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Using a Time Timer™ to increase appropriate waiting behavior in a child with developmental disabilities

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ABSTRACT

This study aimed to examine the use of a predictive stimulus (Time Timer™) and delayed reinforcement to increase appropriate waiting behavior in a child with developmental disabilities and problem behavior maintained by access to tangible items and activities. The study employed a changing criterion design across settings to gradually increase reinforcement delay from 1 s to 10 min. Firstly a baseline phase was conducted to measure the duration of appropriate waiting behavior to access tangible reinforcers/activities. Phase 2 involved the use of a red cue card and the verbal instruction "wait". Phase 3 involved the introduction of the Time Timer™ with the cue card attached, and the verbal instruction "wait". Finally, Phase 4 utilised the Time Timer™ without the cue card. This method was an effective strategy for increasing appropriate waiting behavior with this participant in a school setting. The role of adding a concurrent activity during the reinforcement delay, using cues to predict reinforcement, future generalization, maintenance and the teaching of functionally equivalent skills are discussed.

Impulsiveness and self-control can be operationalised as choice-making behavior between a larger, delayed reinforcer and a smaller, more immediate reinforcer (Jackson & Hackenberg, 1996). Impulsive behavior occurs when responding produces more immediate, relatively smaller reinforcers at the cost

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of delayed, larger reinforcers. Self-control occurs when responding produces greater delayed reinforcers at the expense of more immediate, smaller reinforcers (Logue, 1995; Dixon et al., 1998). Behaviors that yield delayed reinforcement are highly adaptive in day-to-day life (Stromer, McComan, & Rehfeldt, 2000), and as such are a socially significant behavior and worth investigating in applied behavior analysis.

Various methods have been used to establish and maintain reinforcement delay. Schweitzer and Sulzer-Azaroff (1988) described one method whereby the delay is gradually increased for a larger reinforcer while the smaller reinforcer remains immediately available. Dixon and Cummins (2001) extended this research further by illustrating that self-control may be increased by establishing a history in which participants are gradually exposed to progressive delays, and are concurrently given the choice to engage in an intervening activity during that delay. Participants had a choice between: (a) a small immediate reinforcer, (b) a larger delayed item without a response requirement during the delay, and (c) a larger delayed item with a response requirement during the delay. All participants showed a preference for the latter option, and during this contingency, no problem behaviors occurred. However, these studies do not examine visual supports or cues that may serve to predict the availability of reinforcement.

Williams (1999) found that choice for delayed reinforcement would be more likely when stimuli presented during the delay reliably predicted reinforcement. Further studies have used tokens, points and star charts as the predictive stimuli (Kazdin, 1982). In these cases the stimuli that predict reinforcement at the end of the delay may serve as conditioned reinforcers through multiple pairings with the delayed reinforcers. However, it has been noted that more naturally occurring conditioned reinforcers as predictive stimuli would be useful for ensuring generalization to other settings (Williams & Dunn, 1991). These could be verbal in nature, such as praise from a parent, teacher or caregiver, or verbal reminders of the reinforcement that is to occur (Hayes & Hayes, 1993).

However, people with developmental disabilities may not respond well to verbal instructions due to limited or absent verbal comprehension repertoires. Individuals with a developmental disability often present with a restricted verbal repertoire, which is a common factor associated with impulsivity (Mischel & Mischel, 1983). It has been suggested that an adult human's increased preference for delayed, larger reinforcers may somehow be linked to their advanced verbal abilities (Schweitzer & Sulzer-Azaroff, 1988). This may explain why people with a limited verbal capacity experience difficulties in waiting for delayed reinforcement.

Another important aspect of stimuli that predict reinforcement is the length of time one is required to wait before the reinforcer is delivered. Vollmer, Borrero, Lalli, and Daniel (1999) demonstrated that participants with developmental disabilities and severe challenging behaviors were more likely to exhibit self-control than impulsive choices when the longer delays were signalled rather than unsignalled. They also recommended that a further investigation into 'timed' delays (the availability of a visual timer throughout the delay) for future research.

An examination of impulsivity and self-control with regards to individuals with intellectual disabilities and problem behavior is important. Access to consumable or tangible reinforcers frequently maintains severe behavior problems displayed by such individuals (Vollmer et al., 1999). Many studies have focused on impulsive behavior maintained by token reinforcement (money) and not on tangible or attention maintained behaviors that are also sensitive to impulsivity (Vollmer et al., 1999).

In the case of signalled reinforcement delay to promote coping and tolerance skills, the appropriate 'waiting' behavior is essentially under the stimulus control of the signal (verbal instruction or visual cue). Approaching the treatment of tolerance in delayed reinforcement with persons with developmental disabilities using signalled reinforcement delay could be very useful for maintenance and generalization of the appropriate behavior. In addition, the use of stimulus fading that includes highlighting a physical dimension (e.g., colour, size, etc.) of a stimulus to increase the likelihood of a correct response followed by a systematic fading of the exaggerated dimension could be applied to promote appropriate behavior during delayed reinforcement (Cooper, Heron, & Heward, 2007).

The present study aims to increase appropriate 'waiting' behavior using a Time Timer™ with an individual presenting with problem behavior maintained by access to tangible reinforcement. It employs a changing criterion design with the application of a Time Timer™ as a predictive stimulus. A

delay in the delivery of a preferred reinforcer is gradually increased and appropriate waiting behavior is reinforced during the time delay.

1. Method

1.1. Participant and setting

The participant was an 11-year-old girl who lived with her parents and attended a school for children with intellectual disabilities and pervasive developmental disorders. She shared a classroom with four other students—two of whom are her siblings. She is one of a set of triplets. The participant had been diagnosed by a registered clinical psychologist with a moderate level of intellectual disability. She also presented with cerebral palsy, which affects the fine motor movement of her left arm, hand and foot. The participant emited challenging behavior in the form of physical aggression and tantrum behaviors. She could name objects in her environment, but had difficulties asking for objects or help with activities. She has an age-equivalent of oral expression of 2 years. She can follow two-step verbal directions.

1.2. Response measurement and reliability

Inappropriate waiting behavior was defined as tantrum behavior that included crying, dropping to the floor, hitting other students or adults, screaming and repeating the word 'no' or the name of a preferred object or activity at a volume above normal conversational level. The dependent variable was identified as appropriate waiting behavior and was recorded when an absence of the behaviors outlined above was observed during an interval.

During both functional assessment and treatment evaluation, a trained observer recorded the target behaviors during observation periods via paper and pencil. A second observer independently collected data during 82% of functional assessment observation periods and 65% of intervention evaluation sessions. Interobserver agreement was examined on a session-by-session basis by dividing the number of agreements plus disagreements and multiplying by 100%. Agreement values were 88% for functional assessment sessions, and 94% for intervention evaluation.

1.3. Apparatus

A stopwatch was used to measure appropriate waiting behavior during baseline conditions and intervention phases. A Time Timer™ and red card (4 in. × 4 in.) were used as predictive stimuli. The Time Timer™ is 12 in. × 12 in. and resembles a clock. The numbers on the Time Timer™ reflect the passage of time in minutes, and range from 55 to 5 min in a countdown style. To indicate an amount of time, there is a movable piece on the timer that can be 'set' for a particular time frame, e.g., 10 min. When this piece is moved, a red wedge represents the amount of time, and reduces in size gradually as the time passes. The red wedge disappears when the time frame is over.

1.4. Experimental design

A changing criterion design with a baseline and three intervention phases was employed to increase appropriate waiting behavior.

1.5. Functional assessment

The participant was observed directly for a 2-week period in naturally occurring situations that had been identified by care staff as being related to a high probability of the occurrence of target behaviors. Staff responses to target behaviors were recorded, as were probable antecedents in an anecdotal fashion. Every occurrence of the target behavior was analysed according to the anecdotal accounts of possible antecedents and consequences maintained by the experimenter. Results indicated that most of the participant's problem behaviors occurred when objects or activities she wanted were not

temporally available such as wanting to look at preferred pictures of cartoon characters or wanting to hold preferred toys. Behaviors also occurred when waiting for lunch or snack time or wanting to get access to the school playground. These behaviors had significantly impacted on acquisition of novel skills at the time of assessment. The participant would not sit at a desk in her classroom, avoided engagement with any academic curriculum-based activity and spent most of her school day at a computer looking at preferred cartoon characters either on a computer or in a book in an adjacent room. Results of the functional assessment demonstrated that the inappropriate behaviors were maintained by immediate access to tangible items and activities.

1.6. General procedure

The general procedure involved a baseline phase and three intervention phases and, in the interest of clarity, each phase is outlined separately below. The purpose of employing three intervention phases was to establish stimulus control for waiting using a red card during an activity that the participant enjoyed. Following this the goal of intervention was to transfer stimulus control from the red card to the Time Timer™. The red card was selected because the moveable piece of the Time Timer™ is coloured red.

1.7. Phase 1: Baseline

Baseline consisted of Sessions 1–10. An activity that the participant enjoyed engaging in outdoors was selected in order to determine the maximum amount of time the participant would wait appropriately for a reinforcer. The participant enjoyed an activity that involved running up a series of steps in the playground while holding the hands of an adult. Before the activity began the participant was told to 'wait' and the experimenter set a stopwatch to measure appropriate waiting behavior. If the participant waited appropriately for 30 s the activity was delivered. Once inappropriate waiting behavior occurred the stopwatch was stopped and the time was recorded. Contingent on the occurrence of inappropriate behavior the participant was directed to another activity in the playground. Ten baseline probes of this activity were conducted over 2 consecutive days.

1.8. Phase 1: Red card and verbal instruction

Phase 1 included Sessions 11–38. During this phase the experimenter held the red card in front of the participant and gave the verbal instruction 'wait'. The card was removed after one second and the next interval was initiated. This was repeated until four consecutive 1 s intervals were complete. The amount of time the red card was present and the participant was required to wait for the game to resume was systematically extended. Intervals of time for waiting were 1, 3, 6, 10, 16, 7 and 20 s, respectively (see Table 1). Only the word 'wait' preceded the presentation of the red card. The criterion for increasing the interval of time was four consecutive intervals with no occurrence of inappropriate waiting behavior.

During interval 31, instead of increasing the criterion to a longer delay in reinforcement, the delay in the delivery of reinforcement was actually reduced from 16 to 7 s. This reduction in criterion was implemented randomly as a decrease in demand to ensure the participant would continue to wait appropriately in the absence of inappropriate waiting behavior. Although a very gradual change in criterion was implemented across this phase, it was important to set up an opportunity for success as the change in criterion became more difficult to reach. During interval 35 the criterion was once again increased from 7 to 20 s.

1.9. Phase 2: Red card on Time Timer™ and verbal instruction

Phase 2 included Sessions 39–82. During Phase 2 the intervention was transferred to the classroom setting. The participant was seated at a desk with other students and contingent on sitting appropriately she was presented with a picture of a favourite cartoon character. After approximately 10 s the picture was removed and the red card was placed on the Time Timer™ for 15 s along with the

Table 1
Baseline duration of appropriate waiting behavior and systematic increases in intervals during Phases 2–4

Sessions	Maximum duration of appropriate waiting (s)	Did inappropriate behavior occur?
Phase 1: Baseline		
1–10	1	+
Sessions	**Intervals of appropriate waiting (s)**	**Did inappropriate behavior occur?**
Phase 2: Red card and verbal instruction		
11–14	1	–
15–18	3	–
19–22	6	–
23–26	10	–
27–30	16	–
31–34	7	–
35–38	20	–
Phase 3: Red card on Time Timer™ and verbal instruction		
39–42	15	–
43–46	20	–
47–50	30	–
51–54	40	–
55–58	50	–
59–62	65	–
63–66	30	–
67–70	75	–
71–74	90	–
75–78	105	–
79–82	120	–
Phase 4: Time Timer™		
83–86	150	–
87–90	180	–
91–94	240	–
95–98	180	–
99–102	300	–
103–106	360	–
107–110	420	–
111–114	480	–
115–118	540	–
119–122	600	–

verbal instruction 'wait'. Contingent on the non-occurrence of target behavior the cartoon picture was delivered. The intervals for waiting were systematically extended up to 2 m. The criterion for increasing the time interval was four consecutive intervals without the occurrence of inappropriate waiting behavior (see Table 1). Two minutes was considered the shortest interval that could be represented on the Time Timer®. No target behaviors occurred during this phase. During interval 63 the delay in the delivery of reinforcement was reduced from 65 to 30 s instead of increasing the criterion. Similarly to Phase 2, this reduction in criterion was implemented randomly as a decrease in demand to ensure the participant would continue to wait appropriately when a gradually increasing demand was placed upon her. During interval 67 the criterion was once again increased from 30 to 75 s. The criterion for this phase for increasing the time interval was four consecutive intervals with no occurrence of inappropriate waiting behavior.

1.10. Phase 3: Time Timer™

Phase 3 included Sessions 83–122. During Phase 3, the red card was removed and replaced by the red moveable wedge on the Time Timer™. The amount of time required to wait prior to the presentation of a preferred reinforcer was systematically extended to 10 min by gradually increasing the amount of time the participant was required to wait (see Table 1). Similarly to Phases 1 and 2,

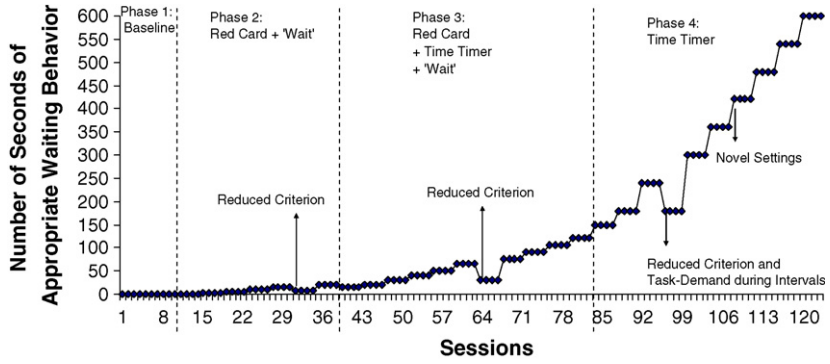

Fig. 1. Duration of appropriate waiting behavior across Phases 1–4.

instead of increasing the criterion at interval 95, the delay in the delivery of reinforcement was reduced from 240 to 180 s. This reduction in criterion was randomly applied. During Session 99 the criterion was once again increased from 180 to 300 s. Sessions 99–122 showed increases in the waiting intervals from 300 to 600 s.

In addition, during this phase (Session 95) desktop activities such as matching tasks, reading tasks and art activities were introduced while the participant waited for a reinforcer. The purpose of this was to ensure that the participant learned to wait while engaging in demanding tasks. Access to choosing additional reinforcers, other than cartoon pictures, was introduced at this point. When stable responding was observed (no occurrence of the inappropriate waiting behavior during Sessions 95–106), the Time Timer™ was used in a novel setting involving contingent access to snacks at lunchtimes (Session 107).

2. Results

Results of Phases 1–4 are presented in Fig. 1. During Phase 1, the maximum amount of time spent waiting appropriately was 1 s during Sessions 1 and 2. During the eight remaining probes there was no instance of appropriate waiting and the duration recorded was 0 s.

With the introduction of the discriminative stimulus and verbal instruction during Phase 2, appropriate waiting was increased using a changing criterion from 1 to 20 s. During Phase 3 the delivery of reinforcement was delayed from 15 to 120 s using both the discriminative stimulus and verbal direction paired with the Time Timer™. During Phase 4 the delay in reinforcement and appropriate waiting behavior was increased from 150 to 600 s in the presence of the Time Timer™ alone.

Over the three intervention phases the changing criterion was increased by greater increments. For example, during Phase 2 the mean increment was 4 s. During Phases 3 and 4 the mean increments were 11.6 and 56 s, respectively.

No inappropriate behavior was demonstrated during the changing criterion phases (see Table 1). Appropriate waiting behavior was gradually increased using a changing criterion from 1 s to 10 min across 122 Sessions.

3. Discussion

This study aimed to increase the appropriate waiting behavior of a child with an intellectual disability and problem behavior maintained by access to tangible reinforcement. The results illustrate that the participant's appropriate waiting behavior was successfully increased from 1 s to 10 min. This outcome also resulted in an increase in classroom instruction time whereby during the waiting interval, the experimenter introduced task-demand at the desktop with access to a choice of multiple reinforcers. Gradually the reinforcers for waiting were increased from one choice to a variety of choices in different settings. These results will be discussed in terms of the addition of the activity to

engage in during the waiting period, the role of cue's in predicting reinforcement, the future fading of the discriminative stimulus to further generalisation of the skill, and with regards to functionally equivalent skills teaching.

3.1. Addition of concurrent activity

These results support Dixon and Cummins (2001) findings that self-control can be increased by gradually extending reinforcement delay, while concurrently given an activity to engage in during the delay. When the participant reached 180 s of appropriate waiting behavior, the experimenter introduced task-demand at the desk in the classroom. This was a significant outcome for the participant, as before this intervention was introduced, she would not engage in any learning activity at the desk. This was having a great impact on her learning, so the present results indicate an improvement in her overall quality of life. Her quality of life has improved in terms of her ability to engage in discrete-trial instruction in the classroom, and her new adaptive skill of waiting appropriately in the presence of the timer.

3.2. Visual stimulis to predict reinforcement

The present study used a visual cue as a discriminative stimulus to *predict* reinforcement and to indicate *when* reinforcement would be delivered. The successful outcome of this study would appear to support Vollmer et al.'s (1999) finding that participants with developmental disabilities and challenging behaviors are more likely to exhibit self-control when delays in reinforcement are signalled. The present results also corroborate Bower, McLean, and Meacham (1966) findings that participants respond positively to being able to predict when a reinforcer would be delivered. The participant in the current study did not engage in any challenging behaviors during the signalled and informed delays. A possible limitation of this study is that it employed both a visual and verbal cue (red card and "wait"), and then a timed visual cue and verbal cue (timer and "wait"). Perhaps future research could compare the use of a visual (cue card) with a timed signal (Time Timer™), with and without a verbal cue to accompany it to investigate which of these methods are more effective—in order to establish the most effective method of teaching this vital skill.

3.3. Generalisation of the skill

Hayes and Hayes (1993) suggested the use of a more naturally occurring predictive stimulus, in the form of verbal statements from a parent or teacher, to ensure generalisation to other settings. In this case, the participant's language skills were limited (2-year-old level), thus verbal reminders of the reinforcement to occur may have had limited comprehensive value. The addition of the Time Timer™ provided a visual predictive stimulus as well as a verbal stimulus (experimenter saying "wait"). However, in order for the participant to establish and maintain her new skill/behavior across settings, the timer will eventually need to be faded out over time.

The timer is a useful tool and presents with the possibility of gradual stimulus fading. It closely resembles a clock, apart from the red wedge to indicate the passage of time. The colour of the wedge could be gradually faded and eventually the hands of the clock could be introduced to indicate the passage of time. In addition, fading the coloured wedge could involve the use of coloured stickers to be placed on the face of the timer to indicate when the time was up, and these stickers could then be transferred to a regular clock. A portable Time Timer™ wristwatch is also available, where the red wedge of the clock is displayed digitally on a wristwatch. The portable watch could be gradually introduced in place of the desktop timer and could be used across settings and instructors to ensure maintenance and generalisation of the skill.

3.4. Functional equivalence

Vollmer et al. (1999) highlighted the need for future research to investigate impulsive behavior in light of a tangible or attention-based function—as these behaviors are also sensitive to impulsivity. The

results of the functional assessment in the present study indicated that the participant's tantrums (inappropriate impulsive behavior) were maintained by access to tangible items/activities. Thus the present research provided a little more insight into this area. Functionally equivalent-based interventions have been an effective meta-strategy in the treatment of challenging behaviors. Cooper et al. (2007) state that if a problem behavior serves a specific function, then the intervention should provide the reinforcer (e.g., tangible item) contingent on a more appropriate response. This new response serves the same function for the individual and, if the intervention is implemented successfully, provides a more efficient, effective and socially valid means of reaching the specific goal. Campbell and Lutzker (1993) illustrate this point in their study, where they successfully employed functional communication training to eliminate tantrums and property destruction in an 8-year-old boy. Appropriate waiting is an essential adaptive skill in day-to-day life for all people, and further applied research in this area is greatly needed.

4. Conclusion

The present study examined the use of a Time Timer™ to gradually increase reinforcement delay in a child with developmental disabilities and problem behavior. This study supports previous findings that participants respond well to knowing that reinforcement will be available (Vollmer et al., 1999) and when reinforcement will be available (Bower et al., 1966). It also lends substantiation to the proposal that functional based interventions are an effective strategy in the treatment of problem behaviors (Campbell & Lutzker, 1993). Further research could compare the efficacy of using either a predictive stimulus (cue card), and timed stimulus (timer) or both—with and without verbal cues, in order to gain a greater understanding of the behavioral mechanisms in effect in an intervention of this nature.

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