



Resistance to change and resurgence in humans engaging in a computer task

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ABSTRACT

The relation between persistence, as measured by resistance to change, and resurgence has been examined with nonhuman animals but not systematically with humans. The present study examined persistence and resurgence with undergraduate students engaging in a computer task for points exchangeable for money. In Phase 1, a target response was maintained on a multiple variable-interval (VI) 15-s (Rich) VI 60-s (Lean) schedule of reinforcement. In Phase 2, the target response was extinguished while an alternative response was reinforced at equal rates in both schedule components. In Phase 3, the target and the alternative responses were extinguished. In an additional test of persistence (Phase 4), target responding was reestablished as in Phase 1 and then disrupted by access to videos in both schedule components. In Phases 2 and 4, target responding was more persistent in the Rich than in the Lean component. Also, resurgence generally was greater in the Rich than in the Lean component in Phase 3. The present findings with humans extend the generality of those obtained with nonhuman animals showing that higher reinforcement rates produce both greater persistence and resurgence, and suggest that common processes underlie response persistence and relapse.

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1. Introduction

Behavioral momentum theory (Nevin and Grace, 2000) proposes that response rate and persistence, defined as resistance to change, are separable aspects of operant behavior. Persistence is expressed as a ratio of responding with and without some disruptor (e.g., extinction). Specifically, the relation between responding and reinforcement determines response rates. The relation between discriminative stimuli and reinforcers determines persistence. Several studies with nonhuman animals (e.g., Nevin et al., 1990) and humans (e.g., Ahearn et al., 2003; Cohen, 1996) have shown greater persistence in the presence of discriminative stimuli associated with higher reinforcement rates (Craig et al., 2014; but see Bell, 1999; Grace et al., 1998; and Lattal, 1989, for other factors affecting persistence).

Some recent studies with rats and pigeons revealed a correlation between resistance to extinction and relapse of an extinguished

response (Berry et al., 2014; Miranda-Dukoski et al., 2015; Podlesnik and Shahan, 2009, 2010). In one type of relapse, resurgence (Epstein, 1983; Lieving and Lattal, 2003), a target response is reinforced in Phase 1. Phase 2 extinguishes target responding and reinforces an alternative response. In Phase 3, the alternative response also is extinguished, and the target response commonly recurs. Podlesnik and Shahan showed that higher reinforcement rates for target responding produced greater resistance to extinction and resurgence, thereby extending behavioral momentum theory to relapse (see Podlesnik and DeLeon, 2015; for a review).

The generality of the relation between persistence and resurgence, however, has not been examined with humans. Thus, the present study used a computer task borrowed from studies of choice (e.g., Madden and Perone, 1999) to assess the relation between resistance to extinction and resurgence with undergraduate students. We also studied access to videos as an additional disruptor to examine the generality of findings, which has been used previously with individuals with developmental disabilities (see Lionello-DeNolf et al., 2010; Mace et al., 1990).

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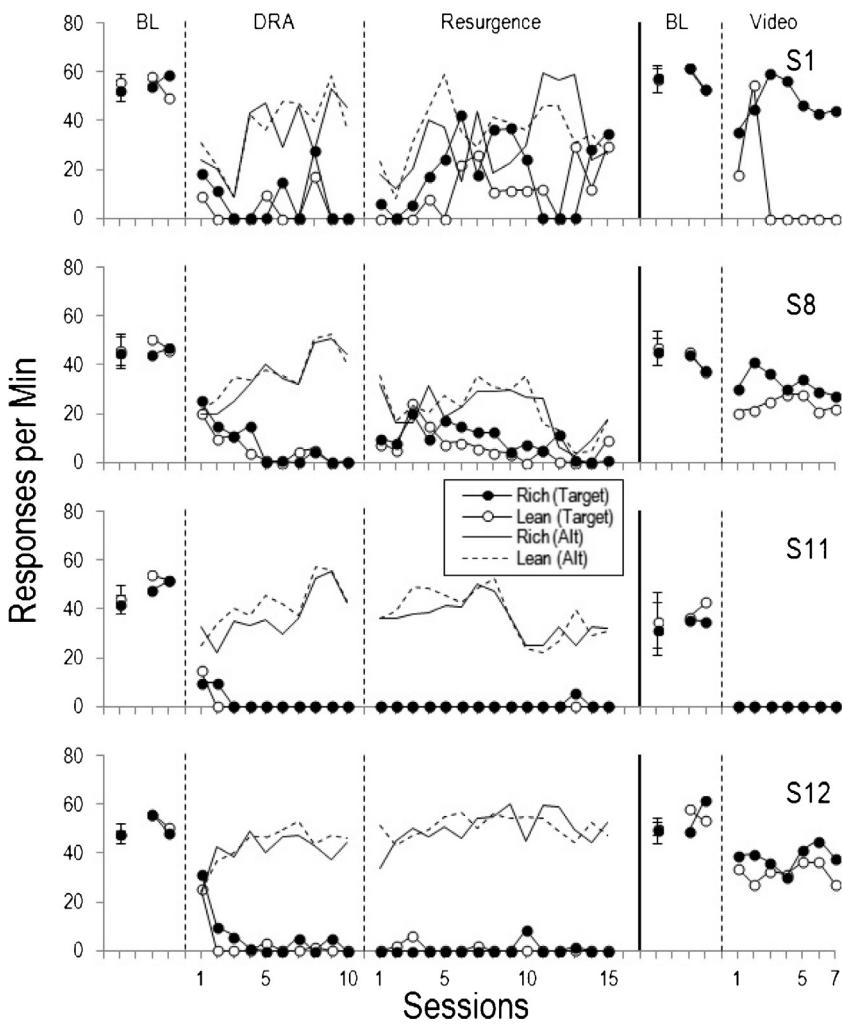


Fig. 1. Responses per min for each participant during baseline (BL), DRA, resurgence-test (Resurgence) and video-test (Video) sessions. Under BL, data points with vertical lines (± 1 SD) show the mean response rates of the last nine sessions of Phase 1; those without vertical lines show response rates in the two baseline sessions just prior to DRA or video-test sessions. Closed and open circles represent the target response in the Rich and Lean components, respectively. Solid and dashed lines without circles represent the alternative response in the Rich and Lean components, respectively.

2. Material and methods

2.1. Participants and apparatus

Participants were recruited by fliers posted at Aichi Bunkyo University. Three female and one male undergraduate students, aged 19–24, participated. They spent approximately 80 min in each laboratory visit, 2–3 times a week, not on consecutive days in general. Sessions occurred in a room with a desktop computer, desk, and a chair. Visual Basic 2008® executed and recorded experimental events, and JavaScript® controlled YouTube® videos.

2.2. Procedure

Participants first watched a 1-min demonstration on how to collect points. Then they signed an informed consent describing that the total money they could receive would be a sum of earned points (0.9 Japanese yen, approximately 0.9 U.S. cent, per point), 400 yen per hour, and a bonus of 100 yen per hour for completing the study. Participants lost 100 yen from the bonus for each canceled laboratory visit. Except for the bonus paid at the end of the study, payment was made after each visit.

On the first laboratory visit, participants read these instructions in Japanese:

You will play a game on a computer. When ready, click the START button. A new page will appear and you will see a button. Clicking the button can cause you to gain points. When this happens, a different button will appear indicating how many points you have just gained. Clicking this button will resume the session. The total points will determine the amount of money you will receive.

During sessions, the computer screen was black except for an 8.8×8.8 cm panel on the left side of the screen in some sessions, or on both sides of the screen in other sessions. The right edge of the left panel and the left edge of the right panel were 3.5 cm away from the midline of the screen and the lower edges were 14.5 cm above the bottom of the screen. In the center of each panel was a gray 0.8×0.8 cm response button. Upon a first click on either response button, they started moving in random directions within each panel, independently from each other, at a rate of 0.53 cm per 0.1 s. A response was a mouse-click on a response button.

Reinforcers consisted of a 0.2-s 1000-Hz tone, the response buttons and panels disappearing, and a consummatory-response button (2.4 cm wide by 1.8 cm high) with the text “+5”, appearing 1.5 cm below the lower edge of the panel on the side of the just-clicked response button. A click on the consummatory-response button increased total gains by 5 points and caused the panels and response buttons to reappear. No point counters or timers were displayed on the screen.

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