**Supplemental Material**

**Participants and Data Screening**

We eliminated data sets meeting any of five exclusion criteria, similar to criteria described in our previous research (Ritchey et al., 2021a). First, we excluded participants engaging in more than 20 responses per second to eliminate data likely produced by “bots.” We also excluded participants with (1) no responses across a two-min period in Phase 1 or Phase 2 or (2) no alternative responses throughout Phase 2 to ensure at least minimal contact with the experimental contingencies. In addition to this, we excluded participants who did not demonstrate at least a 50% reduction from their average Phase-1 target response rate by the last min of Phase 2. Finally, we excluded participants who did not complete the experiment, including the post-experiment survey. We excluded a total of 115 participants (18.5%).

Participants could only access the experimental task on MTurk using Windows or Mac (either desktopor laptop)computers and one of the following browsers: Google Chrome, Mozilla Firefox, or Microsoft Edge. We recruited participants with an MTurk approval rate at or above 95%. The approval rate indicates that percentage of tasks resulting in payment from MTurk employers (Chandler & Shapiro, 2016). Individuals were not eligible to participate if they had completed any of our previously published experiments.

**Procedures**

We presented a general description of the task on the MTurk website. Clicking a link on that website presented an informed consent form followed by instructions for the experimental task. After providing consent, participants could complete both the experimental task and a post-experiment survey. Upon completion of the survey, a unique payment code was provided using *xorshift Random Number Generator* (*RNG*; Marsaglia, 2003) along with instructions to return to the MTurk website to submit the code. Participants received electronic payment within 36 hours of submitting the code. All instructions and survey questions appear below in Supplementary Materials.

A beach scene was presented in the background and two buttons (the “target” and “alternative” buttons) were presented in the foreground with either a red heart or black club symbol. Button symbol and location (left or right side of the interface) were completely counterbalanced across participants. Buttons randomly moved 20 px (a fifth of button size) in one of four directions (up, down, left, and right) at 0.2-s intervals within a rectangular workspace.

During some parts of each experiment, clicking a button sometimes resulted in *reinforcement* and/or presentation of a *cue*. Reinforcement comprised the following events: (1) presentation of a yellow star above the button, (2) a change in the color of the point bar from gray to green for 0.4 s, (3) addition of 100 points to point counter, and (4) addition USD $0.000005 per point to total earnings. Cues consisted of a static fireworks image (Experiments 1a and 1b) or an animated geometric pattern (Experiment 2) presented for 0.4 s at a location equidistant from the two workspaces – see Figure 1A in the article. A *response cost* contingency was also in place for each click on either button (e.g., Shanks & Dickinson, 1991; Chen & Reed, 2020), with response cost comprising the following events: (1) a 0.4-s presentation of red text – “-1” – below the button, (2) a switch in the point-bar color from gray to red for 0.4 s, and (3) a deduction of $0.000005per point lost from total. Clicks on other parts of the interface were recorded but resulted in no programmed consequences. These included clicks (1) within a workspace but not on a button, (2) on the background outside a workspace, (3) on any text indicating number of points earned, total points earned, or total monetary earnings, (4) on the point bar or point-bar label, or (5) on the yellow star.

Each experiment consisted of three 5-min phases; transitions between phases were not signaled. During Phase 1 of each experiment, reinforcement was provided contingent upon target-button clicks according to a VI 2-s schedule. Clicks on the alternative button resulted in no programmed consequences apart from a response cost. In Phase 2, reinforcement was delivered contingent upon alternative-button clicks according to a VI 2-s schedule, while clicks on the target button were extinguished. Alternative-button clicks also resulted in cue presentation according to the same schedule as reinforcer deliveries or according to a separate VI 2-s schedule for some groups in Experiment 2. In the latter case, cue and reinforcer deliveries never occurred simultaneously. Phase-3 contingencies differed across groups and experiments. Table 2 in the article provides a summary of experimental procedures.

Participants were randomly assigned to one of two groups, with all groups experiencing (1) simultaneous reinforcer and cue deliveries in Phase 2 and (2) the presence (hereafter, *cue tests*) and absence of cue presentations (hereafter, *no cue tests*) for alternative-button clicks across 30-s intervals in Phase 3. To facilitate this within-subjects manipulation, we arranged a 1-s *blackout* at 30-s intervals for all groups and across all phases of the experiment. During blackouts, all onscreen stimuli disappeared, and a rotating hourglass appeared atop a white background. Cue tests (A) and no cue tests (B) were presented in a counterbalanced order across participants according to an ABBABAABAB or BAABABBABA pattern.

We manipulated the presence or absence of alternative reinforcement in Phase 3 as a between-groups variable. For the experimental group (Group No Alt P3, *n* = 50) button clicks did not result in reinforcement during Phase-3 tests. For the control group (Group Alt P3, *n* = 51), alternative-button clicks produced reinforcement according to the same VI 2-s schedule in Phase 2 and Phase 3.

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**Results**

Target response rates increased across Phase-1 bins and decreased across Phase-2 bins. Alternative response rates decreased across Phase-1 bins and increased across Phase-2 bins. For target response rates, there was a significant Bin x Phase interaction (β = -1.46, z = -6.15, *p* < .001), suggesting differences in target response-rate patterns within Phase 1 relative to Phase 2 for Group Alt Present. Post-hoc pairwise comparisons confirmed significant differences in the last bin of Phase 1 compared to the last bin of Phase 2 within groups (ts < 6.71, ps < .001). Further, between-group analyses suggested no differences in the last bin of Phase 1 (p = .783) or the last bin of Phase 2 (p = .542).

Results of the statistical analysis for alternative responding indicated a significant Bin x Phase interaction (β = 0.71, z = 7.00, *p* < .001), suggesting differences in response-rate patterns over time in Phase 1 relative to Phase 2 for Group Alt Present (see Figure 1C). Post-hoc pairwise comparisons confirmed significant differences in the last bin of Phase 1 compared to the last bin of Phase 2 within groups (zs < 6.14, ps < .001). Between-group analyses suggested no differences in the last bin of Phase 1 (p = .869) or the last bin of Phase 2 (p = .682) across groups.

To further explore differences between cue and no cue tests, we evaluated differences between the test order. That is, we were interested in understanding whether there was a difference in resurgence if Phase 3 began with either a cue test or a no cue test, and whether any differences were maintained across both groups. We performed a two-way ANOVA to examine the effects of Group (Alt Present vs. Alt Absent), Condition (Cue vs. No Cue), and Phase (last bin of Phase 2 vs. first bin of Phase 3). The results of the ANOVA showed significant main effect of Group (F [1, 192] = 8.84, p < .001), a significant main effect of Phase (F [1, 192] = 15.85, p < .001), and a significant Phase x Group interaction (F [1, 192] = 5.35, p = .022). Post-hoc pairwise comparisons suggested initially experiencing a no cue test (i.e., BAABABBABA) resulted in greater resurgence for Group Alt Absent. No other significant differences were observed (p > .083).

Post-hoc pairwise comparisons suggested significantly lower alternative-response rates in the first bin of Phase 3 relative to the last bin of Phase 2 for Alt Present and Alt Absent if the no cue test was first (ts > 6.83, ps < .001). Additionally, responding also decreased for Alt Present when the cue test was first (t = 8.27, p < .001). Significantly greater responding was observed for Alt Absent when the cue test was first compared to when the no cue test was first (t = 3.91, p = .003). Lastly, alternative responding was significantly higher for Alt Absent when the cue test was first compared to Alt Present (t = 5.13, p < .001).

**Table S1**

Participant Demographics (N=128)

|  |  |  |  |
| --- | --- | --- | --- |
| Measure | *M* (*SD)* | *n* | Percent of Sample |
| Age | 36.36 (11.55) |  |  |
| Sex |  |  |  |
| Male |  | 85 | 66.41 |
| Female |  | 43 | 33.59 |
| Not reported |  | -- | -- |
| Nationality |  |  |  |
| American |  | 119 | 94.44 |
| Indian |  | 5 | 3.5 |
| Other |  | 4 | 1.1 |
| Not reported |  | 0 | -- |
| Place of Residence |  |  |  |
| United States |  | 123 | 96.09 |
| India |  | 3 | 2.34 |
| Other |  | 2 | 1.56 |
| Not reported |  | 0 | 0.0 |
| Color Blindness |  |  |  |
| Red-green |  | 6 | 4.69 |
| Blue-yellow |  | 3 | 2.34 |
| Total |  | 2 | 1.56 |
| Other |  | 0 | 0.0 |
| Not reported |  | 0 | 0.0 |
| Attrition Rate |  | 70/198 | 35.36 |

*Note.* We did not exclude participants with color blindness due to redundant indications of reinforcer deliveries (see Fig. 1).

**Table S2**

**Table S3**

*Reinforcer Rates*

|  |  |  |  |
| --- | --- | --- | --- |
|  | M (SD) | | |
| Group | Phase 1 | Phase 2 | Phase 3 |
| Alt Present | 18.70 (7.17) | 17.50 (8.59) | 19.10 (7.53) |
| Alt Absent | 19.00 (7.11) | 17.40 (8.18) | -- |

Note. M = Mean; SD = standard deviations.

**Table S4**

*Cue rates*

|  |  |  |
| --- | --- | --- |
|  | M (SD) | |
| Group | Phase 2 | Phase 3 |
| Alt Present | 17.50 (8.59) | 19.10 (8.88) |
| Alt Absent | 17.40 (8.18) | 3.07 (3.02) |

Note. M = Mean; SD = standard deviations.

**Appendix A**

Instructions to HIT

After pressing the PROCEED button below, you will play a game to earn as many points as you can. A new page will appear, and you will see a button. Pressing the button could sometimes increase or decrease your points. Points will be tracked by a bar on the screen. The game will take approximately 15 minutes to complete. If you complete the game, you will be paid for completing the task and every point earned will be worth US$0.00021. Failing to begin engaging with the game within 30 seconds after proceeding will terminate the opportunity to participate in this task and the opportunity for payment. Therefore, do not proceed unless you are ready to begin and complete the game. Press the PROCEED button when ready to continue and please begin the game as soon as the interface appears.

**Appendix B**

Post-task Questionnaire

1. On a scale of 1 (definitely no) to 100 (definitely yes), how sure are you there was a button with a RED HEART at some point during the task?
2. On a scale of 1 (definitely no) to 100 (definitely yes), how sure are you there was a button with a BLACK SPADE at some point during the task?
3. On a scale of 1 (definitely no) to 100 (definitely yes), how sure are you there was a button with a RED DIAMOND at some point during the task?
4. On a scale of 1 (definitely no) to 100 (definitely yes), how sure are you there was a button with a BLACK CLUB at some point during the task?
5. On a scale of 1 (not effective) to 100 (very effective), how sure are you the button with a RED HEART was effective for earning points at some point during the task?
6. On a scale of 1 (not effective) to 100 (very effective), how sure are you the button with a BLACK SPADE was effective for earning points at some point during the task?
7. On a scale of 1 (not effective) to 100 (very effective), how sure are you the button with a RED DIAMOND was effective for earning points at some point during the task?
8. On a scale of 1 (not effective) to 100 (very effective), how sure are you the button with a BLACK CLUB was effective for earning points at some point during the task?
9. What do you think was the overall purpose of the study you just completed? If you do not know, please feel free to respond, “I don’t know.” Leave the question blank if you prefer not to answer.
10. Did you have an overall strategy that you used throughout the study?
11. Please describe your overall strategy that you used throughout the study. If you did not have a strategy, please feel free to respond, “I did not have a strategy.” Leave the question blank if you prefer not to answer.
12. Did your strategy change as you moved forward in the study?
13. If there is any other information you wish to explain about your experience during the study, please describe here:
14. What is your age?
15. What gender/sex do you identify with?
16. What is your nationality?
17. In what country do you live?
18. How much distress did you feel resulting from this task from 1 (no stress) to 100 (very stressful)?
19. Do you have any problems with color vision?