

Differentiation of Preference Using Response-Reinforcement Delay in a Child with Autism: A Case Report and Review of the Literature

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Tel: +81-48-471-7042**Citation:** Oishi K. Differentiation of Preference Using Response-Reinforcement Delay in a Child with Autism: A Case Report and Review of the Literature. *Acta Psychopathol.* 2017, 3:2.

Abstract

Assess differentiation of preference in a 13-year-old autistic child with profound developmental delay. We tested the child's response-reinforcement delay by providing a choice of two instructional tasks: a transparent bag containing either two picture cards describable by two hiragana (phonetic) characters, or six picture cards describable by three hiragana characters. We compared two conditions: 1) No-response-delay, where the child could listen to audio immediately after music presentation; 2) Response-delay, where the child had to choose one card set and complete the task before audio. Differentiation of preference was achieved by varying the time for task completion. A task with a small number of trials was necessary before the child was able to promptly select audio. He also learned what could shorten the delay before listening to his chosen audio. By choosing tasks that shortened the time between task and reward, the participant could discriminate response-reinforcement delay.

Keywords: Autism; Behavioural research; Discrimination learning; Choice making**Received:** March 13, 2017; **Accepted:** March 21, 2017; **Published:** March 31, 2017

Introduction

We often use phrases and expressions such as "When we've done task A, we'll do B." Such instructions are frequently used in both school and home settings. However, in the case of the participant of this case report, a child with autism and developmental delay, the use of such instructions did not have a substantial effect on the differentiation of preference or selection of behaviour. Despite this lack of preference, we found that a situation encouraging the finishing of A first so that B, the reinforce, would follow, was helpful in encouraging the desired outcome and was effective in fostering voluntary choice and self-determination in this child. Many studies have assessed the preferences of children with autism and severe or profound developmental delay [1]. Lerman et al. [2] found that the opportunity for making a choice appears to be beneficial for these individuals. Romaniuk et al. [3] reported that individuals who display challenging behaviours often exhibit these when they are given opportunities to make choices, thus demonstrating a stimulus preference.

People offered the same reward after either a short or a longer period of time (delayed reinforcement) naturally choose the reward after the shorter time [4,5]. According to previous

research, delayed reinforcement results in temporal discounting [6]. Also, Gergely [7] stressed that three discriminate features are related to these difficulty.

Here, we present a child diagnosed with autism and profound developmental delay who was able to establish a differentiation of preference.

Case Report

A 13-year-old boy who had been diagnosed with developmental delay with autistic features was referred to our clinic in the university due to parental concerns regarding his impairment in language development, social-emotional reciprocity, and repetitive and self-stimulatory behaviours. He had been born at term after a normal pregnancy and an unremarkable delivery. His motor development was not delayed. There was no family history of autism spectrum disorders.

He was non-verbal, but did vocalize. He demonstrated poor eye contact. His response to instructions was inconsistent. He engaged in stereotypic behaviours, such as peripheral gazing and rocking his head and body. He exhibited high levels of self-stimulatory behaviour and a low level of tantrums. His verbal age as measured by the Picture Vocabulary Test (PVT) was estimated

to be at the level of a 2-year-old, and his IQ as measured by the Tanaka-Binet Intelligence Scale was 18 his mental age as measured by the Tanaka-Binet Intelligence Scale was estimated to be 2-year and 5-month old.

The child had an extensive training history and had accomplished discrimination learning via matching-to-sample tests with colors, shapes, words and conceptual language, such as comparisons. After confirming reinforcer discrimination (i.e., differentiation of preferences among different kinds of music and sound) and task quantity discrimination (classified into large and small tasks based on number of items needing to be matched), we investigated his differentiation of task selection by comparing: (1) The condition in which the most preferred audio was awarded following music presentation; and (2) The condition in which the most preferred audio was chosen first and was then awarded following task completion.

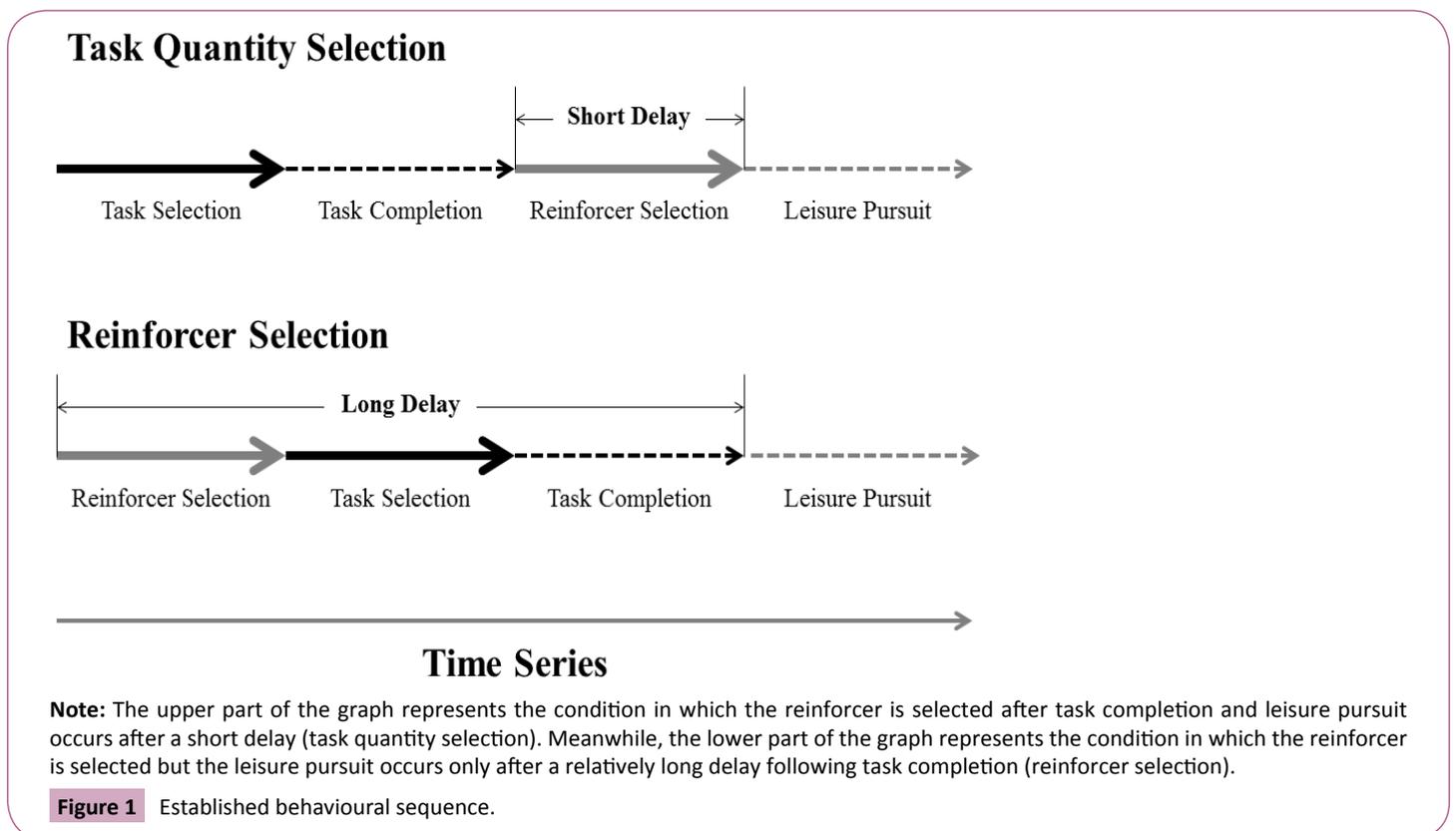
All sessions were conducted in a playroom at the university. The room contained at least two tables, several chairs, instructional tasks, music tapes and recording equipment. Sessions ranged in length from 10 to 15 min, with one session per day. The duration of the study was nine months. During this period, instruction was given in a total of 22 blocks (four trials per block), generally once a week. A 23rd and 24th block were added four weeks following the end of Block 22, to verify maintenance of choice-making behaviour. Blocks 1–8 examined the shorter vs. longer task selection, blocks 9–17 covered the music selection, blocks 18–22 again assessed the shorter vs. longer task selection, and blocks 23 and 24 were designed to assess maintenance of the task quantity selection.

Three choices were prepared to confirm if the child could discriminate among the reinforcer, the premise of the preference assessment. The three stimuli offered as choices were a siren noise, Baroque music, and pop music. There were two kinds of prepared tasks involving clear plastic bags containing either two picture cards (the two-card task set), or six picture cards (the six-card task set).

Two types of behavioural sequences similar to those depicted in **Figure 1** were established. The shorter task set had two cards each depicting actions that he could describe in two hiragana (phonetic) characters (so that the total number of characters was four), and the longer task set had six cards each depicting actions that he could describe in three characters (for a total number of 18 characters). This large difference in characters was designed to ensure that the latter task would require significantly more time.

We employed procedures to verify whether a preference for a task that would result in receiving a reinforcer after a relatively short period of time (time preference) would be clear in a behavioural context where free choice and self-determination were permitted. In the reinforcer discrimination, the selection rate was calculated for a setting in which the child voluntarily selected one of three audios—a siren noise, Baroque music, or pop music before pursuing a task. Looking at audio selection would allow us to study whether or not the preference was differentiated, and whether the selection rate of the shorter two-card task would increase.

Figure 2 shows the results of the shorter task (two-card) selection rate by block. The vertical axis of the graph shows the selection



rate (by percentage) and the horizontal axis shows the block number (four trials=one block). In the first phase (task quantity selection), the selection rate of the two-card task was 50.0% on average while in the second phase (reinforcer selection), the selection rate of the two-card task averaged 86.1%. In the third phase (task quantity selection), it averaged 90.0%, and in the fourth phase (maintenance verification; new task/task quantity selection), the two-card task was selected 100% of the time. Phase 1 exhibited the selection behaviours and selection tendencies, including exchange reactions and position biases. Beginning with Phase 2, the preference was gradually differentiated, and this tendency was maintained in Phase 4, even when the comparison stimuli were replaced with new pictures. Based on the above, the preference for tasks became clear in Phase 2 (reinforcer selection).

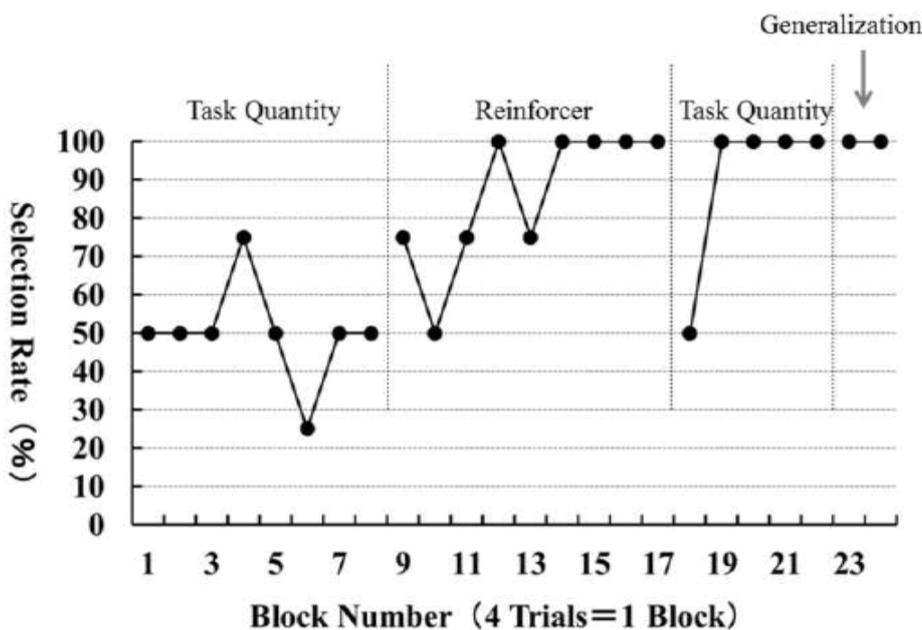
Discussion

We hypothesized that delay discrimination was possible when the audio was chosen first and was then awarded following task completion, and that a preference for the shorter task in which the participant could listen to the audio after a shorter delay (time preference or impulsivity) would be demonstrated. An impulsive preference for one kind of audio over another can be obtained with no delay (i.e., immediately after the selection) and can be an effective strategy for securing and consuming reinforcements. It is obvious that this selection reaction reduces the wait for results, allowing more efficient use of the participant's own time.

Among people with autism or developmental disabilities, waiting or situations involving a high degree of freedom can

trigger behavioural problems [8]. Therefore, the importance of selection reactions based on preference can be greater for people with developmental disabilities than for others. However, there are cases among people with autism, or developmental disabilities involving severe or profound retardation, where selection reactions based on preference. For example, Bowman et al. [9] evaluated stimulus preference in seven individuals with autism who had been diagnosed with moderate to profound developmental delay. They found clear individual differences in preference, including a participant who was unable to demonstrate a preference.

Another example is the position bias or exchange reaction frequently observed in cases where the participant has a long training history [10]. The problems are: (1) Stimulus discrimination, (2) Discrimination of reinforcement quantity, and (3) Delay discrimination. These may be the reasons behind position bias or exchange reaction [11]. For instance, Bowman et al. [9] studied the reaction acceleration effect in cases in which multiple low-preference stimuli or high-preference stimuli were presented, and did not find a reaction acceleration effect in one of the seven children with developmental disabilities under any circumstances. This particular child had been diagnosed with autism and profound developmental delay. Furthermore, Carr et al. [12] applied the preference identification method, in which multiple choices were presented over a brief period of time, and did not reveal a stable preference in any of three children medically diagnosed with autism. On this basis Karsten et al. [13] proposed the preference assessment method for persons with developmental disabilities.



Note: The graph's vertical axis represents selection rate (%); the horizontal axis represents block number (4 trials=1 block). In the first phase, a participant selects task quantity; in the second phase, he selects reinforce; in the third phase, he selects task quantity; and the last phase, stimulus generalization was probed.

Figure 2 Task quantity (two-card) selection rate.

We have followed a procedure similar to Dyer [14]. With regard to these special measures, Dyer [14] conducted a preference identification procedure for reinforcers preceding accomplishment of a task and was successful in diminishing stereotyped reactions by having this procedure accompany the task. Dyer's [14] procedure could be an effective means of solving the problem of reinforcers perceived as unassociated with behavior and reinforcer, as indicated by Carr et al. [15].

Bowman et al. [9], Carr et al. [12], and Lerman et al. [16] all reported cases in which participants were presumed to have failed to discriminate delay between behaviour and reinforcer. Here, to attempt to circumvent this issue, we manipulated the time between response and reinforcement to allow the participant to realize that his own reactions were influencing the length of delay before the reinforcer was received. As a result, there was a clearer preference for tasks in which reinforcers could be obtained after a relatively short delay. Naturally, the preferred task set required a shorter time throughout the entire study. The results of this case support Dyer et al. [8] findings. If a short delay between response and reward had aided in the prediction of the results, this study would have supported Balsam

and Gallistel [17] theory. That is to say, we would prove the fact that the participant showed preference for the choice that could acquire a reinforcer with a short delay. This fact suggests that the participants discriminated the delay and was compared them. However, we did not conduct a comparative analysis in terms of delays, types of response, or behaviour chains. Accordingly, this study makes no findings regarding these factors. Also, if control of experimental conditions is stressed, homogenous tasks must be clearly long and short. We have presented the successful differentiation of preferences in one case. We hope to see larger-scale studies of this phenomenon in the future.

Conclusion

These findings indicate that people with autism or developmental disorders generally have a problem with time evaluation and making behavioural associations. As this study went on, the child with nonverbal had increased chances to communicate (requests as well as selections) in writing. Even in domestic help or in preparation and clean-up, he became capable of making selections and completing them himself.

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