ASSESSING THE IMPACT OF REINFORCER DELAY ON CHOICE ALLOCATION

by

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(Under the Direction of Kara Wunderlich)

ABSTRACT

Choice allocation is a behavior that is sensitive to various dimensions of reinforcement. In order to influence an individual's choice-making, it is first important to consider how dimensions of reinforcement can be manipulated to produce appropriate behaviors and more desirable treatment outcomes. The purpose of this study was to introduce an analogue assessment designed to assess the impact of reinforcer delay on an individual's choice allocation between a more preferred behavior and a less preferred behavior. Once a preferred task was identified for the participant, delay to reinforcement was increased for the more preferred task only. The participant shifted his choice allocation once the delay to reinforcement for the less preferred task was four times that of the more preferred task. This study introduced an analogue assessment that identified a general area of reinforcer dimension that caused the participant to shift choice allocation to the less preferred task.

INDEX WORDS: delay to reinforcement, choice, aberrant behavior, parameters of reinforcement, assessment

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CHAPTER 1

Introduction

Choice allocation refers to how individuals distribute their responding when several choices are concurrently available. This behavior has been shown to be affected by the consequences that follow it (Dixon & Cummings, 2001; Fisher & Mazur, 1997; Flora & Pavlik, 1992; Jackson & Hackenberg, 1996; Neef, Shade, & Miller, 1994). In other words, choice can be influenced by the environment and is sensitive to dimensions of reinforcement. How variables of reinforcement can be altered to shift choice allocation has been a topic of basic and applied research since the 1980s (Fisher & Mazur, 1997).

Choice is sensitive to different dimensions of reinforcement, such as magnitude, immediacy, and quality (Fisher & Mazur, 1997). When assessing choice allocation and reinforcer dimensions with pigeons, Logue, Rodriguez, Peña-Correal, and Mauro (1984) found that pigeons often chose the option with shorter reinforcer delays, although longer delays resulted in a larger quantity of the reinforcer. In an alternative study with human adults, when individuals were given choices that contained differing reinforcement parameters, responses were most often allocated towards the choice that resulted in the more desirable reinforcer dimensions, including larger amounts, shorter delays, or longer access (Flora & Pavlik, 1992). The same has been found for children with autism spectrum disorders (Dixon & Cummings, 2001). Researchers of this study examined how delays to reinforcement and magnitude of reinforcement effected self-control. During baseline, all children allocated responding to immediate, smaller reinforcers. During self-control training, participants chose between an

immediate, small reinforcer, a delayed, large reinforcer with a response requirement during delay, and a delayed, large reinforcer with no response requirement during the delay. All participants showed a preference for chose a delayed, large reinforcer with a response requirement. Problem behavior was also lower during conditions with a response requirement during the delay (Dixon & Cummings, 2001).

Individuals are differentially influenced by reinforcer dimensions. In a study examining the interactive effects of reinforcer dimensions (Neef, Mace, & Shade, 1993), individuals responded differently to reinforcer rate, quality, and delay. When two participants were given concurrent sets of identical math problems with differing dimensions of reinforcement, each participant allocated responding differently. One participant allocated responding to the highest quality reinforcer, while another participant responded exclusively to the behavior that resulted in immediate access to reinforcers (Neef et al., 1993). In a subsequent study, Neef et al. (1994) examined how various dimensions of reinforcement, including rate, quality, and delay, and response effort of work tasks influenced choice making in adolescents with behavior disorders. Participants in the study were given two concurrently available math problems, which varied in required response effort, with differing reinforcer dimensions. Participants allocated their choices differently from one another and choice was differentially effected by the reinforcer dimensions and response effort of the math problems (Neef et al., 1994). Different individuals have different sensitivities to reinforcer dimensions, and individualized dimensions should be identified for successful treatment. These findings support choice as a behavior that is governed by the differential dimensions of its consequences.

When treating individuals who have a learning history of inappropriate behaviors accessing reinforcement, a new contingency is taught which attempts to connect only appropriate

behavior to reinforcement. In natural environments, however, reinforcers for appropriate behaviors are not always immediately available. This introduces unpredictable delays to reinforcement (Ghaemmaghami, Hanley, & Jessel, 2016). In individuals with severe behavior disorders who have undergone treatment, aberrant behaviors might still occur if those behaviors result in immediate, smaller reinforcers, even if appropriate behaviors, such as mands, result in delayed, larger reinforcers (Vollmer, Borrero, Lalli, & Daniel, 1999). Vollmer et al. (1999) assessed the use of differential reinforcement to treat aggression in two participants. During an impulsivity test, aggression produced immediate, smaller reinforcers and mands produced delayed, larger reinforcers. When aggression produced smaller, more immediate reinforcement than mands, the participants engaged in aggression instead of mands. Because the delay between the response and the reinforcer effect choice allocation, individuals may revert back to aberrant behaviors to attempt to access reinforcement (Navarick, 1987).

To implement effective treatments for aberrant behavior, it is first important to consider how to alter the dimensions of reinforcement to effectively influence the individual's choice between two behaviors. An assessment that identifies an individual's preferences for various dimensions of reinforcement could provide clinicians with a tool to systematically assess how an individual's choice is affected by variables of reinforcement. This information could then be used to guide treatment, using the sensitivity found in the assessment to manipulate choice allocation towards appropriate behaviors. The primary purpose of this study was to introduce an analogue assessment designed to assess the impact of reinforcer delay on an individual's choice allocation between a more preferred behavior and a less preferred behavior.

CHAPTER 2

Method

Participant

The participant of this study, Jackson aged 12-years-old, was an adolescent receiving services from a university-based behavior analysis outpatient clinic who had a diagnosis of autism spectrum disorder. During the time of the study, Jackson was receiving home schooling through a computer-based educational program. Jackson spoke in full sentences and completed grade level academic tasks, as well as independently completed self-care routines and household chores.

Jackson was referred to the university's outpatient clinic because of his problem behavior, which consisted of engaging in verbal threats, which his parents identified most frequently occurred following a disciplinary remark or action from his parents. Disciplinary remarks or actions included verbal reprimands, corrective statements (i.e., "No, do it this way instead"), accusatory questions (i.e., "Why didn't you clean the kitchen?"), or physical removal from the area (i.e., sending Jackson to his room for time-out). If Jackson broke a house rule, his parents identified their primary response to be verbal reprimands, followed by sending Jackson to his room for an extended period of time, ranging from three hours to the entire length of the day. This time-out resulted in Jackson engaging in severe problem behavior, which would stop as soon as he was removed from time-out. It was identified that being sent to his room was a delay to reinforcement, where the primary reinforcer was being released from his room attention and activities were once again available.

Setting and Materials

The study took place in a university-based behavior analysis outpatient clinic. Sessions were conducted in a treatment room, which contained one table, two chairs, and a two-way observation mirror. The room was equipped with a microphone and camera for video monitoring. The primary researcher, a masters-level graduate student, conducted each session. Jackson's mother attended the majority of sessions and observed through the observation mirror. Secondary data collectors and faculty observed sessions via the video monitor.

The materials included in this study were two sets of work tasks printed on different colored paper, a mechanical kitchen timer, index cards indicating reinforcer delay, pencils, and preferred reinforcers. The reinforcers were Jenga, Monopoly, and a box of various card games, which were identified as preferred items during multiple paired choice and free operant preference assessments conducted during Jackson's initial visit at the clinic.

In order to conduct the analogue assessment, we first conducted a task preference assessment to determine a more preferred task and a less preferred task. The work tasks included in this preference assessment were 3-digit addition with regrouping worksheets and sentence writing worksheets. These were the tasks used throughout the study.

Measurement, Interobserver Agreement, and Procedural Fidelity

The primary data collector was the therapist of sessions. Secondary data collectors viewed sessions through a video monitor that played the sessions in real-time. Data were collected on task choice. During the task preference assessment, Choice A was defined as the selection of the 3-digit addition task by pointing to the paper, touching the paper, beginning to write on the paper, or verbally indicating the choice. Choice B was defined as the selection of the

sentence writing task by pointing to the paper, touching the paper, beginning to write on the paper, or verbally indicating the choice.

Two independent observers scored the target responses for 43% of sessions. Interobserver agreement was assessed for the participant's choice allocation. Point-by-point agreement was used to determine interobserver agreement. The number of agreements of choice allocation divided by the sum of agreements of choice allocation and of disagreements of choice allocation multiplied by 100. Interobserver agreement averaged 100%. The secondary data collector recorded procedural fidelity for 50% of sessions. In order to measure procedural fidelity, the secondary data collector recorded if the therapist provided a choice to the participant, if the therapist provided the participant with the work he chose, if the therapist waited the correct delay to provide the reinforcer, and if the therapist provided the reinforcer immediately after the delay ended. Procedural fidelity data were collected during 43% of sessions and averaged 100%.

Experimental Design

A concurrent chains procedure embedded in a reversal design (Ledford & Gast, 2014) was used to evaluate how differential delays to reinforcement affect choice allocation. The dependent variable of the research study was the participant's choice between two work tasks. The independent variable was the length of reinforcer delay applied to each task.

Procedures

Task Preference Assessment

The first condition in the sequence served as a task preference assessment to determine which task, three-digit addition or sentence writing, was more highly preferred. During this preference assessment, both tasks had an equal reinforcer delay of 30 s.

To begin sessions, the therapist presented the participant with two work tasks, differentiated by different colored paper, its corresponding reinforcer delay card, a pencil, and a manual kitchen timer. The therapist began sessions by vocally stating instructions to Jackson by saying, "It's time to work. You can choose math or sentence writing. Whichever one you choose, you need to work for one minute. Once you are finished with either task, you have to wait 30 s before we can talk or play games. Pick one". Once the participant chose a task, the therapist removed the unchosen task and its reinforcer delay card from the table. The chosen task's reinforcer delay card remained on the table throughout the task. The therapist then set the timer for 1 min. During work time, the therapist provided prompts as needed to keep the participant on-task or to provide academic assistance when Jackson vocally requested help.

After 1 min of working, the therapist restated how long Jackson needed to wait before reinforcement was available. The therapist set the timer for the designated delay and then appeared busy during the delay by writing on a piece of paper or looking at a phone. If Jackson attempted to get the therapist's attention during the delay interval, the therapist did not respond until the delay was over. This was to mimic Jackson's time in his room, where neither attention nor preferred items were available. Once the delay was over, the therapist provided Jackson with 1 min of reinforcement, which included the therapist's attention and a preferred activity. The task preference assessment was conducted for 10 sessions.

Reinforcer Delay

Once a more preferred task was identified, the delay to reinforcement was altered for that task. These sessions were identical to the task preference assessment, with the exception of differing delays. Three sets of delays (Equal Delay, Delay-60, and Delay-120) were used to evaluate the effects of reinforcer delay on choice allocation. Throughout all conditions, the delay

to reinforcement for the less preferred work task remained at 30 s. The delay to reinforcement for the more preferred work task increased by doubling the previous delay (i.e., 30 s to 60 s to 120 s). This continued until choice allocation shifted from the preferred task to the less preferred task for three consecutive sessions.

Task preference assessment data were used as the first equal delay condition, where each task had a delay of 30 s. The procedures in the subsequent equal delay conditions were identical to those used in the preference assessment. During Delay-60, the less preferred task delay remained at 30 s, while the more preferred task delay increased to 60 s. During Delay-120, the less preferred work task delay remained again at 30 s, and the more preferred work task delay increased to 120 s.

CHAPTER 3

Results

Task Preference Assessment

The first phase of Figure 1 shows the results of the task preference assessment. Although Jackson rotated between Choice A and Choice B for the first three sessions, he then allocated all responding to Choice B, which was sentence writing, for the remaining seven sessions. This task was identified as the higher preferred task, while Choice A, three-digit addition, was identified as less preferred.

Reinforcer Delay

Figure 1 shows the results of Delay-60, Delay-120, and Equal Delay. During Delay-60, the reinforcer was provided after a delay of 30 s and 60 s for the less preferred and more preferred tasks, respectively. Jackson chose the more preferred task for all three sessions for this phase, despite the longer reinforcer delay in place for the more preferred task.

The next phase was Delay-120, during which the reinforcer was provided after a delay of 30 s and 120 s for the less preferred and more preferred tasks, respectively. Jackson chose the less preferred task for all three sessions in this phase. Jackson's switch from the preferred task to the non-preferred task indicated a preference of engaging in a non-preferred behavior to gain access to reinforcement sooner, rather than engaging in a preferred behavior and subsequently waiting longer for reinforcement.

An equal delay of 30 s for both tasks was reintroduced, where Jackson's choice allocation reverted back to his higher preferred task for all four sessions. When Delay-120 was implemented once again, Jackson's choice allocation went to the less preferred task.

CHAPTER 4

Discussion

This study introduced an assessment designed to determine an individual's sensitivities to delays to reinforcement and evaluated how this would affect choice allocation between more preferred and less preferred behaviors. After a task preference assessment was conducted and a more preferred task was identified, the delay to reinforcement following completion of the task was altered until choice allocation switched from the more preferred task to the less preferred task. The individual's choice allocation was unsurprisingly affected by a specific parameter of reinforcement, supporting previous studies with similar findings (Dixon & Cummings, 2001; Fisher & Mazur, 1997; Flora & Pavlik, 1992; Jackson & Hackenberg, 1996; Neef et al., 1994). However, this assessment introduced a way to identify when an individual will shift choice allocation from a more preferred behavior to a less preferred behavior.

This study expands previous literature by examining delay to reinforcement within more preferred and less preferred behaviors. While previous studies have examined how dimensions of reinforcement effect choice with identical problems or problems with differing response requirements, this study assesses how preference is influenced by reinforcer delay.

A primary limitation of this study is that it is introductory in nature. There are not yet data to support that this analogue assessment will transfer to natural settings or transfer to other behaviors not assessed in this study. In addition, the results of this study could be related to the type of tasks chosen. Other tasks could potentially result in a different reinforcer delay required

for choice allocation to shift. If this is the case, behaviors or tasks used in the assessment need to be identical to the targeted behaviors or tasks in the natural environment.

Future research should examine the validity of this assessment being used to guide treatment, as well as how the parameters of reinforcer dimensions shift depending on the task presented. This study demonstrates an initial finding that this assessment can be used to identify how reinforcer delay affects an individual's choice allocation between more preferred and less preferred behaviors.

These findings have important implications for the use of differential reinforcement to treat problem behaviors. While differential reinforcement is most effective with extinction versus without extinction (Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998), extinction is not always feasible. For example, intermittent reinforcement may occur due to poor procedural fidelity or when reinforcement cannot safely be withheld during dangerous behaviors (Worsdell, Iwata, Hanley, Thompson, & Kahng, 2000). Extinction can also result in adverse side effects, such as extinction bursts, high levels of aggression, and generally negative emotional responses (Lerman, Iwata, & Wallace, 1999). For these reasons, it may be beneficial to implement treatment in which more desirable dimensions of reinforcement, such as shorter delay, are assigned to the appropriate behavior rather than the problem behavior (Athens & Vollmer, 2010).

When using differential reinforcement without extinction, this assessment can be a tool used to bias an individual's choice allocation towards appropriate behaviors. This can be done by assigning the differential delays to reinforcement found in this assessment to more preferred behaviors and less preferred behaviors. After assessment, the parameters of this study were applied to appropriate and inappropriate behaviors that the participant engaged in at home. Data collection showed low parent procedural fidelity, but parents anecdotally reported that problem

behavior significantly decreased following treatment. This assessment could be used to guide treatment using the same discrepancy in reinforcement parameters found to be effective for the individual to switch response allocation towards a less preferred or new behavior (i.e., an appropriate replacement behavior).

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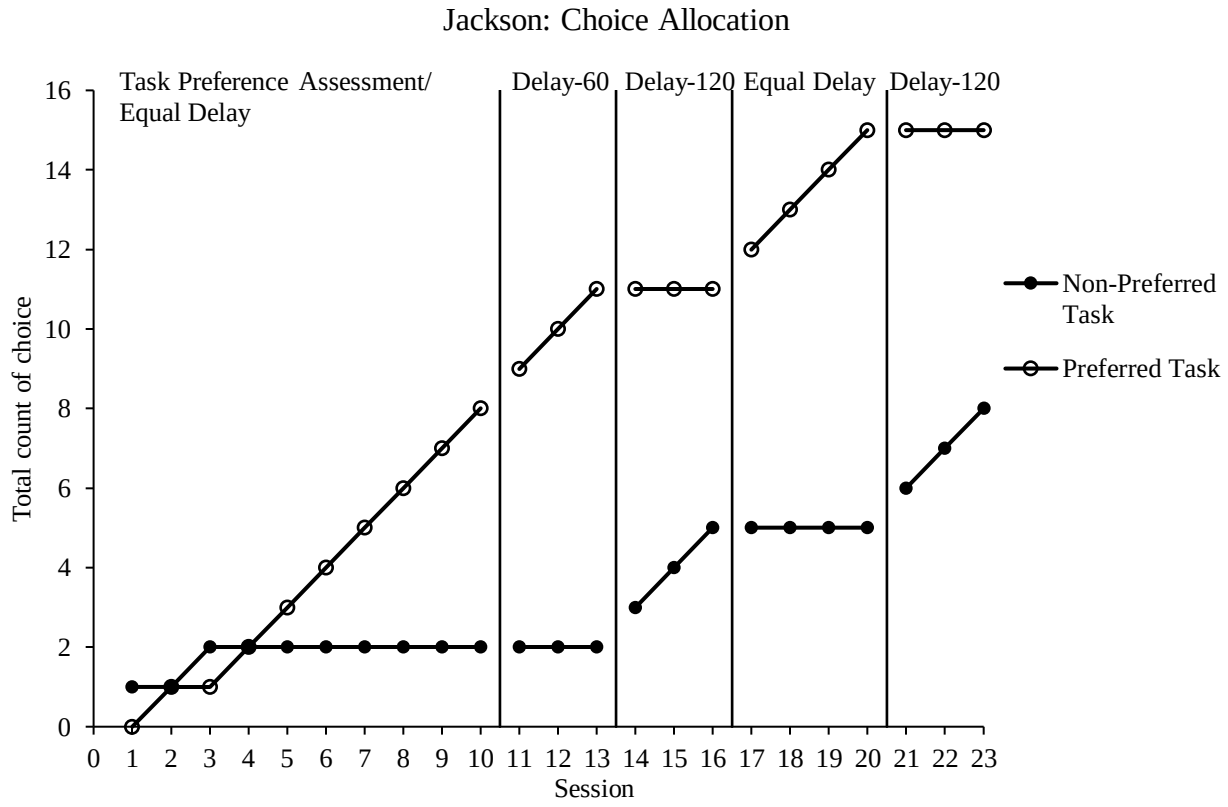

Figure 1. Jackson's cumulative number of selections of each task across various values of delay to reinforcement following task completion. The open circles indicate a choice of the more preferred task and the closed circles indicate a choice of the less preferred task. The value specified in the condition labels are the delay to the preferred task during that condition.