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THE EFFECTS OF PRESENTING DELAYS BEFORE AND AFTER TASK COMPLETION ON SELF-CONTROL RESPONDING IN CHILDREN WITH BEHAVIOR DISORDERS

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We examined relations between self-control responding and environmental variables with 3 children with behavior disorders. Differential delays were presented before or after task completion in a single-session reversal design. Delays presented before task completion produced more impulsive responding than those presented after task completion for all participants.
Key words: choice, delayed reinforcement, impulsivity, self-control

Many behavior problems (e.g., gambling, disruption) involve deficits in self-control (Nevin, 1991). In a typical procedure, self-control is assessed using two equivalent response options in the initial link of a concurrent-chains schedule; one produces a smaller, immediate reinforcer and the other produces a larger, delayed reinforcer. In this arrangement, choice responding is primarily influenced by differences between the terminal links (e.g., longer delays for the larger reinforcer bias responding toward the smaller, more immediate reinforcer; Fisher & Mazur, 1997). However, delays between the initial and terminal links can also bias responding toward either the self-control or impulsive option (Davison, 1988).

In a series of studies on self-control in children, Mischel and colleagues found that variables present during the initial choice presentation biased responding toward or away from self-control (e.g., Mischel, Ebbesen, & Raskoff Zeiss, 1972; Mischel & Gilligan, 1964). In what came to be known as the "marshmallow experiment" (Mischel et al., 1972), experimenters presented children with a single piece of candy and told them that if they did not eat it, they would receive two pieces when the experimenter returned (e.g., after 15 min). In this procedure, only the impulsive response option was available for most of the trial, and participants were required to inhibit responding toward the smaller reinforcer throughout the unsignaled delay interval. This procedure differs from traditional behavior-analytic research on self-control, which (a) focuses almost exclusively on delays that follow a choice response (i.e., terminal link), and (b) removes the option to engage in impulsive responding pursuant to a self-control response.

In the current study, we evaluated whether presentation of delays in the initial link of a self-control procedure would bias responding toward the impulsive option in children who had been referred for the treatment of problem behavior. This study is important because it directly compares the effects of two self-control choice procedures with delays presented in the initial link (as Mischel and colleagues used) and in the

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terminal link (as evident in most behavioral studies). It also extends the research on self-control by incorporating choices between qualitatively, as opposed to quantitatively, distinct stimuli and by including signaled delays.

METHOD

Participants and Setting

Participants included three boys who had been reported by caregivers to engage in impulsive behavior. Brian, 5 years old, had been diagnosed with autism. Stewart, 4 years old, had been diagnosed with a disruptive behavior disorder. Chris, 4 years old, had been diagnosed with adjustment disorder and attention deficit hyperactivity disorder. Sessions were conducted in treatment rooms at an outpatient clinic.

Response Measurement and Treatment Integrity

Observers recorded which reinforcer was chosen and the level of prompting required for task completion (i.e., verbal, gestural, physical) during each trial of a 12-trial session. *Reinforcer selection* was defined as the participant orienting toward and touching task materials associated with a reinforcer. *Task completion* was defined as circling a response (Brian) or tracing a printed letter (Stewart and Chris). All participants engaged in independent reinforcer selection and task completion (i.e., without gestural or physical prompts) on 100% of trials.

We collected reliability and treatment integrity data during 75% (Brian) to 100% (Chris and Stewart) of sessions. Interobserver agreement (percentage of trials with agreements) was 100% for all participants. Perfect treatment integrity (correct stimulus delivery within 2 s of the intended delay) was recorded on 99% of trials for Brian and 100% of trials for Stewart and Chris.

Preassessment Procedure

Preference assessment. We conducted a preference assessment (Fisher et al., 1992) to identify participants' high- (HP) and low- (LP) preference stimuli, defined as those chosen during at least 80% or no more than 25% of trials, respectively. The resulting stimuli were Playstation (HP) and music (LP) for Brian; gummy bears (HP) and ball (LP) for Stewart; and fruit snacks (HP) and cars (LP) for Chris.

Reinforcer sensitivity assessment. We conducted this assessment to show that participants would select and complete a task associated with either one of the reinforcers (HP or LP) when the other option in a concurrent-chains schedule produced no consequence (i.e., extinction). During the initial link of each trial of a 12-trial session, we presented the task associated with one reinforcer and the task associated with extinction. Each task was correlated with a unique discriminative stimulus (i.e., paper color). Choosing the task associated with reinforcement produced access to the reinforcer in the terminal link for 30 s. Choosing the other task produced no consequence during the 30-s terminal link. This assessment ended when a participant selected the task associated with reinforcement on at least 80% of trials for two consecutive sessions, which all participants did in the first two sessions.

Reinforcer quality assessment. We conducted this assessment to show that participants would choose the HP stimulus over the LP stimulus when both were available immediately. Procedures were identical to the prior assessment except that the alternatives presented in the initial link produced either the HP or LP stimulus in the terminal link. All participants chose the task associated with the HP stimulus during at least 90% trials for two consecutive sessions.

Delay sensitivity assessment. We conducted this assessment to show that participants would choose an immediate over a delayed reinforcer. Procedures were identical to the prior assessment except that the discriminative stimulus (i.e., colored background) correlated with the HP stimulus was present for both response options and a kitchen timer was present for the delayed response option. If the participant chose the

immediate response option, immediate access to the HP stimulus was provided, whereas a signaled delay of 60 s preceded reinforcer delivery for choices allocated toward the delayed option. All participants chose the task that produced immediate access to reinforcement on 100% of trials for two consecutive sessions.

Delay Exposure Before and After Task Completion

The following two conditions were alternated in a single-session reversal design. The terminal-link delay condition represented a typical self-control arrangement except that in the current study, the participant chose between an immediate LP reinforcer or a delayed HP reinforcer.

Terminal-link delay (delay after task completion). Procedures were identical to the delay sensitivity assessment with the following exceptions (see Figure 1). In the initial link, the tasks and stimuli associated with the LP and HP stimuli were present at the start of each trial, and the timer was placed next to the HP task. The timer was set for each trial according to the following sequence, which was repeated twice in each 12-trial session: 60 s, 120 s, 240 s, 240 s, 120 s, 60 s. If the participant selected the LP stimulus and completed the associated task, that reinforcer was presented immediately and for 30 s. If the participant selected the HP stimulus and completed its associated task, the timer was activated and the HP stimulus was delivered for 30 s after the associated delay interval had elapsed.

Initial-link delay (delay before task completion). Procedures were identical to those described above except that programmed delays occurred before presentation of each task (signaled by the absence of the HP task from the participant's visual field). HP and LP stimuli were present as was the LP task. Selection of the LP stimulus resulted in access to the LP task followed by immediate access to its associated stimulus. Selection of the HP stimulus resulted in activation of the timer. After the delay programmed for the trial elapsed (e.g., after 60 s), the participant received access to the HP task followed by immediate access to its associated stimulus. Thus, the participant could select the LP task and complete it immediately or wait for the timer to finish and complete the HP task.

RESULTS AND DISCUSSION

In the phases in which the delay occurred after task completion, all participants allocated more responding toward the task associated with the HP reinforcer (see Figure 2). In contrast, when the delay intervals occurred before task access, response allocation shifted towards the task associated with the LP reinforcer. Thus, these results replicate and extend behavioral research on self-control to include choices between qualitatively distinct stimuli. Presentation of delays before task access, the condition under which the children engaged in more impulsive responding, may be analogous to the choices children face in their natural environments in two ways. First, when children are confronted with choices between self-control options and impulsive options (e.g., completing homework immediately to earn access to a favorite video game or watching a less preferred television show immediately), stimuli associated with the former option may be less salient (e.g., the book and worksheets in the child's backpack in a closet). However, stimuli associated with the latter option are often present and highly salient (e.g., television on and visible to child). Second, even when children initially choose a self-control option that involves a lengthy delay before reinforcer delivery, the passage of time may produce a shift in the child's preference toward the impulsive option (e.g., see Neef, Mace, & Shade, 1993). That is, shifts in preference after an initial selection may be more likely for the self-control option because the establishing operations for both reinforcers are in effect during the wait period (and discriminative stimuli for immediate reinforcement remain present). Using the above example, if the child begins to complete

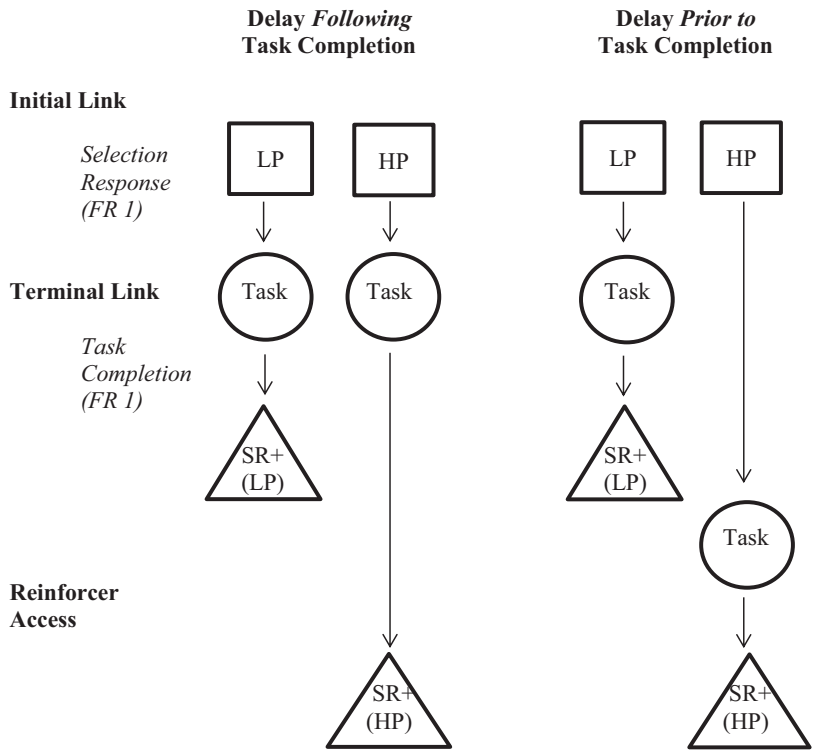

Figure 1. Procedure in which delays occur before and after task completion. LP indicates a selection (verbal or gestural) of the task associated with the participant's LP stimulus. HP indicates a selection (verbal or gestural) of the task associated with the participant's HP stimulus.

homework in the presence of the television, at any time he or she may stop working on homework and attend to the television instead. By contrast, the impulsive option results in immediate reinforcer consumption and removal of its establishing operation. Given that we did not isolate the variables that controlled self-control responding in this study, further research is warranted to evaluate these hypotheses.

This study had several limitations that should be noted. First, exposures to each of the conditions were brief (12 trials per condition), and participants may have responded differently with prolonged exposure. Second, when the delay was programmed before task completion, participants were presented with the option to complete the task associated with the LP stimulus in the absence of the task associated with the HP stimulus. Both HP and LP reinforcers were visible on all trials; however, when the delay occurred before task access, participants may have completed the task that was presented to them rather than making choices as a function of differential delays. Research on delayed gratification suggests that salience of a choice (e.g., visibility) may affect self-control responding (Shoda, Mischel, & Peake, 1990). Future research is needed to evaluate the degree to which the presence or absence of task-related materials affects choice responding.

Furthermore, the conditions under which delayed access to reinforcement is likely to affect tolerance for future delays are not well understood. For instance, a choice to wait for access to the HP stimulus on one trial may affect choice responding on subsequent trials, a behavioral

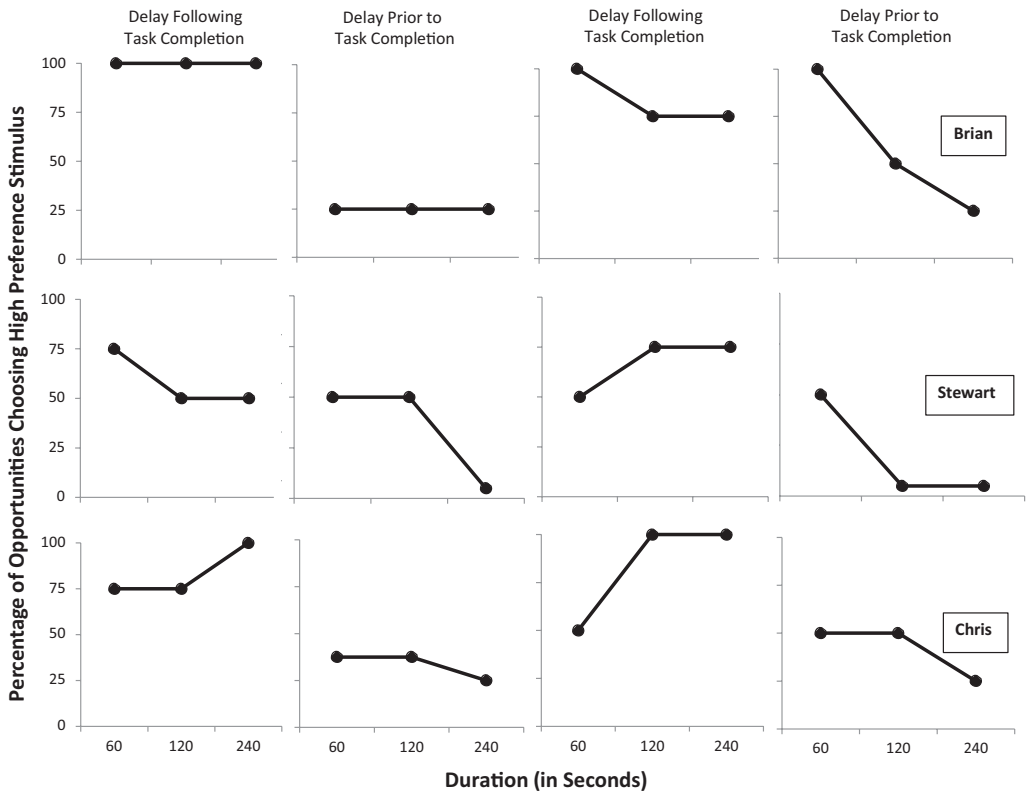

Figure 2. Results for Brian, Stewart, and Chris. Delay values (60 s to 240 s) are depicted on each *x* axis, and the percentage of trials in which responding was allocated toward the HP stimulus is depicted on each *y* axis. For Chris, the second phase depicts the average of two consecutive sessions.

effect observed in basic research on self-control (e.g., Mazur, 2006). This effect might be larger when delays are predictable (e.g., ascending and descending sequences of delay values, as in the current study) rather than randomly distributed.

The differential levels of self-control responding displayed by the participants in this study suggest several intervention strategies worthy of further evaluation. It may be that differential contingencies are more salient when delays occur before rather than after a response. It is also possible that the presence of the LP option during the delay interval for the HP reinforcer increases the likelihood of impulsive responding. Thus, the likelihood of self-control responding might be increased by introducing the option to engage in a commitment response and subsequently removing the alternative option (Rachlin & Green, 1972). When access to competing sources of reinforcement cannot be eliminated, increasing the salience of the HP stimulus relative to the LP stimulus may promote self-control choices.

Continued investigation is needed to further our understanding of self-control and impulsivity in children with behavior disorders. Treatment evaluations are also needed to assess the effectiveness of interventions related to the types of choices children experience in their natural environments.

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