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The effect of temporally spaced responding on preference for stimuli

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Abstract

Human beings, who use language, prefer rewards that follow "effortful events". Recently, the same phenomenon was reported in non-human animals, and further examinations focused on this phenomenon have been conducted. In these studies, events requiring a variety of efforts, especially the number of responses (e.g., FR20 and FR1), were used to produce a preference. However, the results were inconstant. We made the number of responses equal as for both high-effort and low-effort prior events, and we manipulated the inter-response time (IRT) of two responses required. By doing so, we sought to determine whether the temporally spaced responding would lead to a preference for the stimuli that follow. Twelve undergraduate students were trained for two kinds of trial in training. On one kind of trial, 10-sec IRT initial work (high-effort) was followed by a presentation of a simultaneous discrimination. On the other trial, 2-sec IRT initial work (low-effort) was followed by a presentation of different one. Then, in test phase, participants were required a choice between two positive stimuli (S+). To determine whether the mean choice of high-effort S+ ($S+_{10SEC}$) in test phase was significantly different from chance (50%), a single-sample *t* test was conducted. The analysis indicated that choice of $S+_{10SEC}$ (72.0%) was significantly different from chance [t (11) = 3.17, $p < .01$, $d = 1.35$]. The results show that participants preferred the S+

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that followed the 10-sec IRT in training to the S+ that followed the 2-sec IRT. It is likely that the "difficulty" which the temporally spaced responding on initial-work accompanied affected preferences. We will study the difference between the case of manipulating IRT and the case of manipulating delay to reinforcement which was discussed in previous studies.

Keywords: inter-response time; limited-hold; temporally spaced responding; difficulty; preference; humans

1. Introduction

Human beings, who use language, prefer rewards that follow "effortful events." Recently, the same phenomenon was reported in non-human animals (Clement, Feltus, Kaiser, & Zentall, 2000), and further examinations focused on this phenomenon have been conducted. Although events requiring a variety of efforts have been used to produce a preference (Zentall, 2013), most of them were defined quantitatively (e.g., FR20 and FR1). In this study, we defined effort qualitatively in terms of "difficulty," and therefore manipulated the inter-response time (IRT) of two responses required and limited-hold (LH). By doing so, we sought to determine whether the temporally spaced responding (Conrad, Sidman, & Herrnstein, 1958) which involves "relative difficulty" (difference in IRT) and "absolute difficulty" (difference of LH) would lead to a preference for the stimuli that follow.

2. Methods

2.1. Participants

Twenty four students of a private university in Japan were participated (LH-0.3 condition; $N = 12$, LH-2.0 condition; $N = 12$).

2.2. Apparatus

All participants were trained and tested with a program created with Microsoft Visual Basic 2010®, run on a 14-in. notebook computer (ThinkPad Edge E420, lenovo®).

2.3. Materials

White circle drawn vertical line and white circle drawn horizontal line were served as discriminative stimuli in initial work. Before starting pre-training, each participant was presented 14 stimuli drawn with Microsoft Paint®, and was instructed to choose prefer one and hate one in threes. Eight stimuli which were not chosen were employed as discriminative stimuli in terminal work. Four stimuli were assigned to IRT-10 condition and the remaining four stimuli were IRT-2 condition in training, at random. Furthermore, either stimulus assigned to IRT-10 condition or IRT-2 condition was classified positive stimulus (S+) or negative stimulus (S-) in twos.

2.4. Procedure

Pre-training. Two kinds of quasi-DRL schedules with LH were conducted at random. The purpose of this phase was to let the participants learn how to handle the task in which they are to employ themselves in the next phase. Pre-training also aimed to assess whether there was any difference in degree of "difficulty" between two tasks. An IRT-10 trial (hereafter referred to as "IRT-10") consisted of the presentation of a circle drawn vertical line at the center of the screen. Each participant pressed the space bar which made a start of counting, and after the elapse of 10-sec, they pressed the space bar again and got the feedback ("correct" or "wrong"). An IRT-2 trial (hereafter referred to as "IRT-2") consisted of the presentation of a circle drawn horizontal line at the center of the screen. IRT-2 was similar to IRT-10 but the interval of time between two space-bar pressings was 2-sec. On all trials, participants had to response within a certain period of time (in LH-0.3 condition; 0.3-sec and in LH-2.0 condition; 2.0-sec) before and after their second response. Pre-training consisted of blocks of 16 trials, and continued until participants got 13 correct feedback out of consecutive 16 trials (accuracy rate 85 %).

Training. Participants performed on two-component multiple schedules at random. Each component consisted of two kinds of works; initial work and terminal work. In half of trials, a pair of discriminative stimuli (S+ and S-) followed correct response in IRT-10 with LH-0.3 (LH-2.0). In the remaining trials, another pair of discriminative stimuli followed correct response in IRT-2 with LH-0.3 (LH-2.0). When participants chose the S+, the word "correct" appeared. When they chose the S-, the word "wrong" appeared. Training consisted of blocks of 16 trials, and continued until participants got 13 correct feedback out of consecutive 16 trials (accuracy rate 85 %). When Participants met the criterion in training, they proceeded to testing.

Testing. Test trials involved a choice between the S+ followed IRT-10 ($S+_{10sec}$) and the S+ followed IRT-2 ($S+_{2sec}$) or the S- followed IRT-10 ($S-_{10sec}$) and the S- followed IRT-2 ($S-_{2sec}$). Testing consisted of two blocks of 8 trials, randomly presented. In this phase, no feedbacks were provided.

3. Results

A single-sample *t* test was conducted to examine whether there was any difference in degree of "difficulty" between IRT-10 and IRT-2 in pre-training (see Table1). In LH-0.3 condition, the analysis indicated that total counts of error on IRT-10 was significantly different from that one on IRT-2 [t (11) = 3.44, $p < .01$, $d = 1.04$]. In LH-2.0 condition, however, the analysis indicated that total counts of error on IRT-10 was not significantly different from that one on IRT-2 [t (11) = 1.40, *ns*].

The results of testing were represented in Figure 1. To examine whether the mean choice of IRT-10 S+ ($S+_{10sec}$) in test phase was significantly different from chance (50%), a single-sample *t* test was conducted. In LH-0.3 condition, the analysis indicated that choice of $S+_{10sec}$ (72.0%) was significantly different from chance [t (11) = 3.17, $p < .01$, $d = 1.35$]. In LH-2.0 condition, however, the analysis indicated that choice of $S+_{10sec}$ (43.0%) was not significantly different from chance [t (11) = 0.87, *ns*]. None of participants were aware of correlation between initial work (IRT-2 or IRT-10) and terminal work (S+ or S-).

4. Conclusions

We examined the effect of effort in the form of difference in IRT and difference of LH on preferences for stimuli that follow. The results showed that participants preferred the S+ that followed IRT-10 with LH-0.3 to the S+ that followed IRT-2 with LH-0.3. It is likely that the "absolute difficulty" which the temporally spaced responding with LH accompanied affected preferences. Non-significant difference between IRT-10 and IRT-2 in LH-2.0 condition indicates that manipulation of effort in quantitative terms would not adequate to produce a preference for stimuli. The results, however, could be interpreted in terms of the effect of delay to reinforcement (Alessandri, Darcheville, & Zentall, 2008) rather than the effect of "difficulty". We will study the difference between the case of manipulating IRT with LH and the case of manipulating delay to reinforcement which was discussed in previous studies.

References

Alessandri, J., Darcheville, J.-C., & Zentall, T. R. (2008). Cognitive dissonance in children: Justification or contrast? *Psychonomic Bulletin & Review*, 15, 673-677.

Clement, T.S., Feltus, J., Kaiser, D.H., & Zentall, T.R. (2000). "Work ethic" in pigeons: Reward value is directly related to the effort or time required to obtain the reward. *Psychonomic Bulletin & Review*, 7, 100-106.

Conrad, D. G., Sidman, M., & Herrnstein, R. J. (1958). The effects of deprivation upon temporally spaced responding. *Journal of the Experimental Analysis of Behavior*, 1, 59-65.

Zentall, T. R. (2013). Animals prefer reinforcement that follows greater effort: Justification of effort or within-trial contrast? *Comparative cognition & behavior reviews*, 8, 60-77.

Appendix A.

Table1
Total counts of errors in pre-training.

LH	0.3-sec		2.0-sec	
IRT	10-sec	2-sec	10-sec	2-sec
M	14	7	1	0

Note. Mean is the total counts of errors at the point of reaching the criterion in pre-training.

Appendix B.

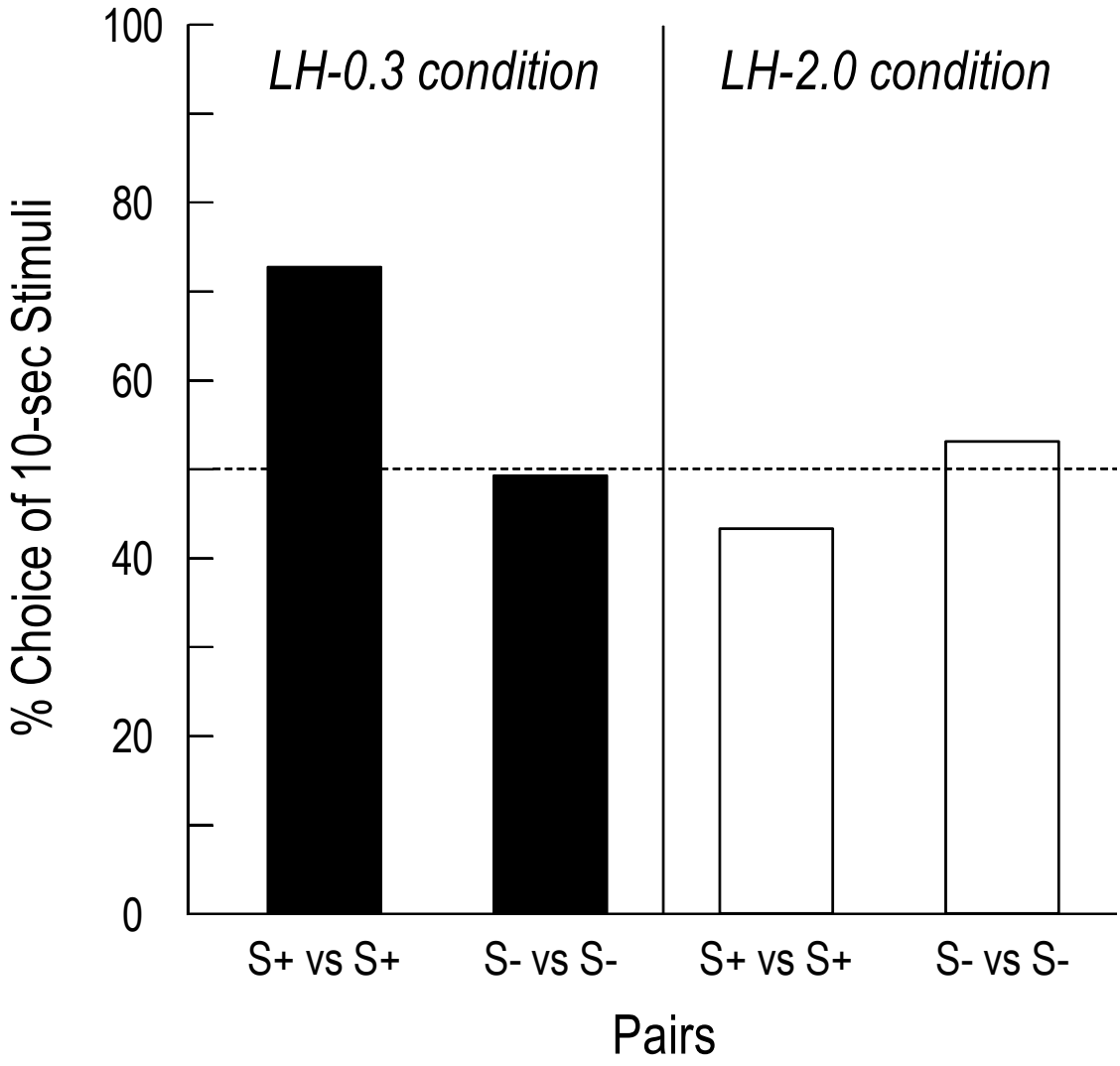

Figure 1. Average percentage choices of the 10-sec stimuli in test phase.