AN EVALUATION OF ITEM PREFERENCE FOR INCREASING SELF-CONTROL IN TYPICALLY DEVELOPING PRESCHOOL CHILDREN

By

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Abstract

Children sometimes have a difficult time waiting for preferred items and make impulsive choices (i.e., choosing a smaller but immediate reinforcer over a larger but delayed reinforcer). Previous research has shown that in the absence of delay fading, providing access to leisure items and activities during the delay period is effective for increasing self-control (i.e., choosing a larger but delayed reinforcer over a smaller but immediate reinforcer) in young children (e.g., Newquist, Dozier, Neidert, 2012). The purpose of the current study was to compare the effectiveness of delivering low-, moderate-, and high-preferred toys during the delay period on self-control. Results were idiosyncratic across participants in that (a) for two participants, all items (regardless of preference level) were effective for increasing self-control, even when the toys were also provided when the participant made the smaller, immediate reinforcer choice and (b) for three participants, only high-preferred items were effective for increasing self-control and only when the items were not also delivered for making the smaller, immediate reinforcer choice.

Keywords: self-control, delay, preference, reinforcement, toys, children

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An Evaluation of Item Preference for Increasing Self-Control in Typically Developing Preschool Children

Previous research has suggested that reinforcers should be provided immediately to increase and maintain responding (e.g., Dews, 1960; Lattal, 1987; Skinner, 1953); however, there are many situations that do not allow for immediate delivery such that reinforcement is delayed. Research on delayed reinforcement has shown that some individuals (e.g., children, individuals with attention-deficit-hyperactivity disorder) have difficulty tolerating delays for reinforcers. Thus, impulsivity (i.e., choosing a small, immediate reinforcer over a large, delayed reinforcer) rather than self-control (i.e., choosing a large, delayed reinforcer over a small, immediate reinforcer) is sometimes observed. For example, a child might choose to receive one small edible immediately rather than wait for a short period of time for four small edibles.

Teaching self-control (i.e., delay tolerance) is important for young children for many different reasons. First, there are many situations throughout the day in which children may not be able to gain access to certain items or activities immediately. For example, a child must wait for their snack to be prepared in order to eat or wait for a high-preferred activity (e.g., recess) at school. These delays to high-preferred items or activities may create deprivation periods for children in which problem behavior may increase until reinforcement is delivered (Fisher, Thompson, Hagopian, Bowman, & Krug, 2000). Second, self-control typically results in access to higher preferred items and activities (e.g., Hanley, Heal, Tiger, & Ingvarsson, 2007). For example, a child may interrupt or yell while a caregiver is on the telephone to gain access to a small amount of attention; however, if the child waits for the caregiver to finish the phone call, he or she may gain access to longer and possible qualitatively better attention from the caregiver. Third, self-control has been shown to be positively correlated with important coping, social, and

academic skills later in life (Mischel & Metzner, 1962; Mischel, Shoda, & Peake, 1988). For example, Mischel et al. (1988) conducted a longitudinal study that found a significant correlation between the time in which preschoolers would wait for a preferred outcome and their levels of verbal fluency, reasoning skills, competence, self-reliance, and concern for others 10 years later. Fourth, impulsive behavior has been positively correlated with obesity (e.g., Epstein, Salvy, Carr, Dearing, & Bickel, 2010) and the maladaptive use of drugs and alcohol (e.g. Petry, 2001; Woolverton, Myerson, & Green, 2007) in which individuals will forgo a delayed reinforcer (e.g., health, employment, money, and family) in exchange for an immediate reinforcer (e.g., cocaine, marijuana, alcohol, and fast food). Thus, it is of utmost importance for children to learn behaviors that result in self-controlled responding early in life.

Previous research has evaluated and attempted to enhance self-control in adults (e.g., Dixon & Falcomata, 2004; Dixon, Rehfeldt, & Randich, 2003), children (e.g., Mischel, Ebbesen, & Zeiss, 1972; Mischel, Shoda, & Peake, 1988), and nonhumans (e.g., Ferster, 1953; Grosch & Neuringer, 1981; Ito & Oyama, 1996). In addition, studies have been conducted on self-control in those with (e.g., Dixon & Cummings, 2001; Fisher et al., 2000) and without disabilities (e.g., Mischel & Ebbesen, 1970; Newquist, Dozier, Neidert, 2012). Research on self-control and impulsivity has shown that various procedures may be implemented to enhance self-control (see discussion below). In addition, research has shown that several additional variables may influence self-control including the (a) presence of the reinforcer, (b) length of the delay, and (c) presence of signals. That is, the presence of reinforcers (i.e., in sight of the participant) has been shown to inhibit self-control, whereas the absence of reinforcers (i.e., out of sight of the participant) enhance self-control for both children and pigeons (e.g., Grosch & Neuringer, 1981; Mischel & Ebbesen, 1970). In addition, the length of the delay has been shown to be negatively

associated with self-control (e.g., Davison & McCarthy, 1988). That is, when the delay to the large reinforcer is relatively short (more immediate), responses are typically allocated to the large reinforcer, whereas with longer delays, responses are typically allocated to the small reinforcer (e.g., Ito & Oyama, 1996; Mazur, 1987). Finally, research has demonstrated that self-control is enhanced when delays are signaled (e.g., a countdown timer) rather than unsignaled (e.g., Ferster, 1953; Lattal, 1984; Schaal & Branch, 1988; Vollmer, Borrero, Lalli, & Daniel, 1999).

Several procedures for increasing self-control have been evaluated in both basic and applied research. A common procedure that has been shown to be effective for increasing self-control is delay fading (e.g., Ferster, 1953; Fisher et al., 2000; Schweitzer & Sulzer-Azaroff, 1988). Delay fading involves systematically increasing the delay to the large, delayed reinforcer using small increments of time. For example, Ferster (1953) demonstrated that in the absence of an intervention, fixed delays decreased a key-pecking response in pigeons to one sixth of the pigeon's original pecking rate. However, when the delay to the large reinforcer was increased systematically from 1 s to 60 s (delay fading), the pigeons maintained responding at high rates. Thus, delay fading was effective for enhancing self-control and maintaining responding for the pigeons. In addition, Schweitzer and Sulzer-Azaroff (1988) implemented delay fading with children by gradually increasing the delay to the large reinforcer by 5-s increments. That is, once the children were consistently choosing the large reinforcer over the small reinforcer, the delay to the large reinforcer was gradually increased. Results showed that four out of five children continued to respond for the large reinforcer when delays were faded up to 35 s.

Delay fading has also been combined with other procedures to increase self-control. These procedures include providing an alternative activity during the delay period (e.g., Binder,

Dixon, Ghezzi, 2000; Dixon & Cummings, 2001; Dixon et al., 1998) and using signals to denote the delay (e.g., Vollmer et al., 1999). Dixon and Cummings (2001) combined delay fading with a work activity (card-matching task) during the delay period. The experimenter presented three options to the participants: (a) a small, immediate item, (b) a large, delayed item with a work requirement during the delay, and (c) a large, delayed item without a work requirement during the delay. If the child selected the small, immediate option, the item was delivered immediately. If the child selected the large, delayed option without the work requirement, the child was required to wait the delay period for the large reinforcer. If the child selected the large, delayed option with the work requirement, the child was required to fulfill the work requirement during the delay period before the large reinforcer was delivered. Results showed an increase in self-control for all children. In addition, the children preferred the condition in which the work activity was implemented during the delay. Furthermore, results showed increased levels of problem behavior during the delays in which there was no work activity provided.

As mentioned above, delay fading has also been combined with signals (e.g., Vollmer et al., 1999). Vollmer et al. (1999) combined delay fading with a countdown timer during the delay to increase self-control for two boys with intellectual and developmental disabilities. The experimenters found that when the delays were signaled, the participants engaged in more self-control and less problem behavior as compared to when delays were unsignaled. Other signals have also been used in combination with delay fading such as rules (e.g., Benedict & Dixon, 2009; Binder, Dixon, & Ghezzi, 2000). Furthermore, basic research has demonstrated that self-control in pigeons can be increased and maintained through the use of brief signals (e.g., key light changes) during delays (Schaal & Branch, 1988; Schaal, Schuh, & Branch, 1992).

Although delay fading with and without additional procedures has been shown to be effective for increasing self-control, it is important to determine procedures that are effective for increasing self-control in the absence of delay fading to increase the efficiency and efficacy of intervention. Delay fading can be a lengthy procedure to implement. For example, Binder et al. (2000) used delay fading combined with a verbal activity (repeating a rule and naming pictures) to increase self-control in three children with attention deficit hyperactivity disorder. For one participant, the delay was increased from 17 s to 51 s by increments of 2 to 3 s every two sessions. This procedure required 38 training sessions for the child to meet the required delay length (51 s), which is a fair amount of sessions. If the delay had been extended to 10 min, it would roughly take 752 training sessions, which may not be practical. Thus, it is important to evaluate procedures in the absence of delay fading that may enhance self-control more rapidly with fewer sessions required.

One procedure that has been shown to be effective for increasing self-control in the absence of delay fading is providing a rule before or during delays (e.g., Hanley et al., 2007; Toner & Smith, 1977). For example, Hanley et al. (2007) demonstrated that a class of preschool children could be taught self-control by repeating a simple rule (i.e., "When I wait, I get what I want.") during delays. For example, when a child encountered a difficult situation in which he or she wanted another child's toy, he or she was prompted by a teacher to say, "When I wait, I get what I want." This rule not only increased self-control when delays were initiated by both teachers and peers but also decreased problem behavior during delay periods for children in the preschool classroom.

Another procedure that has been used for increasing self-control in the absence of delay fading involves providing an alternate activity during the delay period (e.g., Anderson, 1978;

Grosch & Neuringer, 1981; Ito & Oyama, 1996; Mischel et al., 1972; Newquist et al., 2012). For example, Mischel et al. (1972) compared mean waiting times of two groups of children. One group did not have access to an alternative activity, whereas the other group did have access to an alternative activity (i.e., slinky) during the delay. The mean waiting time for children in the alternative-activity group was eight times that of the children in the group with no alternative activity. Furthermore, Grosch and Neuringer (1981) demonstrated that by providing an alternative response key (disc in the rear of the chamber), pigeons allocated responding toward the large, delayed reinforcer rather than the small, immediate reinforcer. When the alternative response key was not available, the pigeons tolerated delays for less than 5% of all trials, rarely obtaining the preferred reinforcer; however, when the alternative response key was available, the pigeons tolerated delays on up 78% of the trials.

In a recent study, Newquist et al. (2012) compared the effects of different interventions commonly used to increase participants' self-control in the absence of delay fading (i.e., a countdown timer during the delay period, child or experimenter rule prior to the delay period, and access to high-preferred toys during the delay period). The experimenters measured self-control by measuring the frequency of selection for a large but delayed reinforcer as compared to the frequency of selection for a small but immediate reinforcer in typically developing children. During each trial, the experimenter presented the child with three different choice options. One plate contained *four* identical high-preferred edible items (large reinforcer), a second plate contained *one* high-preferred edible item (small reinforcer), and a third plate contained *no* edible item (control). Once the child selected a plate, the intervention associated with the condition was applied. The different conditions consisted of a combination of experimenter rule, a timer, child rule, and toy play depending on the condition. During the experimenter-rule condition, choosing

the large reinforcer resulted in the experimenter saying, “When you wait, you get four pieces” to the participant. During the timer condition, choosing the large reinforcer resulted in the experimenter saying, “When you wait, you get four pieces” to the participant and starting a countdown timer that was placed in front of the participant. During the child-rule condition, choosing the large reinforcer resulted in the child saying, “When I wait, I get four pieces.” During the toy-play condition, choosing the large reinforcer resulted in the child saying, “When I wait, I get four pieces,” and the experimenter delivering preferred toys to the participant during the delay. Results showed that the only intervention that successfully promoted selection of the large, delayed reinforcer was providing high-preferred toys during the delay period.

Although the results of the Newquist et al. (2012) have clinical utility in that they suggest that highly preferred items or activities could be presented during delays to increase self-control in young children, there are several limitations of this study that should be addressed in future research. First, there are methodological limitations that preclude determination of the mechanism by which access to high-preferred toys during the delay resulted in increases in self-control responding. That is, the procedures used involved delivery of high-preferred items only if the child chose the large, delayed reinforcer. Thus, it is possible that children were choosing the large, delayed reinforcer because (a) the high-preferred toys were more preferred than the edibles or (b) a combination of both edibles and high-preferred toys resulted in a larger magnitude of reinforcement. Newquist et al. attempted to answer the question of whether the high-preferred toys were more preferred than edibles by conducting a preference assessment between the toys and the four edibles. Results showed that for two of the three participants the high-preferred toys were more preferred than edibles in some of the preference assessment sessions, whereas for the third participant, the edibles were more preferred than the toys.

Therefore, for the two participants for which toys were sometimes more preferred, it is possible that self-control responding occurred to access the preferred toys. However, these data do not rule out the possibility that, for all three children, self-control responding occurred to access a combination of toys and edibles. Thus, it is possible that the overall larger magnitude of reinforcement resulted in responding to the large, delayed choice option. One way to address this limitation would be to provide toys for both the small, immediate and large, delayed reinforcer choice. In addition to the methodological limitations that impeded determination of the mechanism by which self-control was enhanced in Newquist et al., another limitation is that the toys that were provided during the delay were all high-preferred toys. Thus, it is unknown whether any item or activity could be provided during the delay to enhance self-control or whether only items that are high preferred would be effective. It is possible that low-preferred items or activities may be less effective than high- or moderate-preferred items or activities for bridging the delay to reinforcer delivery.

The purpose of the current study was to replicate and extend the Newquist et al. (2012) study. First, we attempted to replicate the effects of providing access to high-preferred toys during delays to enhance self-control responding. Second, we attempted to address some of the limitations of the Newquist et al. study by providing access to toys during both the small, immediate and large, delayed choice options. Third, we attempted to extend the Newquist et al. study by comparing the effects of providing access to low, moderate, and high preference toys during the delay.

Method

Participants and Setting

Five typically developing preschool children, ages 3 ½ to 5, enrolled in a university-based preschool program participated in this study. Inclusion criteria included (a) behavioral sensitivity to magnitude of reinforcement assessed via a reinforcer-magnitude assessment (see below) in which the participant consistently chose the large, immediate reinforcer over the small, immediate reinforcer when both were available immediately and (b) impulsive choices (choosing a small, immediate reinforcer over a large, delayed reinforcer) in the absence of intervention during the delay assessment (see below) when a 3-min delay was implemented for the large, delayed reinforcer.

Experimental sessions were conducted in a session room (9 ft. x 9 ft.) by a trained therapist one to two times per day, 3 to 5 days a week. Sessions were 5-20 min in length (depending on the condition). An additional evaluation was conducted with one participant (Emery) in which some sessions were increased in duration up to 55 min. The session room contained a table, chairs, and relevant session materials.

Preference Assessments

Two separate paired-stimulus preference assessments (Fisher et al., 1992) were conducted prior to the study. During these assessments, the experimenter presented two stimuli during each trial, and the participant was asked to choose his or her favorite item. Once the participant chose one of the items (by saying the name of the item or touching the item), he or she was given access to the chosen item for 30 s. The first preference assessment was conducted with nine edible items, and a preference hierarchy was created based on the percentage of trials in which each edible item was chosen. The edible item that ranked highest was used for the remainder of the study. The second preference assessment was conducted with 16 toys, and a preference hierarchy was created based on the percentage of trials in which each toy was chosen.

Six toys were selected from this preference assessment and were designated to the different preference evaluation conditions (see below).

If a substantial break in sessions (e.g., more than one week) occurred, an additional preference assessment was conducted with the six toys in order to create a new hierarchy that reflected any change in participant preference. If necessary, the toys were reallocated to the different conditions following this preference assessment. This additional preference assessment was conducted with two participants (Emery and Luke).

Response Measurement and Interobserver Agreement

The primary dependent variables were the frequency of large-, small-, and no-reinforcer choices. *Large-reinforcer choice* was defined as the participant touching the plate containing four pieces of a preferred edible. *Small-reinforcer choice* was defined as the participant choosing the plate with one preferred edible. *No-reinforcer choice* was defined as the participant choosing the plate that did not contain any edibles. These data were scored on a trial-by-trial basis.

Data were also collected on additional participant (aggression, property destruction, and toy play) and experimenter behavior (prompt, edible delivery, and toy delivery) during each trial. *Aggression* was defined as any action that could harm the experimenter such as hitting, kicking, pinching, or biting. *Property destruction* was defined as any response that could cause damage such as throwing toys, kicking walls, or ripping up materials. *Toy play* was defined as the participant's engagement with the toys by having at least one hand in contact with the item such that the item moved, or in the case of movies or books, having their eyes oriented toward the item. *Prompt* was defined as the experimenter providing the participant with the statement, "Pick the one you want." *Edible delivery* was defined as the experimenter providing the

participant with a plate with four edibles (large, delayed reinforcer delivery), a plate with one edible (small, immediate reinforcer delivery), or an empty plate (no reinforcer delivery). *Toy delivery* was defined as the experimenter providing the participant with either the high-preferred, moderate-preferred, or low-preferred toys depending on the condition. Toy play was scored using partial-interval recording with 10-s intervals. Aggression, property destruction, and therapist behaviors were scored on a trial-by-trial basis.

Data were collected by trained graduate and undergraduate observers using a hand-held device. In addition, a second independent observer collected data for a minimum of 30% of the sessions across all conditions and participants. For participant choice, edible delivery, toy delivery, aggression, property destruction, and experimenter behavior (prompt, edible delivery, and toy delivery), interobserver agreement (IOA) was calculated on a trial-by-trial basis by comparing the two independent observers' scores on each trial. Agreements for these behaviors were defined as each observer scoring the same behavior during the same trial. The number of trials with agreement was added, then divided by the total number of trials, and multiplied by 100%. IOA for toy play was scored using the interval method. Agreements were defined as each observer recording at least one response (occurrence) or no response (nonoccurrence) of toy play within the same 10-s interval. The number of intervals with agreement were added, then divided by the total number of intervals, and multiplied by 100%. IOA was calculated for 73.3% of sessions for Erin. Mean agreement was 100% for large-reinforcer choice, 100% for small-reinforcer choice, 100% for no-reinforcer choice, 100% for aggression, 100% for property destruction, and 96.3% (range, 85.7%-100%) for toy play for Erin. IOA was calculated for 66.2% of sessions for Emery. Mean agreement was 98.4% (range, 80%-100%) for large-reinforcer choice, 99.6% (range, 80%-100%) for small-reinforcer choice, 100% for no-reinforcer

choice, 100% for aggression, 100% for property destruction, and 95.4% (range, 86.4%-100%) for toy play for Emery. IOA was calculated for 48.3% of sessions for Matthew. Mean agreement was 99.3% (range, 80%-100%) for large-reinforcer choice, 100% for small-reinforcer choice, 100% for no-reinforcer choice, 100% for aggression, 97.9% (range, 60%-100%) for property destruction, and 95% (range, 89%-100%) for toy play for Matthew. IOA was calculated for 54.5% of sessions for Clay. Mean agreement was 98.9% (range, 80%-100%) for large-reinforcer choice, 98.9% (range, 80%-100%) for small-reinforcer choice, 100% for no-reinforcer choice, 98.9% (range, 80%-100%) for aggression, 98.9% (range, 80%-100%) for property destruction, and 91.2% (range, 81%-96%) for toy play for Clay. IOA was calculated for 59.3% of sessions for Luke. Mean agreement was 99.4% (range, 80%-100%) for large-reinforcer choice, 98.1% for small-reinforcer choice (range, 80%-100%), 100% for no-reinforcer choice, 100% for aggression, 96.9% (range, 60%-100%) for property destruction, and 90.5% (range, 78.4%-100%) for toy play for Clay. The mean agreement for experimenter behavior across participants was 97.4% (range, 93.8%-98.9%) for prompt, 98.5% (range, 96.6%-100%) for edible delivery, and 98.7% (range, 97.8%-100%) for toy delivery.

Although the IOA percentages were high for mean agreement across behavior, the ranges highlight that IOA percentages were low for some sessions for some participants. These low percentages result from the limited number of trials and, therefore, behaviors that could occur during a session. For example, if a participant selected the large reinforcer on the third trial, and one observer scored it and the other observer did not score it, the resulting trial-by-trial agreement for the large reinforcer would be 80% because there were a total of 5 trials for each session. For the sessions in which IOA percentages were below 80%, observers were retrained on the definitions of each behavior to ensure understanding and to minimize observer drift.

Experimental Preparations

All sessions were conducted using a concurrent-operants arrangement, and a combination multielement and reversal design was used for experimental control. First, a magnitude assessment was conducted to assess whether a participant's behavior was sensitive to the magnitude of reinforcement. That is, to determine whether he or she would consistently chose the large reinforcer when the delay between the two reinforcers was held constant (i.e., no delay). Second, a delay assessment was conducted to determine whether a participant displayed impulsive behavior. That is, to determine whether he or she would consistently choose the small, immediate reinforcer rather than the large, delayed reinforcer given a 3-min delay for the large reinforcer. Third, if the participant's choice behavior was sensitive to the magnitude of reinforcement and resulted in impulsive responding (inclusion criteria), a preference evaluation was conducted during which toys of different preference levels (high, moderate, and low) were introduced to attempt to increase selection of the large, delayed reinforcer.

General Procedure

During all sessions, the experimenter sat across the table from the participant. All sessions consisted of five trials. Each trial began when the experimenter presented three plates on the table in front of the participant. The position of the plates (i.e., right, center, or left) was alternated during each trial in which no plate was in the same position for more than two trials. One plate contained four preferred edible items (large reinforcer), a second plate contained one preferred edible item (small reinforcer), and the third plate was empty (no reinforcer [control]) (see Appendix A). Prior to the start of all sessions, the experimenter explained the rules for that specific session to the participant based on a script that varied depending on the specific condition (see below). There was no pre-session exposure; however, for one participant (Luke),

rule reminders were delivered prior to sessions on how to interact with the toys appropriately due to high levels of problem behavior during some sessions.

During all sessions across all phases, except for the reinforcer-magnitude assessment phase, an intertrial interval (ITI) was included to ensure that all trials had a constant duration and that a participant could not complete a session earlier by choosing the small reinforcer plate or control plate. The ITI across all sessions was the delay period plus 1 min for that session. For example, the delay for choosing the large reinforcer in the delay assessment was 3 min; therefore, when a participant chose the small or no reinforcer options, the ITI was 3 min (delay period) + 1 min before the start of a new trial. If the participant chose the large reinforcer, the delay period was followed by an additional minute before the next trial began to allow time for consumption of the edibles (see Appendix B for a schematic outlining this procedure). Additionally, the experimenter interacted with the participant throughout the inter-trial interval (ITI) and delay periods.

Reinforcer-Magnitude Assessment. During these sessions, three plates were presented to the participant on each of five trials. One plate contained one preferred edible (small reinforcer), a second plate contained four preferred edibles (large reinforcer), and a third plate was empty (no reinforcer [control]). Prior to the first trial, the experimenter told the participant, "If you pick the plate with one piece, you will get the [food item] right away; if you pick the plate with four pieces, you will get the [food item] right away; if you pick the empty plate, you will not get any [food item]." There was no delay in place for any of the choice options. That is, choosing the large, small, or no reinforcer plate resulted in immediate access to the plate chosen. Once the food was consumed, the plates were presented again.

Delay Assessment. During these sessions, three plates were presented to the participant on each of five trials. One plate contained one preferred edible (small reinforcer), a second plate contained four preferred edibles (large reinforcer), and a third plate contained no edible (no reinforcer [control]). Prior to the first trial, the experimenter told the participant, "If you pick the plate with one piece, you will get the [food item] right away; if you pick the plate with four pieces, you will get the [food item] after you wait; if you pick the empty plate, you will not get any [food item]." Choosing the small reinforcer plate or no reinforcer plate resulted in the participant being delivered immediate access to the corresponding plate, and a 4-min ITI began. Choosing the plate with the large reinforcer resulted in a 3-min delay followed by the delivery of the plate and a 1-min ITI for consumption of the edibles.

Preference Evaluation. During these sessions, the three plates and three identical pictures of the available toys (based on the condition) were presented to the participant at the start of each trial. One plate contained four preferred edibles (large reinforcer) and a picture of the toys, a second plate contained one preferred edible (small reinforcer) and a picture of the toys, and a third plated contained no edible (no reinforcer [control]) and a picture of the toys. The actual toys were placed next to the experimenter. Prior to the first trial, the experimenter told the participant, "If you pick the plate with one piece, you will get the [food item] right away and the toys; if you pick the plate with four pieces, you will get the toys right away, and you will get the [food item] after you wait; if you pick the empty plate, you will not get any [food item], but you will get the toys right away." Choosing the large reinforcer plate resulted in the participant being delivered the toys (based on the condition of that session) immediately, and after 3 min, the toys were removed and the plate containing the four edibles was delivered, followed by the 1-min ITI to allow for consumption of the edibles. Choosing the small

reinforcer plate resulted in immediate delivery of the plate containing the one edible. After 1 min, the toys (based on the condition) were delivered and a 3-min ITI began during which the participant had access to the toys. Choosing the no reinforcer plate resulted in the immediate delivery of the empty plate and the toys, and a 4-min ITI commenced.

High-preferred Toys. During this condition, two high-preferred toys (i.e., items ranked first and second), based on the outcome of the toys preference assessment conducted prior to the study, were provided when the large-, small-, or no-reinforcer options were selected. For the large-reinforcer option, the toys were provided during the 3-min delay period that was followed by the delivery of the large-reinforcer plate. For the small-reinforcer option, the small-reinforcer plate was delivered for the first min then the toys were provided during the 3-min toys access period. For the no-reinforcer option, the toys were provided during the 4-min ITI period.

Moderate-Preferred Toys. During this condition, procedures were identical to the high-preferred toys condition; however, two moderate-preferred toys (i.e., items ranked eighth and ninth), based on the outcome of the toys preference assessment, were provided when the large-, small-, or no-reinforcer options were selected.

Low-Preferred Toys. During this condition, procedures were also identical to the high- and moderate-preferred toys condition; however, two low-preferred toys (i.e., items ranked 15th and 16th, or the two lowest ranked toys that were chosen at least once), based on the outcome of the toys preference assessments, were provided when the large-, small-, or no-reinforcer options were selected.

Reinforcer-Magnitude Probes. If the participant did not choose the large, delayed reinforcer option on at least 4 trials across six consecutive sessions, a reinforcer magnitude probe was conducted to ensure that the participant's behavior was still sensitive to the magnitude of

reinforcement. These probes were identical to the reinforcer-magnitude assessment sessions described above.

Modified Preference Evaluation. This evaluation was conducted if the delivery of toys (regardless of preference level) was ineffective at increasing self-control during the preference evaluation. These sessions were identical to the preference evaluation described above with the exception that toys were only available contingent on selection of the large-reinforcer choice. Choosing the small reinforcer or the no reinforcer did not result in access to the toys. Thus, this evaluation was similar to that conducted by Newquist et al. (2012). This evaluation was conducted with three participants (Erin, Luke, and Matthew).

High-preferred Toys. This condition was identical to the high-preferred toys condition in the preference evaluation with the exception that toys were only available contingent on selection of the large-reinforcer plate. Choosing the small reinforcer plate or the no reinforcer plate did not result in access to the toys.

Moderate-Preferred Toys. This condition was identical to the moderate-preferred toys condition in the preference evaluation with the exception that toys were only available contingent on selection of the large-reinforcer plate. Choosing the small reinforcer plate or the no reinforcer plate did not result in access to the toys.

Low-Preferred Toys. This condition was identical to the low-preferred toys condition in the preference evaluation with the exception that toys were only available contingent on selection of the large-reinforcer plate. Choosing the small reinforcer plate or the no reinforcer plate did not result in access to the toys.

Old versus New Toys. This condition was conducted with one participant (Emery) because of the different levels of large-reinforcer choice between the first set of low-preferred

toys used in the first preference evaluation and the second set of low-preferred toys used in the second preference evaluation. During this condition, the two low-preferred toy sets were compared using procedures identical to the preference evaluation described above.

Extended-Delay Evaluation. This phase was conducted with one participant (Emery) using the toys (high and moderate) that were effective during the preference evaluation for increasing the frequency of selection for the large, delayed reinforcer. Sessions were identical to the preference evaluation sessions, except that the delay was increased across sessions (i.e., from 3 min to 3.5 min then 4, 5, 6, 7, 8, 9, and 10 min). These sessions were conducted as probes in which each extended delay was conducted once per condition and the delay was increased regardless of responding.

Results

Figures 1-5 depict the results of the nine-item edible (top panel) and 16-item toy (bottom panel) paired-stimulus preference assessments for each participant. Edible items and toys are listed along the x-axis, and the percentage of item selection is listed along the y-axis. The asterisks on the edible-item graphs denote the items that were used during the study. The letters H, M, and L on the toy graphs denote the high-preferred toys, moderate-preferred toys, and low-preferred toys, respectively that were used across various phases of the study. As shown in the top panel of figure 1, Clay's most preferred edible item was M&Ms®, which was selected on 87.5% of trials. As shown in the bottom panel of figure 1, Clay's high-preferred toys were the Leapster® and bubblewand (selected on 86.7% and 73.3% of trials, respectively), moderate-preferred toys were the keyboard and polar bear puzzle (selected on 60% and 53.3% of trials, respectively), and low-preferred toys were a book and paper and crayons (selected on 6.7% and 6.7% of trials, respectively). As shown in the top panel of figure 2, Erin's most preferred edible

item was Sour Patch Kids®, which was selected on 100% of trials. As shown in the bottom panel of figure 2, Erin's high-preferred toys were the iPad® and round connectors (selected on 100% and 80% of trials, respectively), moderate-preferred toys were an airplane and blocks (selected on 46.7% and 46.7% of trials, respectively), and low-preferred toys were bubbles and a popper (selected on 13.3% and 6.7% of trials, respectively). As shown in the top panel of figure 3, Luke's most preferred edible item was M&Ms®, which was selected on 87.5% of trials. As shown in the middle panel of figure 3, Luke's high-preferred toys were walkie talkies and a mini basketball with a hoop (selected on 86.7% and 86.7% of trials, respectively), moderate-preferred toys were cars and McDonald's® plastic food (selected on 53.3% and 40% of trials, respectively), and low-preferred toys were a bear puppet and a book (selected on 20% and 13.3% of trials, respectively). Following a substantial break in school, another toy preference assessment was conducted with the same six toys to reflect any changes in preference that may have occurred. As shown in the bottom panel of figure 3, Luke's high-preferred toys were the cars and walkie talkies (selected on 100% and 80% of trials, respectively), moderate-preferred toys were the basketball with the hoop and McDonald's® plastic food (selected on 60% and 40% of trials, respectively), and low-preferred toys were the bear puppet and book (selected on 20% and 0% of trials, respectively). As shown in the top panel of figure 4, Matthew's most preferred edible item was Sour Gummy Worms®, which was selected on 100% of trials. As shown in the bottom panel of figure 4, Matthew's high-preferred toys were barbies and ponies (selected on 100% and 93.3% of trials, respectively), moderate-preferred toys were paper and crayons and a truck (selected on 46.7% and 40% of trials, respectively), and low-preferred toys were little people and potato head (selected on 20% and 6.7% of trials, respectively). As shown in the top panel of figure 5, four edible items (Kit Kat®, Sour Patch Kids®, Oreo®, Skittles®) were

selected on 62.5% of trials. Because these four items were selected on the same amount of trials, the trials in which the items were pitted against each other were evaluated. Sour Patch Kids® was selected the most from the trials in which the four edibles were pitted against each other, followed by Kit Kat®, Oreo®, and Skittles®. Sour Patch Kids® were originally chosen as Emery's high-preferred edible item; however, after the second session, Emery requested for a different edible because his tongue was being rubbed raw from the Sour Patch Kids®. Thus, Kit Kat®, ranked number two, was selected as the new high-preferred edible to use for the duration of the study. As shown in the middle panel of figure 5, Emery's high-preferred toys were the iPad® and piano (selected on 100% and 86.7% of trials, respectively), moderate-preferred toys were a 3D viewer and cars (selected on 40% and 40% of trials, respectively), and low-preferred toys were string beads and a book (selected on 20% and 20% of trials, respectively). Following a substantial break in school, another toy preference assessment was conducted with the same six toys to reflect any changes in preference that may have occurred. As shown in the bottom panel of figure 5, Emery's high-preferred toys were the iPad and 3D viewer (selected on 100% and 80% of trials, respectively), moderate-preferred toys were a piano and string beads (selected on 40% and 40% of trials, respectively), and low-preferred toys were the cars and book (selected on 20% and 0% of trials, respectively).

Figures 6-10 depict the large-reinforcer choices (top panel), percent interval toy play during large-reinforcer choice trials (middle panel), and the percent interval toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude delay assessment, preference evaluation, modified preference evaluation (Erin, Luke, Matthew), and delay extension (Emery). Only large-reinforcer choices are depicted because the participants seldom selected the no-reinforcer choice. Therefore, when the participant did not choose the large

reinforcer option, they almost exclusively selected the small reinforcer option. The red x on the middle and bottom panels denote session in which the reinforcer choice was not selected or the toys were not available for that choice.

Figure 6 depicts the results for Clay. During the reinforcer-magnitude assessment, Clay selected the large, immediate option on more trials than the small, immediate option. These data suggest that his behavior was sensitive to the magnitude of reinforcement. Next, during the delay assessment, Clay selected the large, delayed option less often than the small, immediate option suggesting that his behavior was sensitive to the 3-min delay. During the preference evaluation, Clay selected the large, delayed option during the majority of trials across the low-, moderate-, and high-preference toy conditions suggesting that the presence of toys (regardless of preference level) during the delay was effective for increasing self-control. Upon returning to the delay assessment phase, Clay initially selected the large, delayed option on the majority of trials; however, over time, this selection decreased. The middle panel depicts the percent interval of toy play during large-reinforcer choice trials for Clay. The average percentage of intervals with toy play for high-, moderate-, and low-preferred toys during the preference evaluation for large-reinforcer choice trials was 82.7% (range, 73.3%-96.5%), 58.5% (range, 44.1%-84%), and 53.9% (range, 30.4%-72.7%), respectively. That is, Clay interacted with the toys at high and sustained levels across the high-preferred toy condition and moderate levels across all the moderate- and low-preferred toy conditions. The bottom panel depicts the percent interval of toy play during small-reinforcer choice trials for Clay. The average percentage of trials with toy play for high-, moderate-, and low-preferred toys during the preference evaluation for small-reinforcer choice trials was 87% (range, 73.7%-94.7%), 79.6% (range, 69.1%-90.1%), and 42.1%, respectively. That is, when the small reinforcer was selected, Clay interacted with

the toys at high and sustained levels across the moderate- and high-preferred toy conditions and relatively low levels across the low-preferred toy condition.

Figure 7 depicts the results for Erin. During the reinforcer-magnitude assessment, Erin selected the large, immediate option on more trials than the small, immediate option. These data suggest that her behavior was sensitive to the magnitude of reinforcement. Next, during the delay assessment, Erin selected the large, delayed option on less trials than the small, immediate option, suggesting that her behavior was sensitive to the 3-min delay. During the preference evaluation, Erin continued to select the large, delayed option on less trials than the small, immediate option suggesting that access to toys (regardless of preference) were not effective for increasing self-control responding. During this phase, we conducted reinforcer-magnitude probes to determine whether Erin's choice behavior was still sensitive to the magnitude of reinforcement. During these probes, Erin selected the large, immediate option on the majority of trials. Because the preference evaluation was ineffective for increasing self-control but Erin's choice behavior was still sensitive to the magnitude of reinforcement, the modified preference evaluation was conducted. During the modified preference evaluation, Erin selected the large, delayed option more often than the small, immediate option during the high-preference toy condition; however, she selected the large, delayed option less often than the small, immediate option during the low- and moderate-preference toy conditions. These data suggest that high-preferred toys were effective for increasing self-control, but only if access to these toys were restricted to the large, delayed option. The middle panel depicts the percent interval of toy play during large-reinforcer choice trials for Erin. The average percentage of intervals with toy play for high-, moderate-, and low-preferred toys during the preference evaluation during these trials was 92.2% (range, 89.5%-94.7%), 70.7% (range, 58.8%-85%), and 89.3% (range, 84.2%-

94.4%), respectively. That is, Erin interacted with the toys at high levels across all toy-preference conditions during the preference evaluation. The average percentage of intervals with toy play for high-, moderate-, and low-preferred toys during the modified preference evaluation for large-reinforcer choice trials was 95.4% (range, 92.6%-97.5%), 97.4%, and 41% (range, 40%-41.9%), respectively. That is, Erin interacted with the high- and moderate-preferred toys at higher levels as compared to the low-preferred toys. The bottom panel depicts the percent interval of toy play during small-reinforcer choice trials for Erin. The average percentage of trials with toy play for high-, moderate-, and low-preferred toys during the preference evaluation during these trials was 88.2% (range, 83.3%-91.3%), 65.1% (range, 13.3%-85.4%), and 63.2% (range, 57%-63.4%), respectively. That is, when the small reinforcer was selected during the preference evaluation, Erin interacted with the high-preferred toys at higher and sustained levels as compared to the low- and moderate-preferred toys.

Figure 8 depicts the results for Luke. During the reinforcer-magnitude assessment, Luke selected the large, immediate option on more trials than the small, immediate option. Next, during the delay assessment, Luke initially selected the large, delayed option on all trials; however, over time he began to select the this option on less trials than the small, immediate option suggesting that his behavior was sensitive to the 3-min delay. During the preference evaluation, Luke initially selected the large, delayed option on more trials as compared to the small, immediate option; however, as sessions continued, he selected the large, delayed option less frequently as compared to the small, immediate option across all toy conditions, suggesting that the presence of the toys did not effectively increase self-control when the toys were available for all choice options. Reinforcer-magnitude probes were conducted during this phase to determine whether Luke's choice behavior was still sensitive to the magnitude of

reinforcement. During these probes, Luke selected the large, immediate option on the majority of trials. Because the preference evaluation was ineffective for increasing self-control, and Luke's choice behavior was still sensitive to the magnitude of reinforcement, we conducted the modified preference evaluation. During the modified preference evaluation, Luke selected the large, delayed option consistently more during the high-preference toy condition as compared to moderate- and low-preference toy conditions. Albeit, he chose the large, delayed option more often during the moderate-preferred toy condition as compared to the low-preferred toy condition. These data suggest that the high-preferred toys were the most effective for increasing self-control, but only if access to these toys was restricted to the large, delayed option. The middle panel depicts the percent interval of toy play during large-reinforcer choice trials for Luke. The average percentage of intervals of toy play during these trials for high-, moderate-, and low-preferred toys during the preference evaluation was 83.3% (range, 68.4%-95.8%), 67.2% (range, 0%-100%), and 61.5% (range, 25%-94.7%), respectively. That is, Luke interacted with the high-preferred toys during the preference evaluation at high and consistent levels as compared to the low- and moderate-preferred toys when the large reinforcer was chosen. The average percentage of intervals with toy play during these trials across high-, moderate-, and low-preferred toys during the modified preference evaluation was 89.1% (range, 83%-96.8%), 73.8% (range, 43.2%-89.5%), and 70.5%, respectively. That is, Clay interacted with the high-preferred toys during the modified preference evaluation at somewhat higher levels as compared to the moderate- and low-preferred toys. The bottom panel depicts the percentage of intervals of toy play during small-reinforcer choice trials for Luke. The average percentage of trials with toy play during these trials across high-, moderate-, and low-preferred toys during the preference evaluation for small-reinforcer choice trials was 86.2% (range, 70.4%-100%), 63.4% (range,

37.9%-88.5%), and 41.6% (range, 1.3%-86.1%), respectively. That is, when the small reinforcer was selected during the preference evaluation, Luke interacted with the high-preferred toys at higher and sustained levels as compared to the moderate- and low-preferred toys.

Figure 9 depicts the results for Matthew. During the reinforcer-magnitude assessment, Matthew selected the large, immediate option on more trials than the small, immediate option suggesting that his behavior was sensitive to the magnitude of reinforcement. Next, after the first several sessions of the delay assessment, Matthew began selecting the large, delayed option less often than the small, immediate option, suggesting that his behavior was sensitive to the 3-min delay. Next, during the preference evaluation, Matthew selected the large, delayed option less often than the small, immediate option across all toy preference conditions suggesting that the presence of the toys did not effectively increase self-control when the toys were available for all choice options. Reinforcer-magnitude probes showed that Matthew's behavior continued to be sensitive to magnitude. Because the preference evaluation was ineffective for increasing self-control and Matthew's choice behavior was still sensitive to the magnitude of reinforcement, the modified preference evaluation was conducted. During the modified preference evaluation, Matthew selected the large, delayed option on the majority of trials across all toy preference conditions; however, the high-preference toy condition was slightly more effective for increasing self-control. These data suggest that all toy preferences were effective for increasing self-control but only when access to the toys was restricted to the large, delayed option. Because there was minimal differentiation between the toy-preference conditions during the modified preference evaluation, delay-assessment probes were conducted to demonstrate experimental control. During the delay-assessment probes, Matthew selected the large, delayed option less consistently as compared to the small, immediate option, suggesting that in the absence of an intervention,

Matthew did not engage in self-control responding. The middle panel depicts the percent interval of toy play during large-reinforcer choice trials for Matthew. Matthew interacted with the high-, moderate-, and low-preferred toys during 94.7%, 91.9%, and 85% of trials, respectively. That is, Matthew interacted with the toys at similar levels when the large-reinforcer option was selected during the preference evaluation. The average percentage of intervals with toy play for high-, moderate-, and low-preferred toys during the modified preference evaluation for large-reinforcer choice trials was 92.8% (range, 86.6%-100%), 92.9%, (range, 84.7%-96.5%), and 78.7% (range, 44.2%-98.7%), respectively. That is, Matthew interacted with all toys at relatively high levels; however, he interacted with the high- and moderate-preferred toys at somewhat higher and more consistent levels. The bottom panel depicts the percent interval of toy play during small-reinforcer choice trials for Matthew. The average percentage of small-reinforcer choice trials with toy play for high-, moderate-, and low-preferred toys during the preference evaluation was 71.6% (range, 21.8%-92.3%), 66.1% (range, 60.2%-72.8%), and 68.7% (range, 50%-85.3%), respectively. That is, when the small reinforcer was selected during the preference evaluation, Matthew interacted with the high-preferred toys at somewhat higher levels (with the exception of session 24) as compared to the moderate- and low-preferred toys.

Figure 10 depicts the results for Emery. During the reinforcer-magnitude assessment, Emery selected the large, immediate option on more trials than the small, immediate option. These data suggest that his behavior was sensitive to the magnitude of reinforcement. Next, during the delay assessment, Emery selected the large, delayed option on less trials than the small, immediate option suggesting that his behavior was sensitive to the 3-min delay. Next, during the first preference evaluation, Emery selected the large, delayed option during the majority of trials across the low-, moderate-, and high-preference toy conditions suggesting that

the presence of toys (regardless of preference level) was effective for increasing self-control. Upon returning to the delay-assessment phase, Emery selected the large, delayed option on less trials than the small, immediate option suggesting that Emery did not engage in self-control responding in the absence of an intervention. Following the delay assessment, there was a month break, so a new preference assessment was conducted with the original six toys used in the first preference evaluation. The toys were reassigned to each toy-preference condition based on the new preference hierarchy. During the second preference evaluation phase, Emery selected the large, delayed option on more trials during the moderate- and high-preference toy conditions as compared to the low-preference toy condition. These data suggest that moderate- and high-preferred toys were effective for increasing self-control responding. Because of the difference in the effect of the low-preference toy condition across the phases, we compared the effects of the first set of low-preferred toys to the second set of low-preferred toys. During this phase (old vs. new toys), Emery selected the large, delayed reinforcer most consistently during the condition in which the first set of low-preference toys was used. Next, we conducted a delay extension to determine the length of time Emery would wait for the large, delayed reinforcer. During the moderate- and high-preference toy conditions, Emery selected the large, delayed option on the majority of trials as compared to the small, immediate option across all delay times (3.5 min, 4 min, 5 min, 6 min, 7 min, 8 min, 9 min, 10 min); however, the high-preference toy condition was slightly more effective. These data suggest that both moderate- and high-preferred toys are effective for increasing self-control at longer delays. The middle panel depicts the percentage of toy play across the different toy-preference conditions (preference evaluations, old vs. new toys, and delay extension) during large-reinforcer choice trials for Emery. The average percentage of intervals with toy play for high-, moderate-, and low-preferred toys during the first preference

evaluation was 92.4% (range, 88.5%-94.7%), 94.1% (range, 87.7%-97.4%), and 92.8% (range, 84.2%-94.7%), respectively. That is, Emery interacted with the toys at high levels across all toy preference conditions when the large-reinforcer option was selected. During the second preference evaluation (new toys), the average percentage of intervals with toy play for high-, moderate-, and low-preferred toys was 93.7% (range, 91.6%-95.8%), 92.7% (range, 89.7%-96.8%), and 97.2% (range, 81.6%-92.9%), respectively. That is, Emery interacted with all toys at similar and high levels. During the old versus new preference evaluation, the average percentage of intervals with toy play for the first set of low-preferred toys was 94.5% (range, 86%-98.7%), whereas for the second set of low-preferred toys it was 79.5% (range, 39.2%-98.2%). Thus, Emery interacted with first set of low-preferred toys at higher and more stable levels as compared to the second set of low-preferred toys. During the delay extension, the average percentage of intervals with toy play for high- and moderate-preferred toys was 97.7% (range, 95.8%-99.2%) and 96.6% (range, 91.6%-99.4%), respectively. That is, Emery interacted with both the moderate- and high-preferred toys at high and stable levels. The bottom panel depicts the percentage of toy play across the different toy-preference conditions (preference evaluations, old vs. new toys, delay extension) in the preference evaluation phase during small-reinforcer choice trials for Emery. The average percentage of intervals with toy play during these trials for high-, moderate-, and low-preferred toys during the first preference evaluation was 81%, 91% (range, 87.2%-94.7%), and 93.2%, respectively. That is, Emery interacted with the toys at high levels across all toy-preference conditions when the small-reinforcer option was selected. During the second preference evaluation, the average percentage of intervals with toy play for high- and low-preferred toys was 85.9% and 83.6% (range, 77.6%-89.5%), respectively. That is, Emery interacted with the low- and high-preferred toys at high levels. During the old

versus new preference evaluation, the average percentage of intervals with toy play for the first and second set of low-preferred toys was 92.5% (range, 85.7%-100%) and 61.7% (range, 0%-100%), respectively. That is, Emery interacted with first set of low-preferred toys at higher and more stable levels as compared to the second set of low-preferred toys. During the delay extension, the average percentage of intervals with toy play for high- and moderate-preferred toys was 98.2% and 95.9% (range, 92.3%-100%), respectively. That is, Emery interacted with both the moderate- and high-preferred toys at high and stable levels.

Figure 11 depicts the mean number of trials across conditions that Luke engaged in property destruction. During the reinforcer-magnitude assessment and delay assessment, Luke engaged in zero levels of property destruction. When toys were available for all three choice options (preference evaluation), Luke engaged in property destruction during an average of 1.79 trials during the high-preferred toy condition, 1.13 trials during the moderate-preferred toy condition, and 1.63 trials during the low-preferred toy condition. When toys were available contingent on selection of the large, delayed option only (modified preference evaluation), Luke engaged in property destruction during an average of 2.5 trials during the high-preferred toy condition, .01 trials during the moderate-preferred toy condition, and .01 trials during the low-preferred toy condition. These data suggest that the presence of some toys were associated with instances of property destruction.

Discussion

The current study extends previous research by evaluating the effects of delivering high-, moderate-, and low-preferred toys during a delay period in the absence of delay fading for increasing self-control in children. When the toys were provided across all three choice options (preference evaluation), results showed an increase in self-control for two of the five participants

(Clay and Emery). For Clay, all toy preferences were effective for increasing self-control. For Emery, the first preference evaluation showed that all toy preferences were effective for increasing self-control; however, during the second preference evaluation (following a break and a new preference hierarchy), only the high- and moderate-preferred toys were effective for increasing self-control. The procedures of the preference evaluation were ineffective for increasing self-control in three of the five participants (Erin, Matthew, and Luke). However, when toy delivery was restricted to the large, delayed choice option (as in the Newquist et al., 2012 study), all toy preferences were effective for one participant (Matthew) and high-preferred toys were the most effective for increasing self-control for two participants (Erin and Luke).

There are several possible explanations as to why the preference evaluation procedures were effective for increasing self-control in two of the participants (Clay and Emery). First, it is possible that providing toys during the delay period decreased the aversiveness of the delay. For example, previous researchers have noted that behaviors have emerged during delays to reinforcement such as singing, talking, and playing with hands (e.g., Mischel & Ebbesen, 1970; Schweitzer & Sulzer-Azaroff, 1988), which possibly decrease the aversiveness of the delay or "distract" the participant during the delay period. Other research has demonstrated that programmed alternative activities and work requirements have also facilitated self-control (e.g., Dixon & Holcomb, 2000; Grosch & Neuringer, 1981). Thus, it is possible that the toys provided in our study may have decreased the aversiveness of the delay or "distracted" the participants during the delay period. Second, although attention, toys, and edibles were delivered across large and small choice options, more edibles compounded with attention and toys may have resulted in a greater magnitude or quality of reinforcement for large-reinforcer choices (Newquist et al., 2012). Third, it is possible that the participants were responding to gain

immediate access to the toys rather than immediate access to one edible. In our preference evaluation arrangement, large-reinforcer choices resulted in immediate access to the toys as compared to small-reinforcer choices that resulted in immediate access to edibles followed by the toys a minute later, thus participants may have preferred immediate toy access rather than immediate access to one edible.

There are a couple explanations as to why all toys (regardless of preference level) were effective for increasing self-control choices during the preference evaluation for two of the participants (Clay and Emery [first phase]). First, it is possible that access to any activity would have resulted in an increase in self-control responding. Previous research has demonstrated that programmed activities (including work requirements) during the delay have resulted in increases in self-control (e.g., Dixon et al., 1998; Fisher et al., 2000). Thus, it is possible that simply giving children something to do during the delay can increase self-control. Second, it is possible that all toys (regardless of preference level) were effective for increasing self-control responding because they functioned as reinforcers. Previous research has demonstrated that low-, moderate-, and high-preferred items can function as reinforcers when there is no alternative (e.g., Lee, Yu, Martin, & Martin, 2010; Roscoe, Iwata, Kahng, 1999; Taravella, Lerman, Contrucci, & Roane, 2000), which is perhaps why the low- and moderate-preferred toys were effective for increasing self-control for both Clay and Emery (first set). In fact, our toy play data suggest that both Clay and Emery interacted with the toys across all toy preferences at moderate to high levels when they were provided.

As mentioned above, the preference evaluation procedures were ineffective for three participants; however, when the toys were restricted to only the large, delayed reinforcer choice during the modified preference evaluation, all toy preferences were effective for increasing self-

control for one participant (Matthew) and high-preferred toys were effective for increasing self-control for two participants (Erin and Luke). First, these data suggest that it may be necessary to restrict access to toys for delay periods in order to increase the efficacy of this intervention, which may be why the toys were ineffective during the preference evaluation for these three participants. Restriction of the toys could serve as an establishing operation that alters the value of the toys (e.g., Michael, 1993; Vollmer & Iwata, 1991). The restriction of the toys results in deprivation such that it increases the value and reinforcing efficacy of the toys to facilitate self-control responding. Thus, it may have been that high-preferred toys were the most effective during this study because these toys were the most restricted throughout the day in the children's preschool classroom environment (i.e., iPad, ponies, barbies, walkie talkies). It is possible that the participants had more exposure to the moderate- and low-preferred toys throughout the day because these items may have been more frequently available in the classroom (i.e., books, paper and crayons), thus having an abative effect within session. Second, it is possible that the participants were responding to access the toys rather than the large reinforcer; however, if this is the case, the participants should have selected the large reinforcer more often in the preference evaluation in order to gain access to the toys immediately. Third, it is possible that the large-reinforcer option (toys, four edible items, and attention) may have resulted in a compound reinforcer resulting in a greater magnitude of reinforcement when the large, delayed reinforcer was selected as compared to the small, immediate reinforcer (Newquist et al., 2012). Fourth, for Matthew, it is possible that the toys were functioning as discriminative stimuli that signaled the subsequent delivery of the large, delayed reinforcer (e.g., Ferster, 1953; Fisher et al., 2000; Lattal, 1984; Schaal & Branch, 1988; Vollmer et al., 1999) or as conditioned reinforcers due to

their pairing with the four edibles, becoming predictive of the delivery of the primary reinforcer and strengthening the large-reinforcer response (e.g., Mazur, 2006).

Dixon and Cummings (2001) demonstrated that problem behavior increased during sessions in which no alternative activity was available during delay periods; however, when an alternative activity was available during delays, little to no problem behavior was observed. During this study, one participant (Luke) engaged in moderate levels of property destruction when toys were *available* during the delay period. This behavior included banging toy cars together and biting or punching the bear puppet. This is in contrast to low levels of problem behavior during sessions in which toys were not provided during the delay. Thus, it does not seem that the delay, per se was evoking problem behavior but rather the presence of toys was associated with the occurrence of problem behavior.

One limitation of the current study is that the therapist interacted with the participants throughout the delay period. Although this was controlled throughout each phase (i.e., attention was delivered continuously throughout all phases and choice options), this may not mimic real world delay situations in which children may be expected to wait without anyone with whom to interact. Jones, Dozier, Neidert, and Ackerlund-Brandt (in preparation) found that therapist attention combined with toys is more preferred and a more effective reinforcer than therapist attention or toys alone. It is possible that therapist attention may have increased self-control responding; however, therapist attention was ineffective for increasing self-control when delivered independent of the toys during the delay assessment. It may be that the delivery of attention alone is not effective for bridging the delay to reinforcement; however, when attention is combined with the delivery of toys or other activities with which to engage is effective. Future

research should evaluate how therapist attention may combine with the availability of toys to enhance self-control.

A second limitation of the current study is that the participants may have been responding to immediate consequences (i.e., access to toys) rather than the delayed consequences (i.e., access to edibles) in choosing the large, delayed option. There are two ways in which to control for this in future research. First, following the small, immediate choice, the toys and edible could both be delivered immediately. This would control for the immediate delivery of toys across choice options. Second, a preference assessment could be conducted to determine whether the one edible item or toys are more preferred immediately. If toys are found to be more preferred for a particular participant then it would suggest that responding may occur to access the toys more immediately, whereas if the edible is more preferred, it would suggest that responding may occur to access the single edible item more immediately. If the participants select immediate toy play, then preference of the toys would be responsible for the increase in self-control.

Future researchers should continue to evaluate effective procedures for increasing self-control responding in children. First, researchers should determine whether items or activities that do not function as reinforcers would have similar effects on self-control responding. As mentioned above, this study demonstrated that providing access to low- and moderate-preferred toys during delay periods could function to enhance self-control for some participants, which may be consistent with previous research in which work tasks (e.g., Dixon et al., 1998) or moderately preferred items (e.g., Mischel et al., 1972) were provided. For example, as mentioned above, Dixon and Cummings (2001) demonstrated that a work task (match-to-sample task) during the delay was effective for increasing self-control in three children with an autism

spectrum disorder. Furthermore, research on the reinforcing efficacy of stimuli with various preference levels has shown that low- and moderate-preferred items and activities can function as reinforcers for increasing and maintaining various behaviors (e.g., Lee et al., 2010; Roscoe et al., 1999; Taravella et al., 2000). Although these data suggest that is it is possible for low- and moderate-preference activities to bridge the delay to reinforcement, additional research needs to be conducted. Second, given Emery's delay extension data in which both moderate- and high-preferred toys were effective for increasing self-control at relatively long delays, it would be interesting to determine whether access to toys during the delay period would allow for a more rapid increase in the delay period as compared to procedures such as delay fading during which delays are gradually increased by small increments of time (i.e., 2-3 s). Providing toys during delay periods may facilitate more rapid delay fading. Third, given our results, it would be interesting to evaluate the effects of a classroom-wide procedure during which high-preferred items are provided during delay periods throughout the delay in a preschool classroom environment. Hanley et al. (2007) demonstrated that children in a preschool classroom could be taught to tolerate delays by repeating a rule during the delay period, perhaps providing high-preferred items during those delay periods would further facilitate self-control in young children.

The current study suggests that providing toys, regardless of preference, during delays may facilitate self-control responding for some children. However, for other children, it may be necessary to program a period of deprivation for particular toys to increase the value of these toys to enhance self-control responding. It is still unclear as to why some toy preferences were more effective for enhancing self-control responding than others. For example, high-preferred toys were more effective for enhancing self-control. It may be that the high-preferred toys included in this study were more effective because they were restricted in the everyday

environment as compared to low- or moderate-preferred toys that were sometimes available in the classroom. It may also be that preference affects later consequences. Thus, choosing the one high-preferred edible item is more preferred than the immediate low-preferred toys followed by the four high-preferred edible items after a delay. It is important to note that providing toys to children during delays can enhance self-control. This has clinical significance in that caregivers can select high-preferred toys and allow access to them during delay periods such as waiting for a meal to be served. Future researchers should continue to evaluate the mechanisms of effective procedures for enhancing delay tolerance, providing work tasks (or stimuli that are not reinforcers) during delays, and consider evaluating how therapist interaction might be incorporated into delay periods to increase self-control.

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Figure Captions

Figure 1. The percentage of trials Clay chose each of the edible items (top panel) and toys (bottom panel) during the two paired-stimulus preference assessments. The star denotes the high-preferred edible item used during the study. The H, M, and L denote high-preferred, moderate-preferred, and low-preferred toys, respectively used during the study.

Figure 2. The percentage of trials Erin chose each of the edible items (top panel) and toys (bottom panel) during the two paired-stimulus preference assessments. The star denotes the high-preferred edible item used during the study. The H, M, and L denote high-preferred, moderate-preferred, and low-preferred toys respectively, used during the study.

Figure 3. The percentage of trials Luke chose each of the edible items (top panel) and toys (bottom panel) during the two paired-stimulus preference assessments. The star denotes the high-preferred edible item used during the study. The H, M, and L denote high-preferred, moderate-preferred, and low-preferred toys respectively, used during the study.

Figure 4. The percentage of trials Matthew chose each of the edible items (top panel) and toys (bottom panel) during the two paired-stimulus preference assessments. The star denotes the high-preferred edible item used during the study. The H, M, and L denote high-preferred, moderate-preferred, and low-preferred toys, respectively used during the study.

Figure 5. The percentage of trials Emery chose each of the edible items (top panel) and toys

(bottom panel) during the two paired-stimulus preference assessments. The star denotes the high-preferred edible item used during the study. The H, M, and L denote high-preferred, moderate-preferred, and low-preferred toys, respectively used during the study.

Figure 6. Clay's large-reinforcer choices (top panel), percent interval of toy play during large-reinforcer choice trials (middle panel), and percent interval of toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude assessment (SR+ Mag), delay assessment (delay assess), and preference evaluation. The red x denotes sessions in which the reinforcer choice was not selected or the toys were not available for that choice.

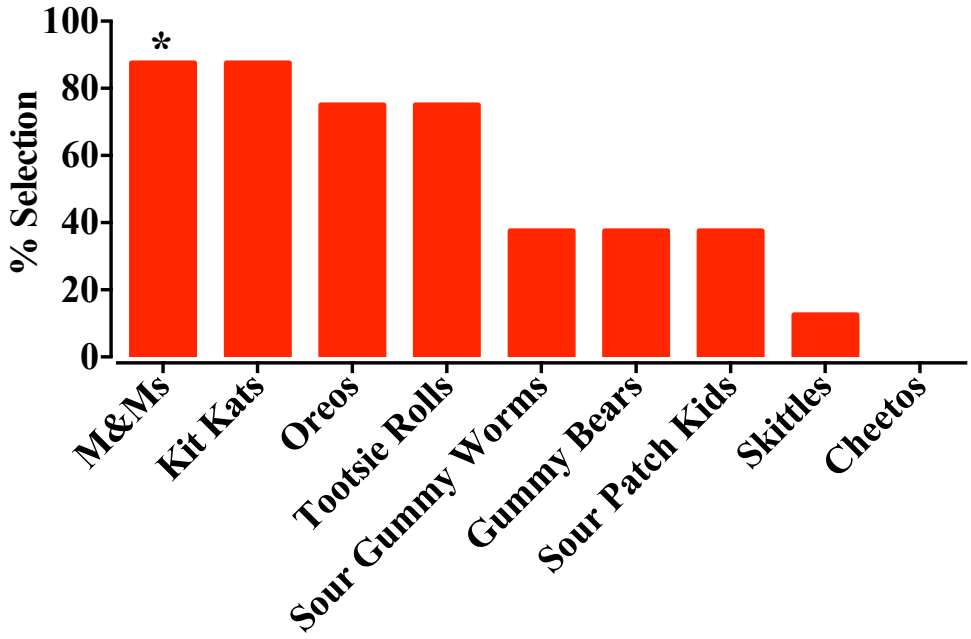
Figure 7. Erin's large-reinforcer choices (top panel), percent interval of toy play during large-reinforcer choice trials (middle panel), and percent interval of toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude assessment (SR+ Mag), delay assessment (delay assess), preference evaluation, and modified preference evaluation. The red x denotes sessions in which the reinforcer choice was not selected or the toys were not available for that choice.

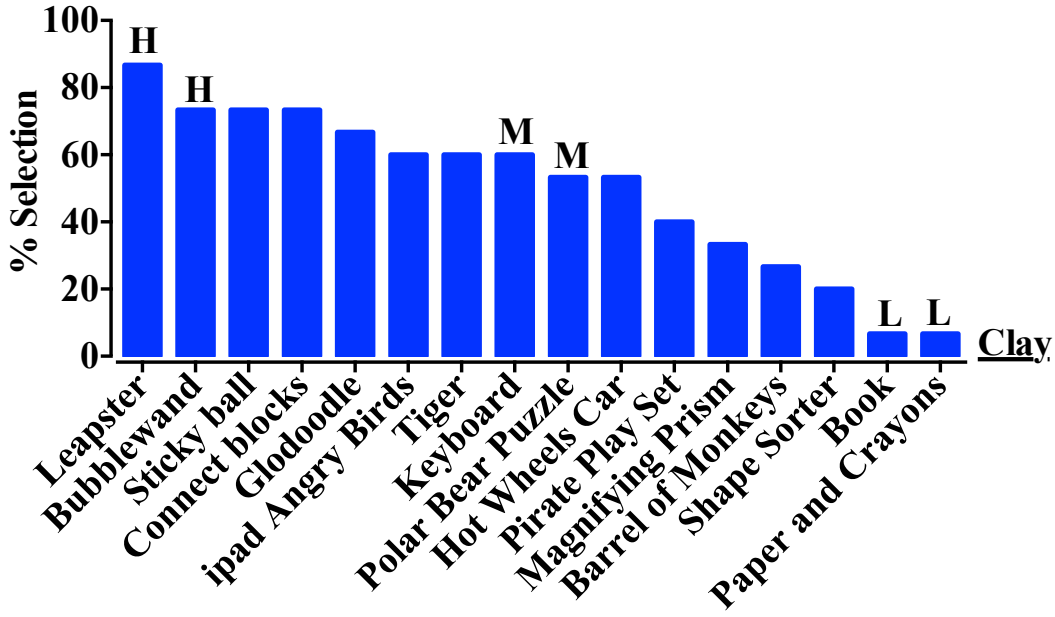
Figure 8. Luke's large-reinforcer choices (top panel), percent interval of toy play during large-reinforcer choice trials (middle panel), and percent interval of toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude assessment (SR+ Mag), delay assessment (delay assess), preference evaluation, and modified preference evaluation. The red x denotes sessions in which the reinforcer choice was not selected or the toys were not available for that choice.

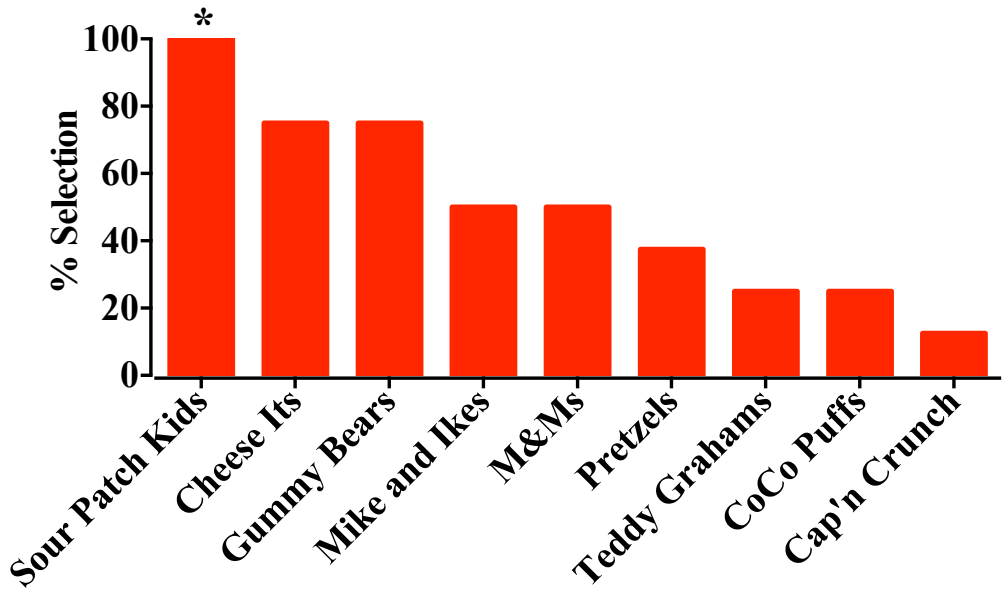
Figure 9. Matthew's large-reinforcer choices (top panel), percent interval of toy play during large-reinforcer choice trials (middle panel), and percent interval of toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude assessment (SR+ Mag), delay assessment (delay assess), preference evaluation, and modified preference evaluation. The red x denotes sessions in which the reinforcer choice was not selected or the toys were not available for that choice.

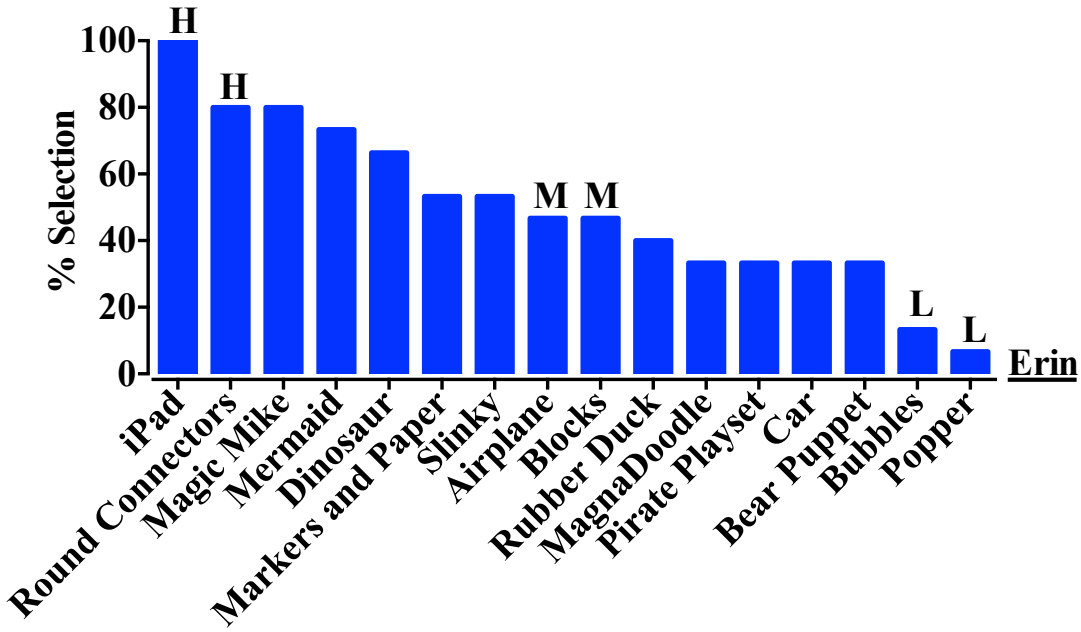
Figure 10. Emery's large-reinforcer choices (top panel), percent interval of toy play during large-reinforcer choice trials (middle panel), and percent interval of toy play during small-reinforcer choice trials (bottom panel) across the reinforcer-magnitude assessment (SR+ Mag), delay assessment (delay assess), preference evaluations, and delay extension. The red x denotes sessions in which the reinforcer choice was not selected or the toys were not available for that choice.

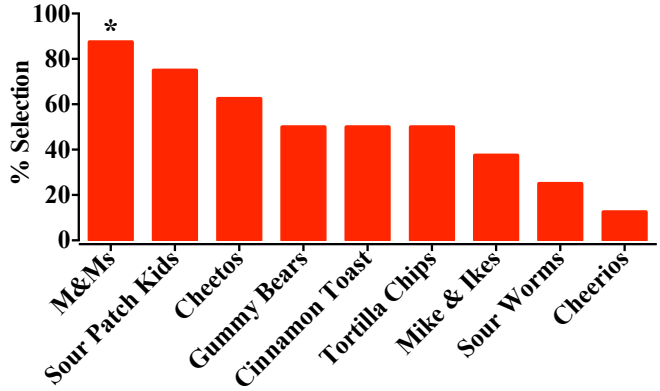
Figure 11. The mean number of trials with property destruction for Luke across the reinforcer-magnitude assessment, delay assessment, preference evaluation conditions (high, moderate, and low), and modified preference evaluation conditions (high, moderate, and low).

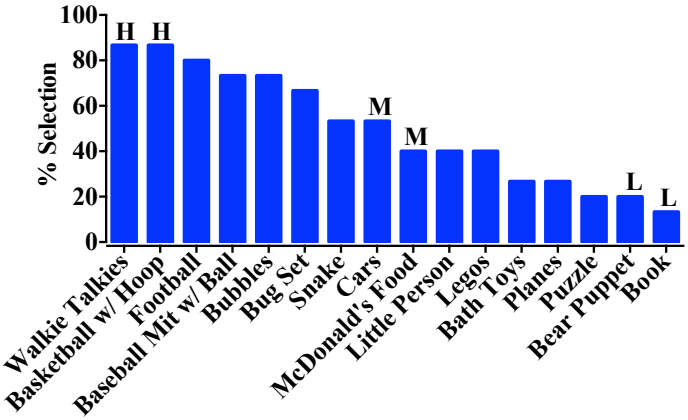

100
80
60
40
20
0
% Selection
*
M&Ms
Kit Kats
Oreos
Tootsie Rolls
Sour Gummy Worms
Gummy Bears
Sour Patch Kids
Skittles
Cheetos

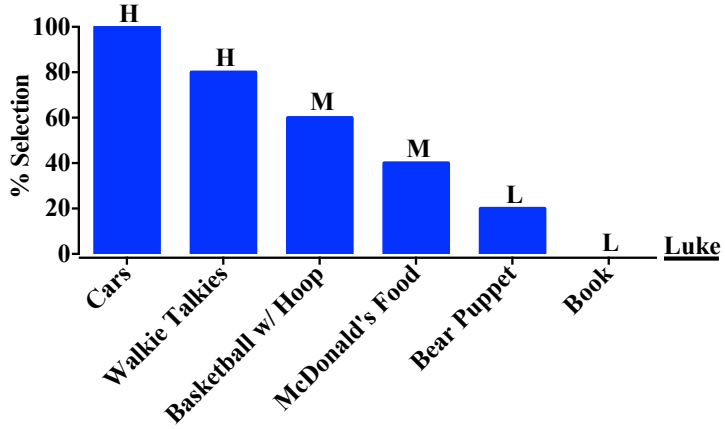

100
80
60
40
20
0
% Selection
H
H
M
M
L
L
Clay
Leapster
Bubblewand
Sticky ball
Connect blocks
Glodoodle
ipad Angry Birds
Tiger
Keyboard
Polar Bear Puzzle
Hot Wheels Car
Pirate Play Set
Magnifying Prism
Barrel of Monkeys
Shape Sorter
Book
Paper and Crayons

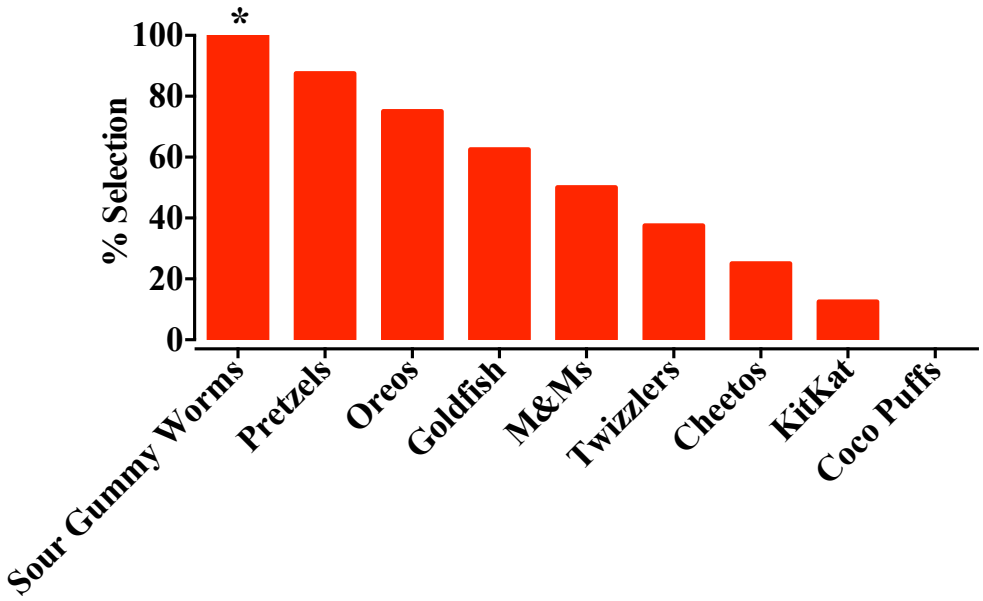

*
100
80
60
40
20
0
% Selection
Sour Patch Kids
Cheese Its
Gummy Bears
Mike and Ikes
M&Ms
Pretzels
Teddy Grahams
CoCo Puffs
Cap'n Crunch

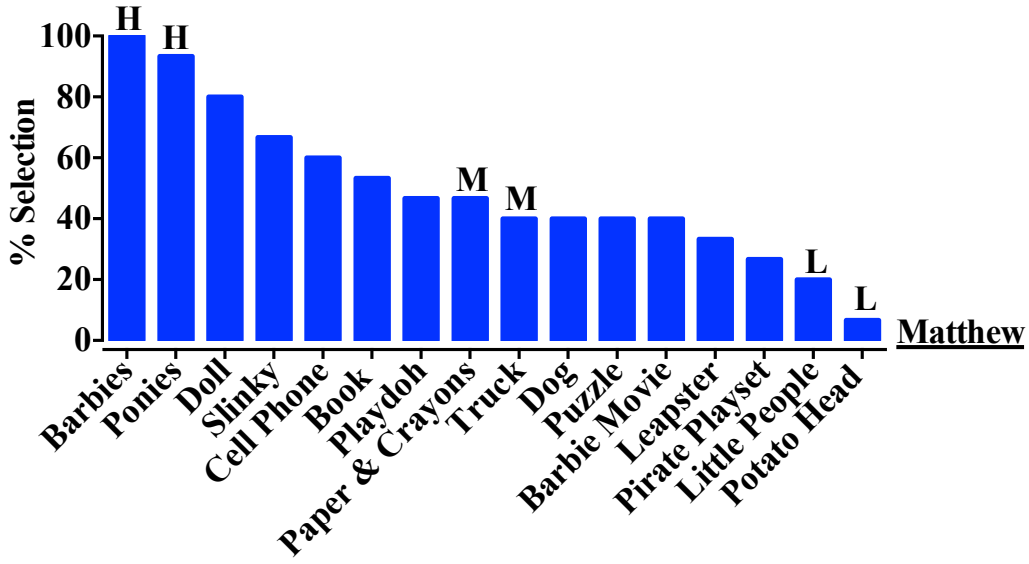

H
H
M
M
L
L
100
80
60
40
20
0
% Selection
iPad
Round Connectors
Magic Mike
Mermaid
Dinosaur
Markers and Paper
Slinky
Airplane
Blocks
Rubber Duck
MagnaDoodle
Pirate Playset
Car
Bear Puppet
Bubbles
Popper
Erin


100
80
60
40
20
0
% Selection
*
M&Ms
Sour Patch Kids
Cheetos
Gummy Bears
Cinnamon Toast
Tortilla Chips
Mike & Ikes
Sour Worms
Cheerios


100
80
60
40
20
0
% Selection
H
H
M
M
L
L
Walkie Talkies
Basketball w/ Hoop
Football
Baseball Mit w/ Ball
Bubbles
Bug Set
Snake
Cars
McDonald's Food
Little Person
Legos
Bath Toys
Planes
Puzzle
Bear Puppet
Book


100
80
60
40
20
0
% Selection
H
H
M
M
L
L
Luke
Cars
Walkie Talkies
Basketball w/ Hoop
McDonald's Food
Bear Puppet
Book


*
100
80
60
40
20
0
% Selection
Sour Gummy Worms
Pretzels
Oreos
Goldfish
M&Ms
Twizzlers
Cheetos
KitKat
Coco Puffs


H
H
M
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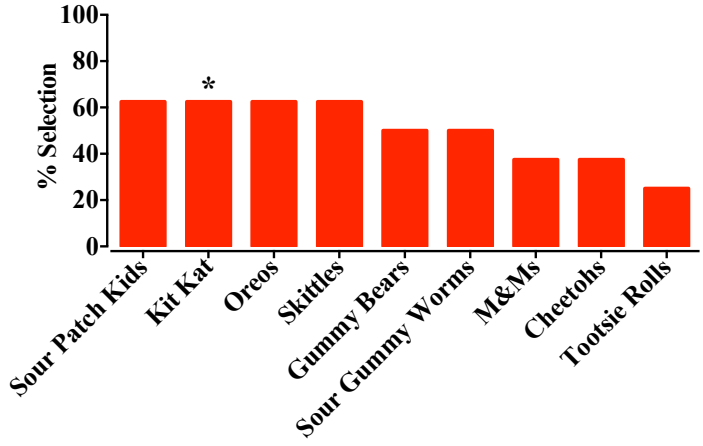
L
L
100
80
60
40
20
0
% Selection
Barbies
Ponies
Doll
Slinky
Cell Phone
Book
Playdoh
Paper & Crayons
Truck
Dog
Puzzle
Barbie Movie
Leapster
Pirate Playset
Little People
Potato Head
Matthew


100
80
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40
20
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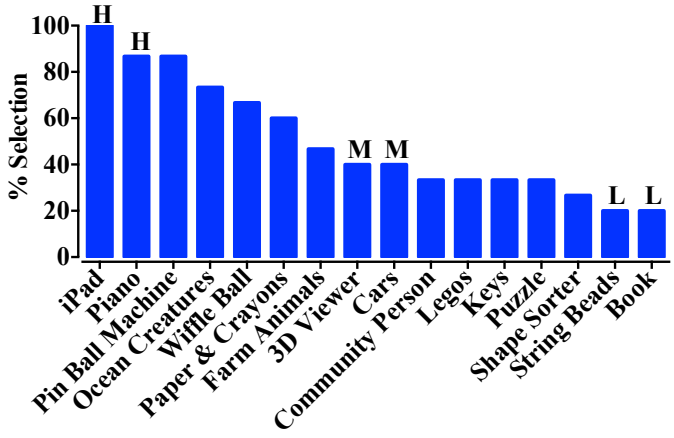
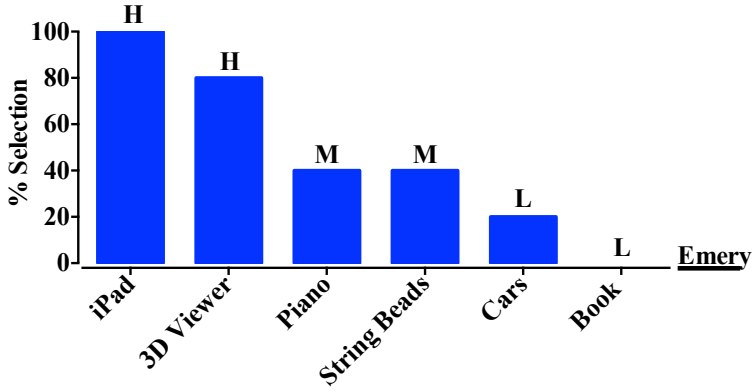
% Selection
*
Sour Patch Kids
Kit Kat
Oreos
Skittles
Gummy Bears
Sour Gummy Worms
M&Ms
Cheetohs
Tootsie Rolls


100
80
60
40
20
0
% Selection
H
H
M
M
L
L
iPad
Piano
Pin Ball Machine
Ocean Creatures
Wiffle Ball
Paper & Crayons
Farm Animals
3D Viewer
Cars
Community Person
Legos
Keys
Puzzle
Shape Sorter
String Beads
Book


100
80
60
40
20
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% Selection
H
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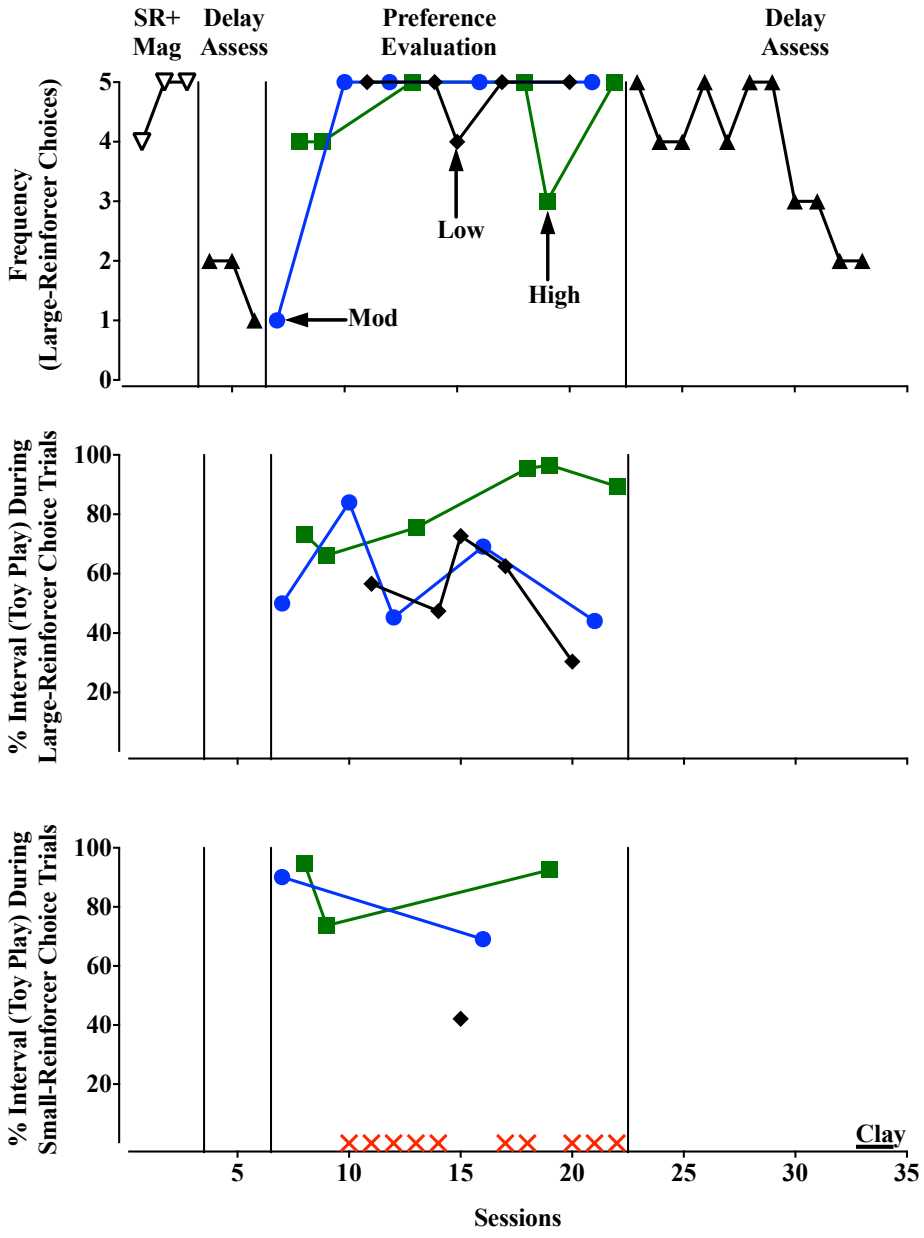
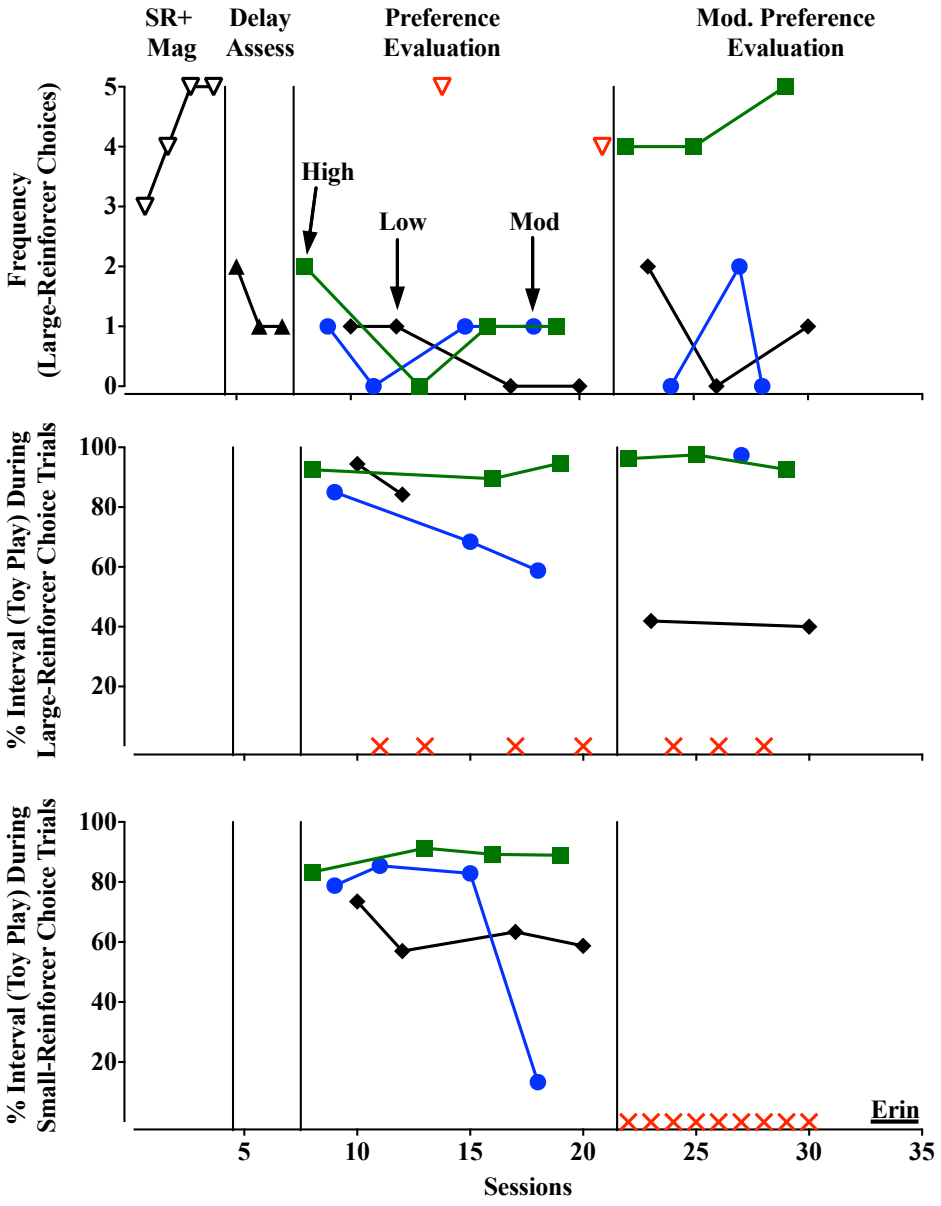
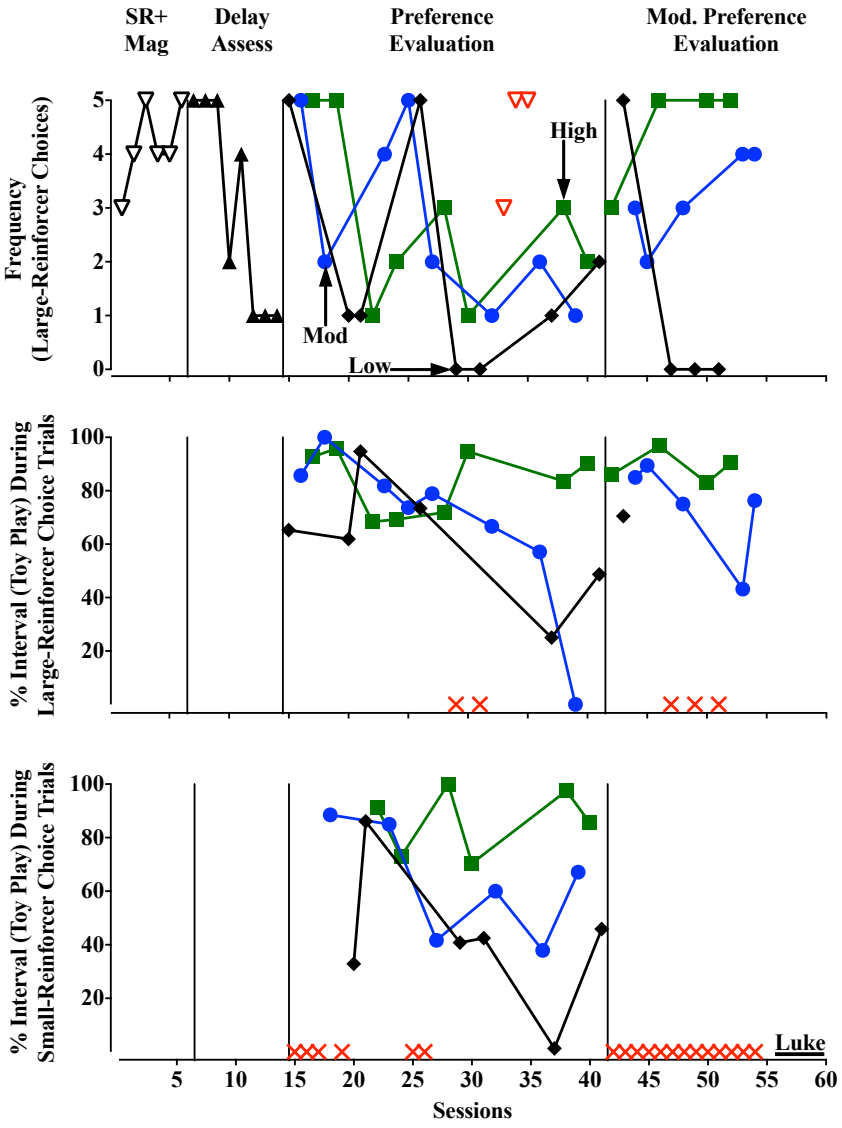
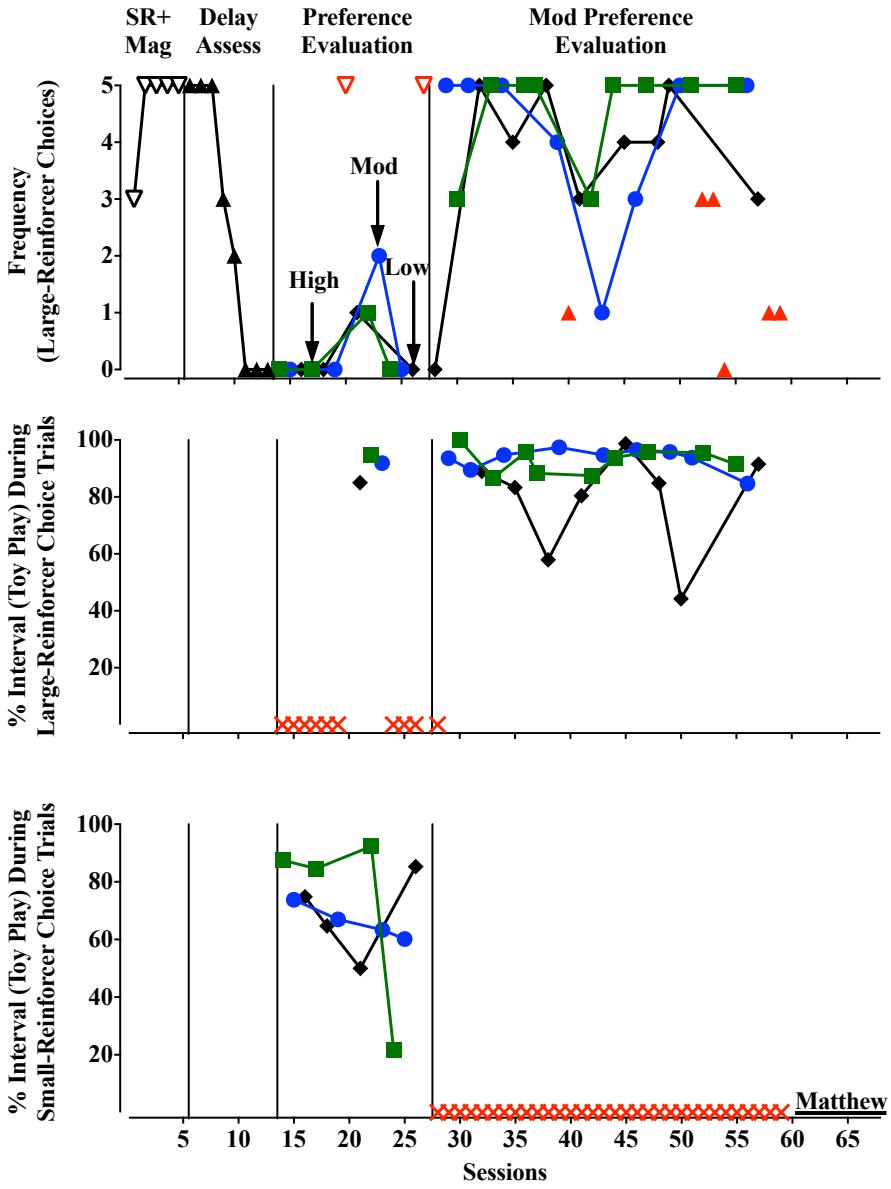
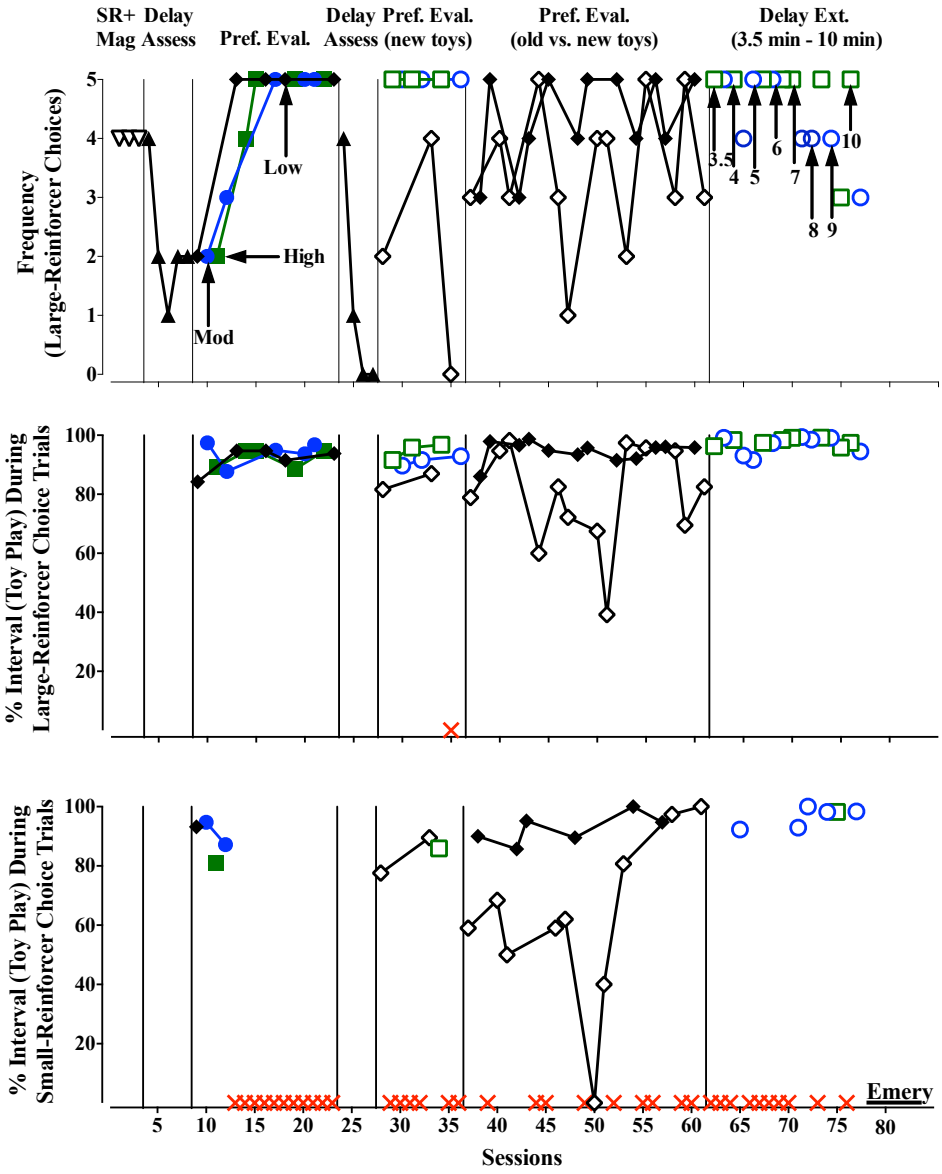
M
L
L
iPad
3D Viewer
Piano
String Beads
Cars
Book
Emery

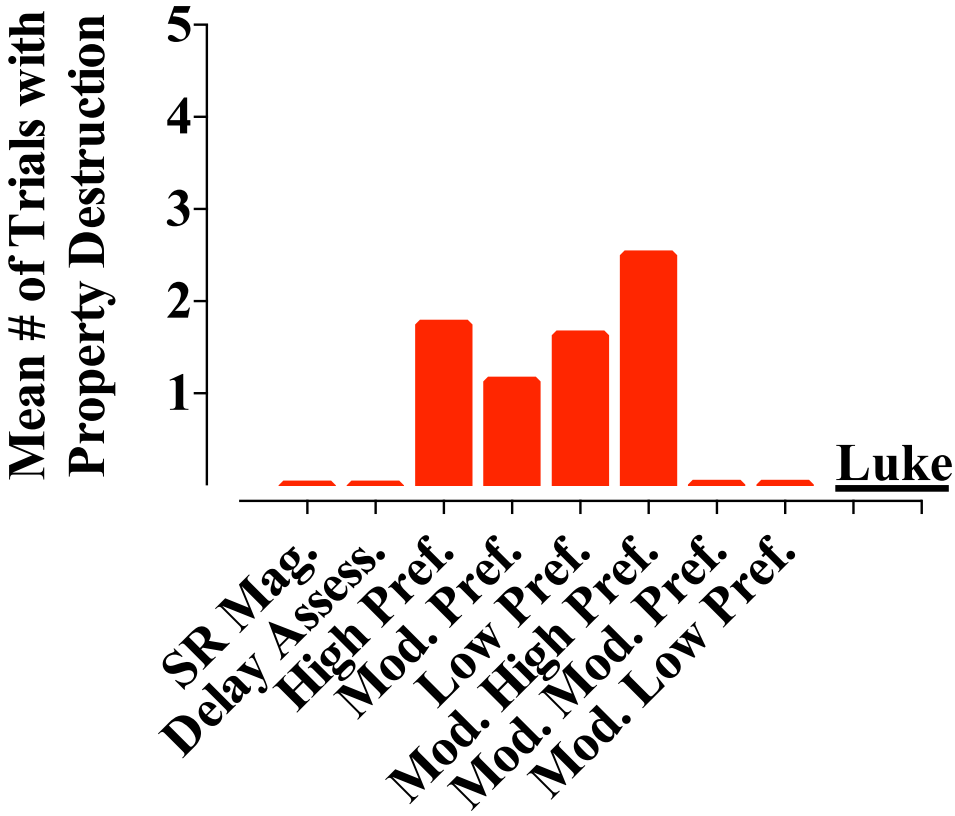

SR+ Mag
Delay Assess
Preference Evaluation
Delay Assess
Frequency (Large-Reinforcer Choices)
Mod
Low
High
% Interval (Toy Play) During Large-Reinforcer Choice Trials
% Interval (Toy Play) During Small-Reinforcer Choice Trials
Clay
Sessions


SR+ Mag
Delay Assess
Preference Evaluation
Mod. Preference Evaluation
Frequency (Large-Reinforcer Choices)
High
Low
Mod
% Interval (Toy Play) During Large-Reinforcer Choice Trials
% Interval (Toy Play) During Small-Reinforcer Choice Trials
Erin
Sessions


SR+
Mag
Delay
Assess
Preference
Evaluation
Mod. Preference
Evaluation
Frequency
(Large-Reinforcer Choices)
High
Mod
Low
% Interval (Toy Play) During
Large-Reinforcer Choice Trials
% Interval (Toy Play) During
Small-Reinforcer Choice Trials
Luke
Sessions

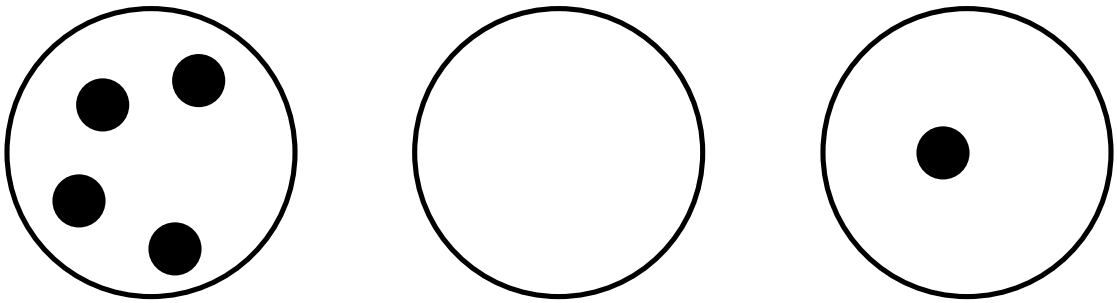

SR+ Mag
Delay Assess
Preference Evaluation
Mod Preference Evaluation
Frequency (Large-Reinforcer Choices)
Mod
High
Low
% Interval (Toy Play) During Large-Reinforcer Choice Trials
% Interval (Toy Play) During Small-Reinforcer Choice Trials
Matthew
Sessions


SR+ Delay Mag Assess
Pref. Eval.
Delay Pref. Eval. Assess (new toys)
Pref. Eval. (old vs. new toys)
Delay Ext. (3.5 min - 10 min)
Frequency (Large-Reinforcer Choices)
Low
High
Mod
3.5
4
5
6
7
8
9
10
% Interval (Toy Play) During Large-Reinforcer Choice Trials
% Interval (Toy Play) During Small-Reinforcer Choice Trials
Emery
Sessions


Mean # of Trials with Property Destruction
5
4
3
2
1
Luke
SR Mag.
Delay Assess.
High Pref.
Mod. Pref.
Low Pref.
Mod. High Pref.
Mod. Mod. Pref.
Mod. Low Pref.

APPENDIX A

The general set up for all sessions across all phases.



APPENDIX B

The set up for sessions with a delay of 3 min (delay assessment, preference evaluation, modified preference evaluation).