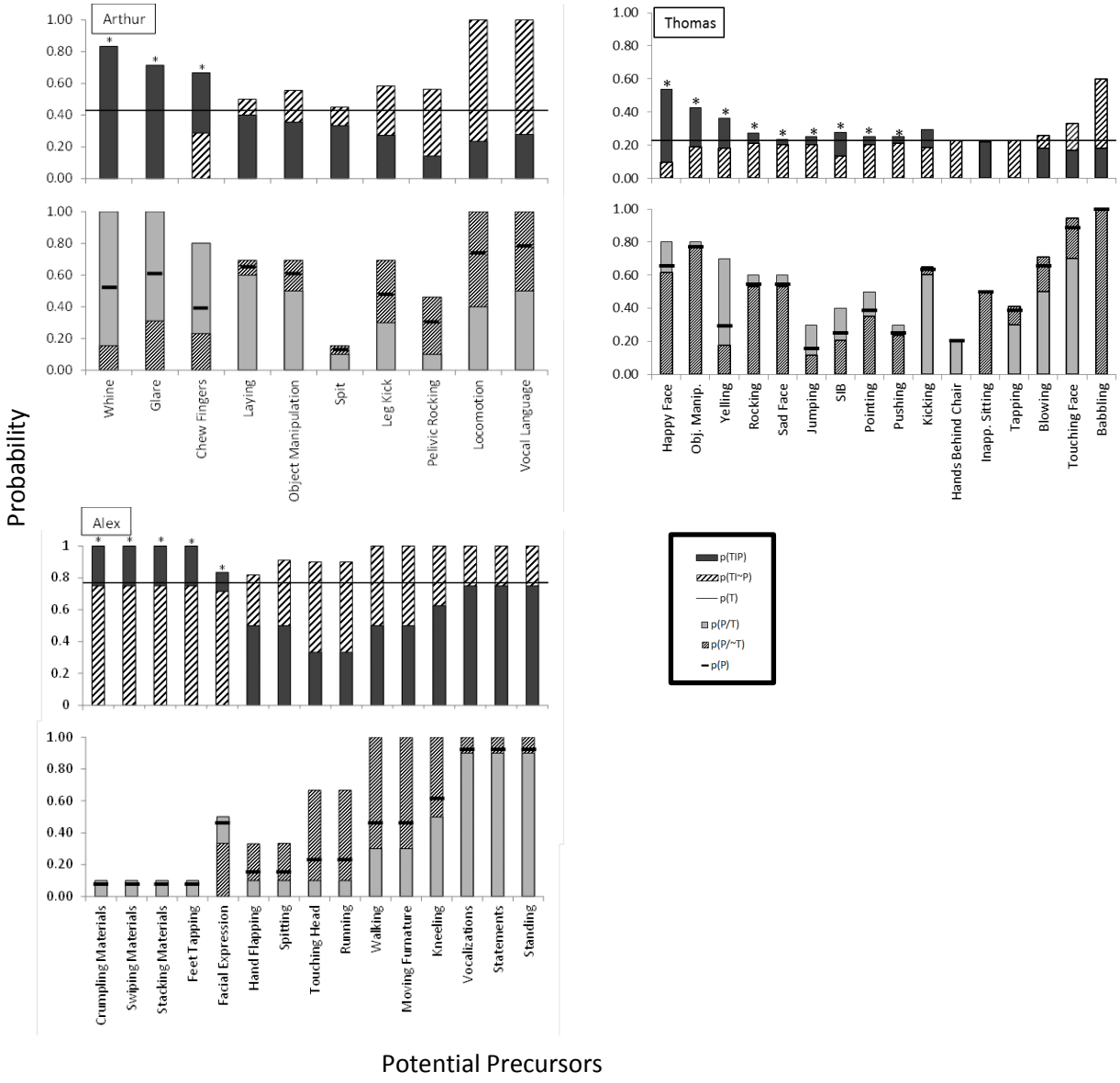

Figure 2. Results of the precursor analysis. The top graph for each depicts the probabilities for problem behavior. The bottom graph for each depicts the probabilities for precursor behavior. The asterisks indicate the identified precursors. p(T/P) = the probability of the problem behavior given the precursor behavior. p(T/~P) = the probability of the problem behavior given the absence of the precursor behavior. p(T) = the unconditional probability of the problem behavior. p(P/T) = the probability of the precursor given the problem behavior. p(P/~T) = the probability of the precursor given the absence of the problem behavior. p(P) = the unconditional probability of each precursor behavior.

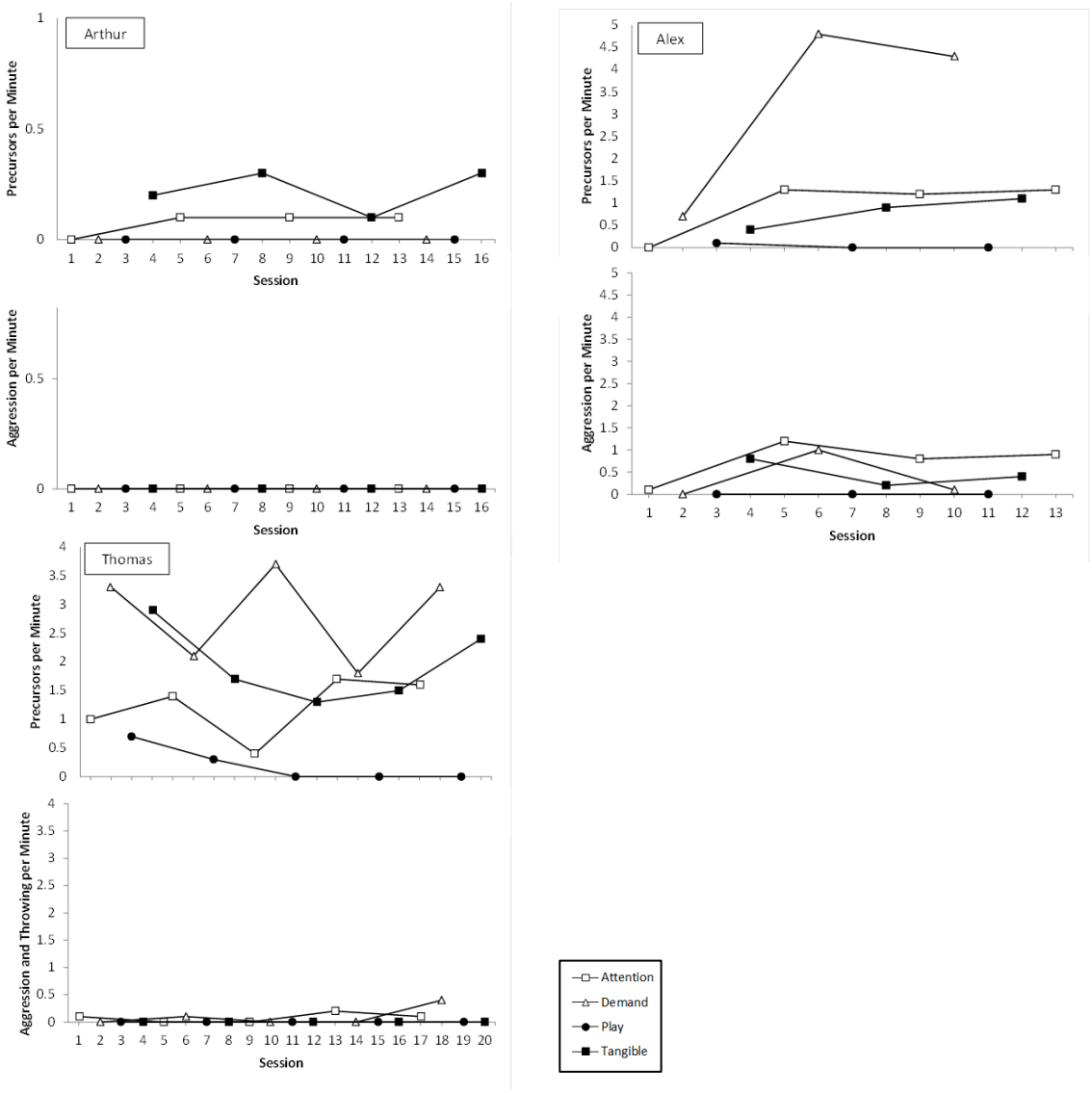

Figure 3. Precursor FA. For each individual, the top graph depicts the rate of precursors per minute and the bottom graph depicts the rate of problem behavior per minute. Each data path represents one condition of the precursor FA. The attention, demand, and tangible conditions are compared to the play condition.

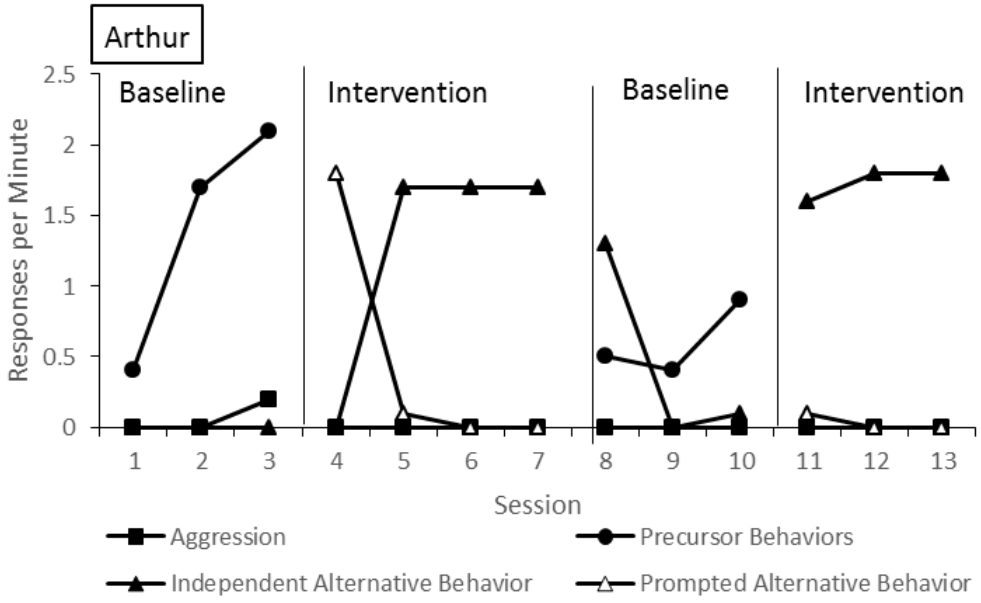

Figure 4. Intervention for Arthur. Aggression, precursor behaviors, independent alternative behavior, and prompted alternative behavior are all shown as rate of behavior.

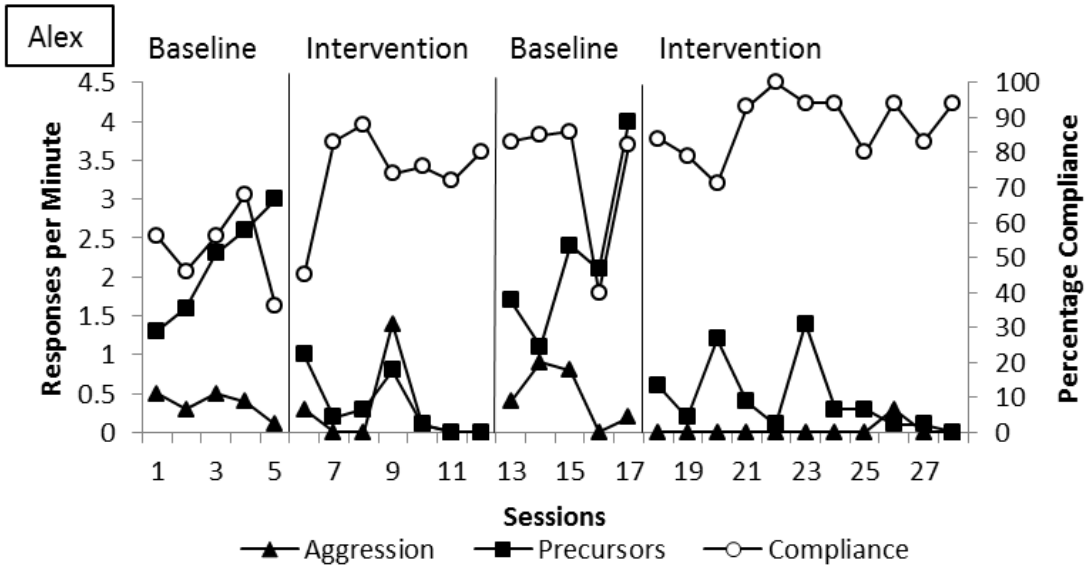

Figure 5. Intervention for Alex. Aggression and precursors are shown as rate. Compliance is shown as a percentage of opportunities and graphed on the right y-axis.

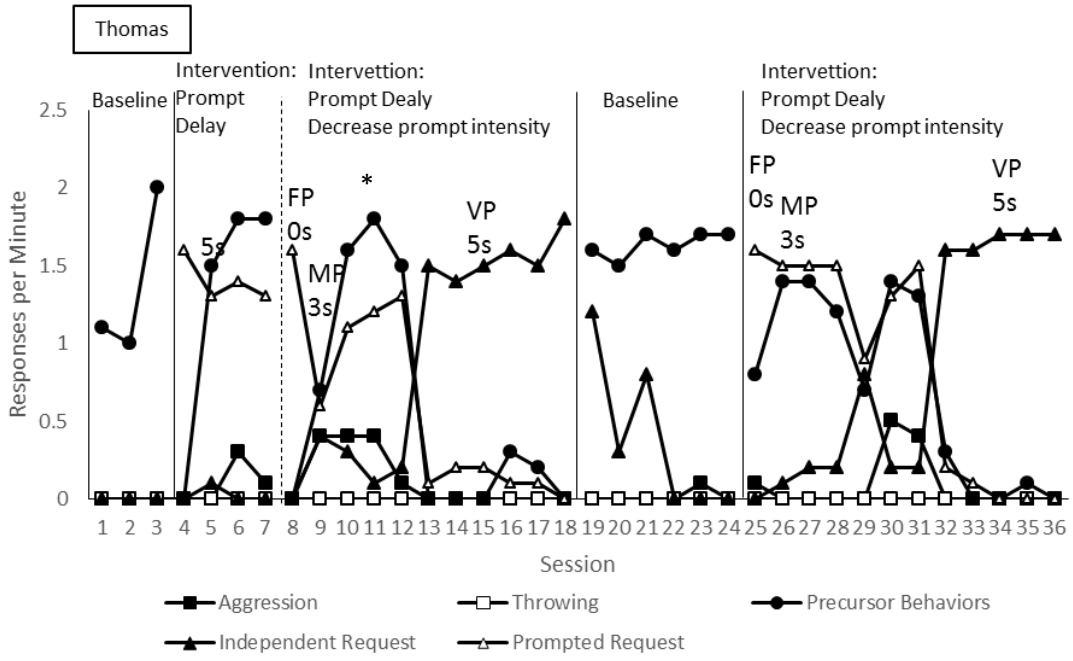

Figure 6. Intervention for Thomas. Aggression, throwing, precursor behaviors, independent request, and prompted request are all shown as rate of behavior. Prompt intensity is indicated on the graph at FP for full physical, MP for model prompt, and VP for verbal prompt. The time delay is indicated on the graph by the number of seconds before the prompt was given. The asterisk indicates the shift we were informed of a medication change.