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Self-control in a child with an autism spectrum disorder: effects of delay and magnitude of reinforcement

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Self-control in a Child with an Autism Spectrum Disorder: Effects of Delay and Magnitude of
Reinforcement

A Thesis Presented

by

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In partial fulfillment of the requirements

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Abstract

Impulsive choice, or the choice to obtain a smaller reward that can be obtained sooner (SS) over a larger reward that can be obtained later (LL), may be related to problem behavior that can interfere with social, academic, and independent living skills. Self-control choice is defined as the choice to receive a larger reward after a longer period of time over a smaller but more immediate reward. Few strategies have been reported to increase self-control choice. One of the strategies for increasing self-control responding is systematically increasing the delay to the SS reward until response allocation shifts to the LL reward. This effect was demonstrated with adolescents with developmental disabilities (Ragotzy, Blakely, & Poling, 1988). The purpose of this study was to systematically replicate the study conducted by Ragotzy et al, with a child with an Autism Spectrum Disorder as a participant, and using edible items identified as highly preferred using a forced-choice preference assessment (Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992) as rewards instead of the arbitrary edible stimuli chosen by Ragotzy et al. In addition, self-control responding was evaluated using adjusting and fixed intertrial intervals (ITI) to determine whether or not ITI type affected responding. Results indicated that the participant demonstrated self-control responding when the SS reward was delayed, and response patterns did not differ in regards to the ITI type used.

Self-control in a Child with an Autism Spectrum Disorder: Effects of Delay and Magnitude of Reinforcement

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Self-Control in a Child with an Autism Spectrum Disorder: Effects of Delay and Magnitude of Reinforcement

Self-control can be defined as “A person’s ability to ‘delay gratification’ by emitting a response that will produce a larger (or higher quality) delayed reward over a response that produces a smaller, but immediate reward” (Cooper, Heron, & Heward, 2007, p. 704). In contrast, impulsivity would be defined as choosing the smaller, more immediate reward, over the larger, more delayed reward. Much research on self-control has been conducted in the field of applied behavior analysis (ABA), most of which derived from the basic lab (Rachlin & Green, 1972). However, many children with developmental disabilities, including attention deficit hyperactivity disorder (ADHD), also exhibit a lack of self-control, or impulsivity, in their natural setting (Logue, 2000). The same may also be true for children with autism. Because self-control is an important skill outside of the contrived basic lab setting, more research on the topic of self-control and impulsivity is needed in the applied setting.

The importance of exhibiting self-control becomes clear in the classroom setting for all children, particularly those with developmental disabilities. It is important to teach self-control to students with developmental disabilities because these students may exhibit disruptive and even harmful behaviors if they cannot access a particular reinforcer (or “reward”) immediately. According to Fisher and Mazur (1997), an individual’s allocation of responding is affected by variables such as response effort, reinforcement rate, and magnitude, quality, and immediacy of reinforcement. Therefore, teaching children self-control in the school setting could decrease problem behaviors, and substitute them with a more appropriate one, waiting, regardless of the maintaining variable for that particular

behavior.

Self-control and decreasing challenging behavior

Increasing self-control has been used in the applied setting to reduce escape maintained problem behavior for “difficult” task demands. In a study conducted by Cuvo, Lerch, Leurquin, Gaffaney, and Poppen (1998), 6 participants were presented with work requirements and a reinforcement schedule. At first, the reinforcement schedule for both sets of work requirements was the same, and Cuvo and his colleagues found that participants allocated responding to the “easier” work requirement (easier meaning less of the particular task needed to be completed for reinforcement to be delivered). When the schedule of reinforcement was thinned for the “easier” task demand, response shifted away from this task. However, all participants maximized reinforcement while minimizing response effort. According to Catania (2007) maximizing refers to emitting a response with a higher probability of reinforcement when given the option to emit two or more responses. This is crucial to note when teaching self-control because according to the matching law, rates of responding across choice conditions will proportionally match the rates of reinforcement (Cooper, Heron, & Heward, 2007). In other words, waiting for the larger delayed reinforcer needs to be worth the response effort for the individual.

Self-control and increasing appropriate behavior

In a study conducted by Dixon, Hayes, Binder, Manthey, Sigman, and Zdanowski (1998), researchers targeted self-control and the increase in appropriate behaviors for three adults with developmental disabilities. During baseline, the selected target behavior for each participant (group activity, in-seat behavior, or exercising, respectively) remained at zero. During training, with the use of a progressive-duration requirement of engagement

in the target behavior, all participants consistently chose to stay engaged in target behaviors for an increased duration to gain access to the larger reinforcer. Researchers concluded that while increasing self-control may be a beneficial component in a treatment package for decreasing aberrant behaviors, it may be used to increase appropriate behaviors as well.

Increasing Self-control

Self-control can be assessed, and subsequently taught, in various different ways. Using pigeons as subjects, Rachlin and Green (1972) succeeded in increasing self-control responding by allowing subjects to make a commitment response that would make a later option for impulsive responding unavailable. When subjects were given a choice between a smaller immediate reward or a larger delayed reward, all subjects chose the smaller more immediate reward. When given a choice between this initial link in which both options were available, or an initial link in which the option to choose the smaller reward was turned off, subjects' chose the initial link for which impulsive responding was restricted, increasing self-control responding.

Another way in which self-control responding can be established is by systematically increasing the time delay to the larger reinforcer, as Schweitzer and Sulzer-Azaroff did in their 1988 study. Here, all participants initially chose the smaller reinforcer over the larger one when delay to the larger reinforcer exceeded 15 s. During training, both the smaller reinforcer and a larger reinforcer (edibles for some participants, stickers for others) were available to each participant without delay. After responding became stable, the larger reinforcer was systematically delayed by intervals of 5 s until the participant's responding once again became stable. Through this systematic delay, experimenters were

successful in teaching the self-control choice to all participants up to a 20 s delay (5 s longer than pre-training), and one participant continued to choose the larger reinforcer with up to a 65 s delay. Researchers concluded that teaching self-control is possible for students that may make more impulsive choices in terms of access to positive reinforcement.

Another study of central importance to teaching self-control to individuals with developmental disabilities is a study conducted by Ragotzy, Blakely, and Poling (1988) in which three individuals with severe mental retardation were taught to choose a larger more delayed edible reinforcer over a smaller more immediate one. Here, Cocoa Puffs were chosen as a reinforcer, with one piece of cereal representing the smaller reinforcer and three pieces of cereal representing the larger reinforcer. Each reinforcer was associated with a particular stimulus card, being either a yellow square or a purple circle, which was assigned randomly to each response choice in the concurrent-operants arrangement. Each subject was first given five sessions of pre-training, each consisting of 20 trials in which two familiar objects were placed on the desk. The participant was asked to “touch__”, and was verbally praised if the participant did this correctly. After pre-training, training occurred, where each session consisted of 10 forced trials and 10 choice trials. For each forced choice session the participant was seated at a desk facing the experimenter and either the yellow square or a purple circle was presented on the table in front of a student (the other stimulus was covered with a white card). The participant was then asked to “pick one”. Once the participant pointed to the stimulus, the response card was removed and the delay interval associated with that stimulus began. The procedure for choice trials was the same as forced choice trials, with the exception that both response

cards were presented in random placement on the desk in front of the participant. Also, in choice trials, a minimum intertrial interval (ITI) of 10 s was selected, and if the participant chose the smaller but more immediate reinforcer, the delay interval of the larger reinforcer was added to the ITI to insure that rate of reinforcement was not affected by choice responding.

In phase 1 of the study, neither the smaller nor the larger reinforcer was delayed across sessions or across participants. The purpose of this phase was to assess preference when no delay was in place. Here, subjects consistently chose the larger reinforcer. Once responding was stable, delivery of the larger reinforcer was initially delayed by 5 s, and this delay increased by intervals of 5 s until choice allocation shifted from the larger reinforcer to the smaller reinforcer. For participants 1, 2, and 3, this shift occurred after the larger reinforcer was delayed by 10 s, 20 s, and 30 s, respectively. This delay was then systematically decreased in intervals of 5 s until both reinforcers were again available immediately upon responding.

In phase 2, researchers assessed the effects of systematically delaying both the larger and the smaller reinforcers. In the initial condition of this phase, the smaller reinforcer was not delayed at all, and the larger reinforcer was delayed by the amount of time that shifted response allocation to the smaller reinforcer in phase 1. Following this condition, each condition added 5 s to the delay time of both the larger and the smaller reinforcer until 80% of responding was allocated toward the response card associated with the larger reinforcer for 3 consecutive sessions. This occurred when the smaller reinforcer was delayed by 15 s for participant 1, and for 25 s for participant 2. For participant 3, delays for the smaller reinforcer were increased to 30 s and the larger was increased to

60 s, but at this point, considerable emotional responding was observed, and delays were no longer increased for either reinforcer. From this study, Ragotzy, Blakely, and Poling concluded that teaching self-control in the form of a progressive delay to edible reinforcement was possible for people with severe developmental disabilities.

The purpose of the current study was to systematically replicate the Ragotzy, Blakely, and Poling (1988) study, using a child with an autism spectrum disorder. A second purpose of the study was to compare experimental session response patterns when using adjusting and fixed intertrial intervals.

Method

Participant

The participant for this study was a 13 year-old girl diagnosed with autism. She attended a school for autism and other developmental disabilities, and was a full time resident at this school. According to her primary caregiver, edible items were often used as reinforcers for appropriate behavior, and it was reported that she had prerequisite skills needed for inclusion of the study, including sitting in a chair, scanning, pointing with an isolated finger, and using a computer mouse.

Apparatus and stimuli

Sessions were conducted 4 times per week in the residential facility where the participant lived. Sessions occurred in the hour prior to meal times (in the 4pm hour), when edible reinforcement was potentially most motivating for the participant. The session room contained a table and chair, bookshelves containing books and toys, and a staircase leading to the main floor of the house. The participant was seated away from all potential distractors (the windows, door leading to outside of the residence, staircase, and all books

and toys). Each session was programmed using Apple Keynote, and all sessions were presented on a MacbookPro laptop screen. The participant responded to each presented trial by clicking on the stimulus or one of the two stimuli (depending on trial type) using a wireless mouse. During all pre-experimental sessions as well as experimental sessions, the stimuli were a yellow square and a purple circle, each 1.75 in x 1.75 in in size, and located 1.5 in from the side margin, 2.5 in from the top of the screen, 2.5 in from the bottom of the screen, and 3 in from one another. During delay to reinforcement, the screen was either purple or yellow, which corresponded with the stimulus chosen for that particular trial. For the ITI the screen was black. When each trial was presented on the screen, a tone was presented as a prompt for the participant to make a selection. Once the selection was made, the delay screen with the programmed delay time was presented, and then the ITI screen, which was accompanied by a “pop” sound was presented as a cue that the reinforcer has been delivered. For all sessions, the laptop was positioned flat on the table top, 12 in from the participant.

Measurement and data collection

For this study, self-control responding was measured for the 10 free-choice trials within each session for the four experimental phases. Self-control responding was recorded when the participant clicked on the discriminative stimulus associated with the larger, more delayed reinforcer. Participant responses for all 10 trials of the session were recorded on the data sheet with an “L” recorded for all self-control responses, and an “S” recorded for all impulsive responses.

Interobserver agreement

An independent observer scored 33% of all sessions, in all conditions, and in all four phases, for comparison with the scoring of the primary data collector. An agreement was defined as identification by both observers of the occurrence or nonoccurrence of the target response (self-control responding). Interobserver agreement (IOA) was calculated by dividing the number of agreements by the number of agreements plus disagreements, and multiplying by 100%.

For the first exposure of the adjusting ITI sessions and the fixed ITI sessions IOA was 100%. For the second exposure of the adjusting ITI sessions, IOA was 92%, for an average of 97% (range, 92%-100%) reliability between observers.

Procedure

Preference Assessment. Prior to all other pre-experimental sessions, a paired stimulus preference assessment was conducted using the procedure outlined by Fisher, Piazza, Bowman, Hagopian, Owens, and Slevin (1992). For this procedure, 8 stimuli were identified using the results of a survey, which was filled out by the case manager for the student prior to the start of this study. These stimuli included Milk Duds, dried mango, yellow skittles, tootsie rolls, mini oreos, craisins, twizzlers, and purple nerds. The preference assessment consisted of a paired stimulus assessment, where the 8 stimuli were presented in pairs, each stimulus being presented once with every other stimulus in a randomized order. For each trial, the two stimuli were presented on the table top 1 ft from the student and at a distance of 1 ft from each other. Approaching one edible stimulus resulted in access to eating the edible. Approach was recorded if the participant reached toward the stimulus, picked the stimulus up, and consumed the stimulus. If the edible was

not consumed, the experimenter represented the trial. If neither edible was consumed on the represented trial, the experimenter removed the stimuli and moved on to the next trial.

Pre-experimental sessions

Session behavior assessment. One session was conducted to ensure that the participant had the necessary prerequisite skills to participate in the study (in-seat behavior, scanning, and clicking a stimulus presented on a computer screen). At the beginning of this session, the participant was seated in a chair at a table across from the experimenter, who modeled sitting in the chair facing forward, with both feet on the ground and both hands in their lap. Once the participant was seated in this way, the experimenter placed the laptop in front of the participant. On the left side of the display was the yellow square stimulus, and on the right side was the purple circle stimulus. The participant was then asked to “touch (yellow/purple).” If participant touched the correct stimulus, verbal praise (e.g., “good job”) was delivered and a small piece of a highly preferred edible (as identified in the preference assessment) was placed in front of the student. If the participant did not click on the correct stimulus, the student was prompted to make the correct response on the next trial. Prompting consisted of the experimenter immediately pointing to the correct stimulus as they gave the directive, “touch (yellow/purple).” Correct responding was followed with praise, but no edible item. This session consisted of 10 trials. If the participant completed this task with 100% independent and correct responses, they were included in the study. If the participant at any time in this session responded with two consecutive incorrect prompted trials they were excluded from the study.

Work assessment. Prior to experimental sessions, a work assessment was conducted to evaluate whether or not the participant would exhibit self-control responding with a work task that mimicked a task that may be presented in the applied setting. For this assessment, tangible stimuli that were identical to the shape and dimensions of the stimuli used in the training sessions were velcroed onto the front of a white piece of paper. Each session began with 10 forced-choice trials, with the purple circle correlating with one trial of receptive identification of body parts (i.e., “touch head”, “touch stomach”, touch foot”) and one piece of a moderately preferred edible, and the yellow square correlating with 10 trials of receptive identification of body parts and four times the amount of that moderately preferred edible. Following the forced-choice trials were 10 free-choice trials, in which both stimuli were presented, and the participant chose one of the stimuli. After a choice response was made, the participant was then presented with the task associated with the discriminative stimulus chosen for that free-choice trial.

Magnitude assessment. Following the work assessment, a magnitude assessment was conducted to ensure that the participant would choose four pieces of an edible over one piece of the same edible when all other variables remained constant. To do this, four pieces of the participant’s highest preferred edible (as indicated by the prior preference assessment) was placed 12 in in front of, and 6 in to the left of, the participant. One piece of the highest preferred edible was simultaneously presented to the participant 12 in in front of, and 6 in to the right of, the participant. The participant was then asked to “pick one”. This assessment consisted of 10 trials designed in this way, and if the participant chose four pieces of the edible over one piece of the edible 100% of the time (10/10 trials), they

were included in the study. If the participant did not choose the larger quantity of edibles, they were excluded from the study.

Experimental sessions. Following all pre-experimental assessments, the experimental portion of the experiment was conducted. The experimental procedure was the same as the pre-experimental procedure, with one stimulus presented on the right or left side of the screen for forced choice trials, and with both stimuli presented on the right and left side of the screen for free choice trials. Each session contained 10 forced-choice and 10 free-choice trials, and the stimuli used were the yellow square and purple circle described above.

Each trial began with the experimenter placing the laptop in front of the participant, and modeling clasped hands and feet on the floor. The experimenter then waited for the participant to imitate clasped hands and feet on floor before beginning the session. The location in which each of the stimuli (yellow square and purple circle) was static, for example, with the yellow square on the left, and the purple circle on the right. As the first trial was presented, the participant was asked to “pick one”.

Forced-choice trials. During forced-choice trials, only one stimulus was present on the screen, in its usual location (e.g., the yellow square would appear on the left and the purple on the right). When the participant touched the stimulus, a solid-color slide that was the color of the chosen stimulus (i.e., either yellow or purple) appeared on the screen, and the associated delay-to-reinforcement interval (hereafter, delay interval) began. After the delay interval elapsed, a “pop” tone sounded, signaling the delivery of the reinforcer corresponding to the chosen stimulus (one small piece of the edible if the participant touched the stimulus correlated with the smaller sooner reward, or SSR, or three small

pieces of edible if the participant touched the stimulus correlated with the larger later reward or LLR).

Free-choice trials. In free-choice trials, both stimuli were presented to the participant at the start of the trial, and the participant was told to “pick one”. Once a selection was made, the slide containing the stimuli was removed and the next slide, which was a slide consisting of the color of the chosen stimulus came on the screen. At this time the delay to reinforcement began. Throughout the study, each experimental condition remained in effect until responding stabilized for that particular participant. The criterion for stability was three consecutive sessions in which response allocation toward one stimulus did not change at all, or five consecutive sessions in which choice responding varied by less than 10%.

Intertrial intervals. Sessions were conducted using either adjusting intertrial intervals (ITI) or fixed intertrial intervals. For adjusting ITI sessions, ITIs during each session were systematically manipulated so that response allocation could not result in a higher rate of reinforcement for choosing the smaller, less delayed reinforcer. To do this, the stimulus correlated with the larger reinforcer had an ITI of 2 s. The delay to reinforcement for the larger reinforcer was added to this, made up the total trial time. To account for total trial time equality, the ITI for the smaller reinforcer was manipulated so that it was equivalent to the delay to reinforcement plus ITI for the larger reinforcer (See Table 1). For fixed ITI sessions, all ITIs for both response choices remained at 2 s (see Table 2). The purpose of this was to determine whether the participant would maximize her rate of reinforcement by making more impulsive choice responses in sessions using fixed a fixed ITI. If the participant’s responding did not differ in regards to the ITI type

used, this may indicate that ITI is arbitrary and using an adjusting ITI rather than a fixed ITI may not be a controlling variable for responding. If this is the case, using a fixed ITI may be more beneficial for the applied setting due to the ease of implementation.

This experiment was conducted using an ABA reversal design in which adjusting ITI sessions were conducted in four phases until the participant met the criterion for terminating sessions (self-control choice responding when both the larger and smaller reward were delayed), followed by the presentation of the four experimental phases using fixed ITIs, and finally representing the four experimental phases using adjusting ITIs.

Post-Experimental sessions

Work assessment. After the participant was finished with all experimental sessions, the work assessment was re-presented to determine whether the participant's self-control responding during delay to reinforcement would generalize to self-control responding when given a choice between 1 trial of a task for a small edible or 10 trials of the same task for a larger edible.

Results

The paired stimulus preference assessment given to the participant prior to all other pre-experimental assessments resulted in mini Oreos as the highest preferred edible item. When given a choice between two edibles (which were varied throughout the preference assessment), stimuli chosen over 80% of the time were considered highly preferred edibles, stimuli chosen between 50%-80% of the time were considered moderately preferred edibles, and the stimuli chosen less than 50% of the time were considered low preferred edibles. The percentages in which the participant chose each stimulus were as follows: Oreos (86%), yellow skittles (79%), tootsie rolls (64%), milk

duds (57%), twizzlers (36%), craisins (21%), dried mango (14%), and purple nerds (14%). Due to the results of the preference assessment, mini Oreos were the only edible item considered highly preferred, and therefore the only edible item used as a reward throughout the training portion of the study. For the work assessment portion of the study, milk duds (57%) were chosen as the moderately preferred edible to be delivered as reinforcement.

When presented with one pre-experimental session, in which the participant was seated in front of a computer screen with a yellow square positioned on the left side of the screen and a purple circle positioned on the right side of the screen, the participant independently pointed to the correct stimulus when given the vocal Sd to “touch yellow” or “touch blue” in 10/10 programmed opportunities. 100% correct responding resulted in participation for subsequent assessments, as well as the experimental portion of the study.

For the first work assessment, 10 forced-choice trials and 10 free-choice trials were delivered in which the yellow square was associated with 10 trials of receptive identification of body parts followed by three pieces of milk dud upon completion, and the purple circle was associated with one trial of receptive identification of body parts and one piece of milk dud upon completion. For 100% of free choice trials, the participant chose the discriminative stimulus for one trial of receptive identification of body parts, and received one piece of milk dud for completing each trial requirement.

In an effort to verify that the participant would prefer a larger quantity of an edible item over a smaller quantity of the same edible item, a magnitude assessment was conducted. This assessment consisted of 10 trials in which one mini Oreo was presented in front of and to the left hand side of the participant, as well as $\frac{1}{4}$ of a mini Oreo presented in

front of and to the right hand side of the participant. The participant was then asked to choose. In 100% of trials, the participant chose the full mini Oreo.

Figure 1 shows summary data for the first exposure of the adjusting ITI sessions. Summary data consisted of the last three sessions within each experimental condition. Phases 1 and 2 are located on the top panel of the graph, and Phases 3 and 4 are located on the bottom panel of the graph. In Phase 1, when both the larger and smaller reinforcers were available immediately, the participant allocated 100% of responding toward the larger reinforcer. This continued when the SS reward was immediate and the LL reward was delayed by 2 s. Responding shifted when the SS reward was available immediately and the LL reward was available after 4 s, with the participant allocating 100% of responding to the SS reward. Results from Phase 1 were replicated in Phase 2 with the exception of the first data point when both larger and smaller were immediate, or 0 s(0 s) delay. Here 90% of responding was allocated toward the larger reinforcer, and 10% was allocated toward the smaller reinforcer. Since >80% of responding was the criteria for self-control responding, the participant was considered to be exhibiting self-control responding.

In phase 3, both the smaller and larger reinforcer were systematically delayed in 2 s intervals until participant's responding shifted back to the LL reward. In the first condition of this phase, the larger reward was delayed by 6 s and the smaller reward was delayed by 2 s. This resulted in 100% responding toward the smaller reward. When delay intervals were increased to 8 s(2 s), responding shifted, and 100% of responding was allocated toward the larger reinforcer. This was replicated in Phase 4.

Figure 2 shows participant summary data for fixed ITI sessions. Phases 1 and 2 are located on the top panel of the graph, and Phases 3 and 4 are located on the bottom panel

of the graph. In Phase 1, Responding for the second portion of the study (fixed ITI) was like that of the first portion (adjusting ITI) in that the participant allocated responding exclusively to the larger reinforcer when both were available immediately, and shifted responding when the larger reinforcer was delayed. Unlike the first portion of the study, the participant continued to respond exclusively toward the larger reinforcer when the smaller was available immediately and the larger was delayed by 4 s. For these sessions, responding did not shift toward the smaller reinforcer until the larger was delayed by 6 s. Here, responding was 100% toward the smaller reinforcer. Phase 2 replicated the results found in Phase 1 with the exception of the percentage of trials in which she chose the larger reinforcer in the 6 s(0 s) condition. In this condition, the participant allocated 20% of responses toward the larger reinforcer, which still met the >80% criteria for impulsive choice responding.

In Phase 3, responding immediately shifted to the LL reward when both the smaller and larger reward were delayed. In this condition, the LL was delayed by 8 s and the SS was delayed by 2 s, resulting in 100% responding toward the larger reward. This was replicated in Phase 4.

Figure 3 shows participant summary data for the second exposure of the adjusting ITI sessions. Phases 1 and 2 are located on the top panel and Phases 3 and 4 are located on the bottom panel of the graph. Like the previous portions of this study, In Phase 1 responding was allocated exclusively toward the larger reinforcer when both larger and smaller reinforcer were immediate. Responding continued at 100% toward the larger reinforcer during the 2 s(0 s) delay, and at 90% in the 4 s(0 s) delay. Responding then shifted toward the smaller reinforcer when the larger reinforcer was delayed by 6 s. Phase

2 replicated these results, with the exception of 100% responding toward the larger reinforcer (as opposed to the 90% in Phase 1) in the 4 s(0 s) delay condition.

In Phase 3, responding shifted immediately to the larger reward with 100% response allocation when both the larger and smaller reward were delayed. In this condition the larger reward was delayed by 8 s and the smaller reward was delayed by 2 s. These results were replicated in Phase 4.

When the use of adjusting ITIs were compared with the use of fixed ITIs, no difference in responding was found. While responding shifted exclusively toward the smaller reinforcer after the larger was delayed by 6 s in the fixed ITI sessions and only after 4 s in the initial adjusting ITI sessions, response patterns for the second presentation of the adjusting ITI sessions were similar to that of the fixed ITI sessions, with a responding shift at 6 s. In Phases 3 and 4 of the initial adjusting ITI, responding shifted back to the larger reward after two conditions in which the SS was systematically delayed in intervals of 2 s. In the fixed ITI as well as the second presentation of adjusting ITI sessions, responding shifted exclusively back to the LL reward after only one delay condition (SS delayed by 2 s).

Discussion

For the present study, the researcher has concluded that delaying the availability of a smaller reward was effective in increasing self-control responding toward a larger, more delayed reward, replicating the findings of Ragotzy et al., 1988. In addition, the experimenter found no difference in response patterns when using a fixed ITI as opposed to an adjusting ITI for training sessions.

Exhibiting self-control choices, or choosing a larger, more delayed reward over a smaller, more immediate reward has many advantages in the applied setting. Making self-

control choices may lead to a decrease in attention maintained problem behavior by allowing a greater time delay between a request for attention and the delivery of attention. It may also decrease problem behavior associated with waiting for tangible items, or access to preferred activities. This may in turn lead to an increase in environments for which the particular individual is successful. For example, if a child is able to exhibit self-control responding, he or she may choose to wait at a restaurant instead of eating fast food that can be prepared quickly. Group activities or turn-taking games may become appropriate activities due to the ability to wait for reinforcement while the social peer is taking their turn. He or she may also be able to earn larger reinforcers such as community trips, watching an entire movie, or eating a larger snack if they are able to exhibit self-control. Without self-control responding, these reinforcers would likely become unavailable due to time constraints, socially stigmatizing behavior, or interference with academic programming.

The purpose of the pre-experimental and post-experimental work assessments were to evaluate whether self-control responding would generalize from a time delay to a work requirement setting. The ability to complete a full session of work (in this case, 10 trials) before obtaining reinforcement would be beneficial for students who may otherwise work on an FR1 schedule of reinforcement. By delaying reinforcement for 10 trials of work, students may be able to finish academic sessions free of the challenging behavior associated with waiting for a preferred item. In both work assessments, the participant was asked to choose between a discriminative stimulus associated with one trial of work and a smaller reinforcer, or 10 trials of work and a larger reinforcer, resulting in 100% response allocation toward the smaller work requirement in both assessments. This may have been

due to the overall trial length (delivery of vocal Sd, participant's response, delivery of reinforcement, and ITI) exceeding that of the time delay sessions used in the experimental sessions. If this were the case, 10 trials of work would equate to a much longer delay than that of even the longest delay in which the participant waited in experimental sessions (8 s). In attempts to generalize the response patterns found in training sessions, future research may focus on systematically increasing the work requirement for the discriminative stimulus associated with less work.

In terms of generalization of self-control responding to a more applied, academic setting, the second focus of this study becomes especially important. In this study, the experimenter found that there was no difference in responding between sessions in which a fixed ITI was used in comparison with an adjusting ITI. Due to the ease of implementation of a fixed ITI (not needing to equate trial length), procedural integrity in the applied setting could potentially be much higher when using a fixed ITI. Implementing the same procedures used in this study, along with a fixed ITI, may successfully increase self-control responding in the applied setting, both with delay to reinforcement, as well as increased work requirements to obtain reinforcement.

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Table 1

Adjusting ITI Values: Exposure 1

<u>Phase</u>	<u>Condition</u>				
	<u>(# of sessions)</u>	<u>Delay to LL</u>	<u>LL ITI</u>	<u>Delay to SS</u>	<u>SS ITI</u>
1	1 (19)	0	2	0	2
	2 (3)	2	2	0	4
	3 (8)	4	2	0	6
2	1 (4)	2	2	0	4
	2 (3)	0	2	0	2
	3 (5)	4	2	0	6
3	1 (3)	6	2	2	6
	2 (3)	8	2	4	6
4	1 (3)	6	2	2	6
	2 (4)	8	2	4	6

Note. Table 1 encompasses the 4 experimental phases within the first exposure of adjusting ITI sessions. In column one is the phase number, in column two is the number of conditions within each phase along with the number of sessions it took to meet the criterion to move onto the next condition. Column three is the delay to the larger reinforcer; column four is the ITI duration associated with the larger reinforcer. The fifth

column is the delay values for the smaller reinforcer, and the sixth column are the ITI values for the smaller reinforcer. Total trial time was equated for both choice responses.

Table 2

Fixed ITI values

<u>Phase</u>	<u>Condition</u> <u>(# of</u> <u>sessions)</u>	<u>Delay to LL</u>	<u>LL ITI</u>	<u>Delay to SS</u>	<u>SS ITI</u>
1	1 (5)	0	2	0	2
	2 (3)	2	2	0	2
	3 (5)	4	2	0	2
	4 (7)	6	2	0	2
2	1 (6)	4	2	0	2
	2 (5)	6	2	0	2
	3 (5)	2	2	0	2
	4 (3)	0	2	0	2
3	1 (3)	8	2	2	2
4	1 (4)	8	2	2	2

Note. All columns similar to that of Table 1. For fixed ITI sessions, trial time was not equated, and all ITI values were held at a constant 2s

Table 3

Adjusting ITI values: Exposure 2

<u>Phase</u>	<u>Condition</u> <u>(# of</u> <u>sessions)</u>	<u>Delay to LL</u>	<u>LL ITI</u>	<u>Delay to SS</u>	<u>SS ITI</u>
1	1 (4)	0	2	0	2
	2 (3)	2	2	0	4
	3 (5)	4	2	0	6
	4 (8)	6	2	0	8
2	1 (3)	4	2	0	6
	2 (3)	2	2	0	4
	3 (3)	0	2	0	2
	4 (3)	6	2	0	8
3	1 (3)	8	2	2	8
4	1 (3)	8	2	2	8

Note. All columns similar to that of Table 1. For the second exposure of adjusting ITI sessions, total trial time was once again equated by keeping the ITI values for the LL reinforcer at 2s and adjusting the ITI values for the SS reinforcer to equal the delay to the corresponding LL plus 2s.

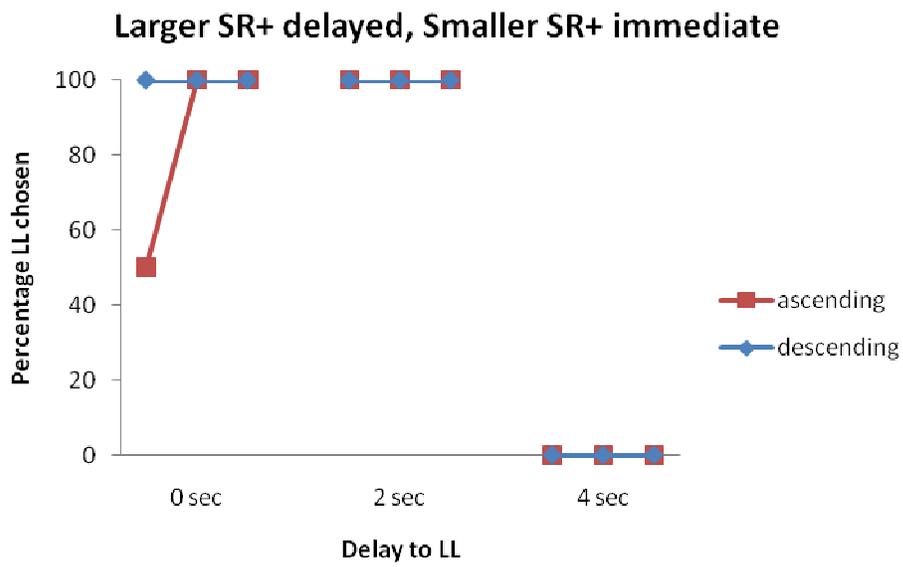
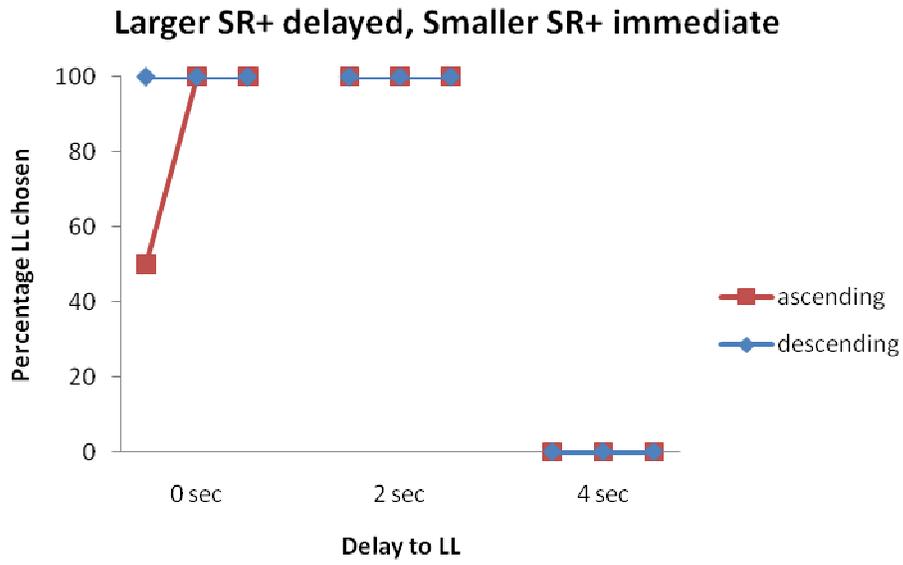


Figure 1

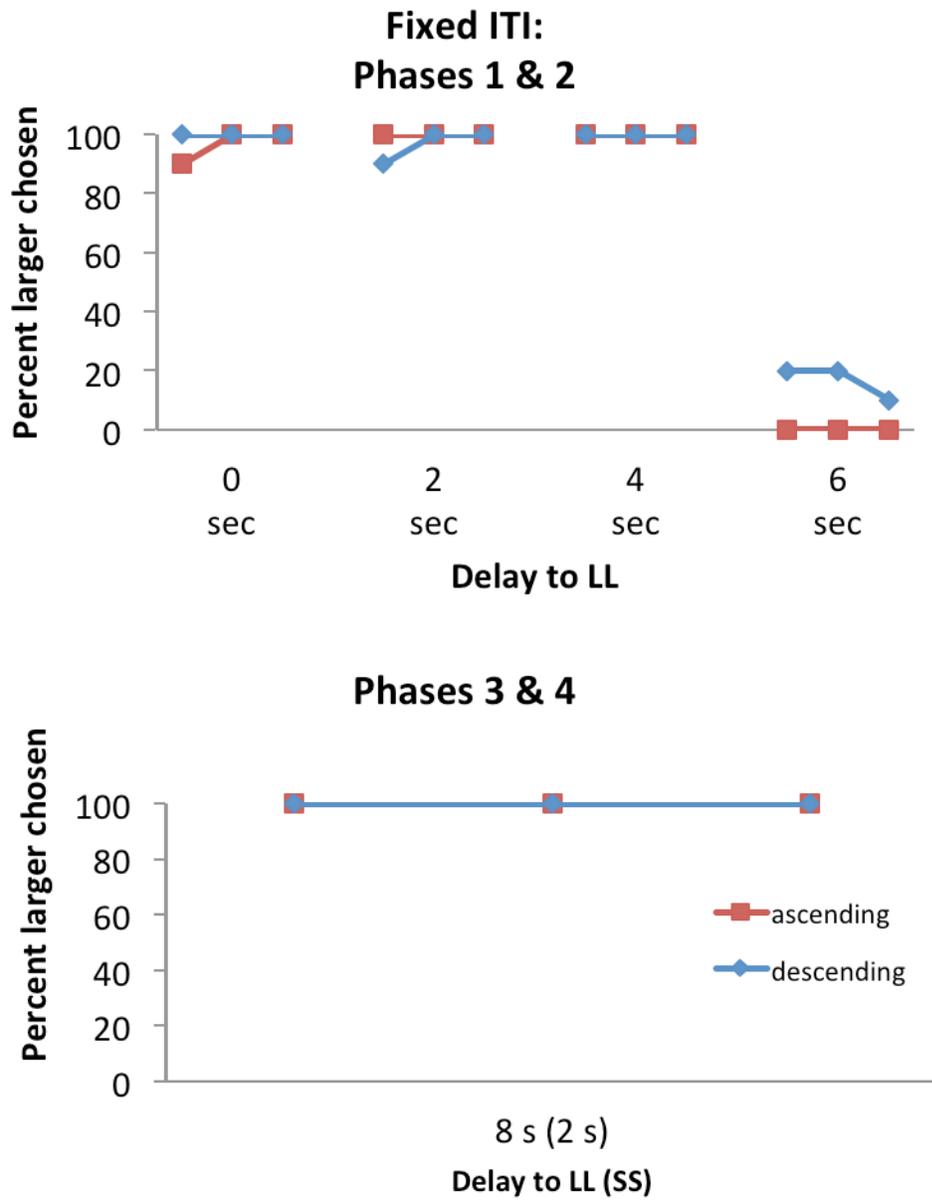


Figure 2

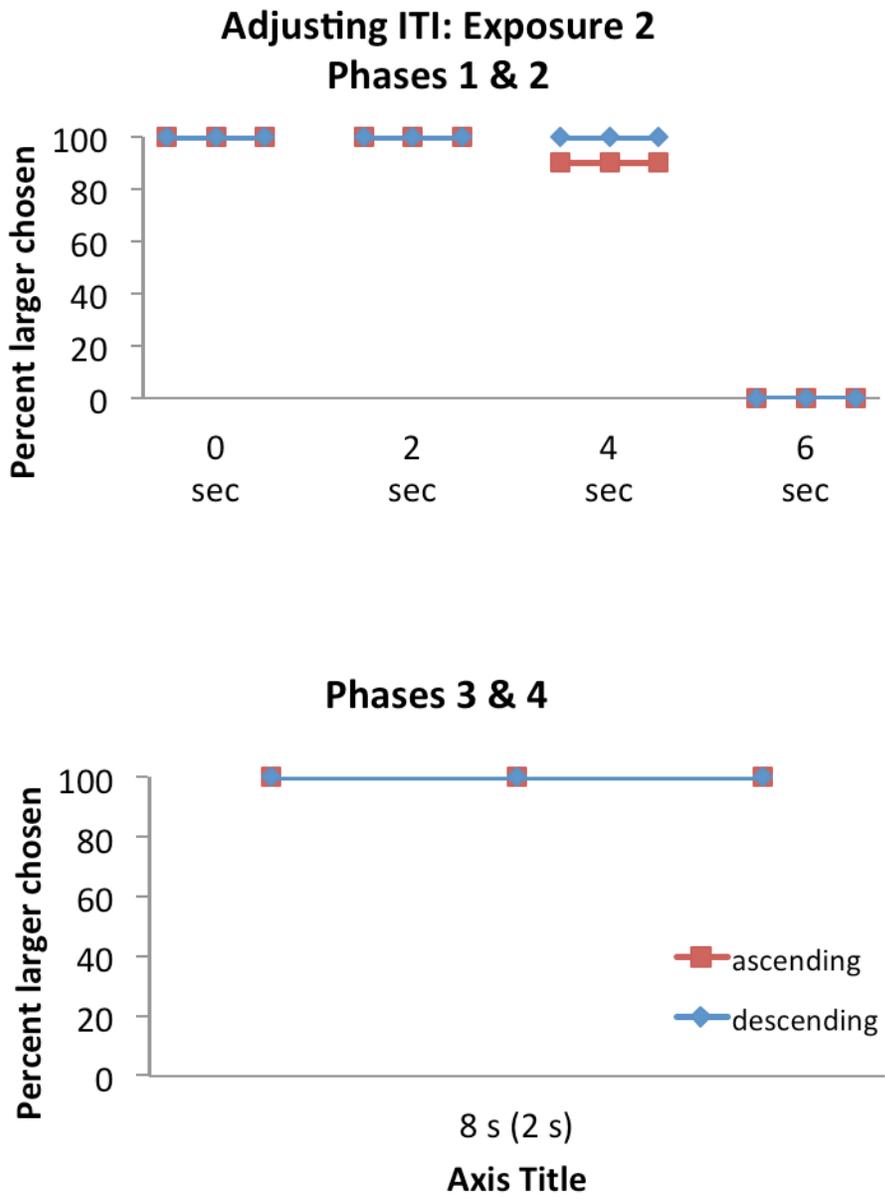


Figure 3