**Detailed Results of Alternative-Response Analyses**

**Experiment 1**

Results of the mixed-effects analysis of alternative responding indicated significant fixed effects of Phase (χ2[2.00] = 136.82, *p* < .001), a significant Phase x Group interaction (χ2[4.00] = 100.28, *p* < .001), a significant Bin x Phase interaction (χ2[2.00] = 215.84, *p* < .001), and a significant Bin x Phase x Group interaction, χ2(4.00) = 95.26, *p* < .001. The Bin and Group factors and Bin x Group interaction were not significant, *p*s > .118. Solid and dashed lines in the bottom panel of Figure 2 show the predictions from the final mixed-effects model. Table S1 shows beta coefficients and standard errors for each factor in the final model.

To further examine the significant three-way interaction among Bin, Phase, and Group, we first evaluated differences in alternative responding between phases within each group. Response rates were lower in the last bin of Phase 1 compared to the last bin of Phase 2 within Groups Low Rate and High Rate (*t*s > 8.47, *p*s < .001), and there was strong evidence for these differences, BF10 > 3.00E+8. Levels of responding at each of these timepoints were comparable in Group EXT (*p* = .999), and there was moderate evidence for this null effect, BF01 = 6.02. Thus, arranging reinforcement for the alternative response in Phase 2 produced higher rates of alternative responding compared to arranging reinforcement only for the target response in Phase 1. Response rates were also lower in the first bin of Phase 3 compared to the last bin of Phase 2 in Groups Low Rate and High Rate (*t*s > 2.82, *p*s < .037). There was moderate evidence for this difference in Group Low Rate (BF10 = 5.21), and strong evidence for this difference in Group High Rate, BF10 = 1.89E+12. In contrast, there was not a significant difference in responding between these two timepoints in Group EXT (*p* = .999), and there was moderate evidence for this null effect, BF01 = 6.14. These findings indicate that alternative responding decreased with the removal of both higher- (VI 1) and lower-rate alternative reinforcement (VI 6).

Finally, we observed no between-group differences in alternative responding in the last bin of Phase 1 (*p*s = .999), and there was moderate evidence for these null effects, BF01 > 3.06. These findings indicate similar levels of responding on the alternative button in the presence of identical reinforcement conditions. In the last bin of Phase 2, Groups Low Rate and High Rate responded at higher rates on the alternative button compared to Group EXT, and Group High Rate responded at higher rates than Group Low Rate (*t*s > 4.87, *p*s < .001). There was strong evidence for these between-group differences, BF10 > 3.72E+3. Thus, alternative responding increased to a greater extent by the end of Phase 2 with higher rates of alternative reinforcement compared to lower rates of alternative reinforcement. In the first bin of Phase 3, Groups Low Rate and High Rate responded at higher rates than Group EXT (*t*s > 4.71, *p*s < .001), and there was strong evidence for these differences, BF10 > 2.20E+3. There was no difference in the initial level of responding in Phase 3 between Groups Low Rate and High Rate (*p* = .999), but there was only anecdotal evidence for this null effect, BF01 = 2.72. These results indicate that alternative responding (1) likely decreased to similar levels following the removal of both higher-rate (VI 1) and lower-rate (VI 6) alternative reinforcement at the beginning of Phase 3, and (2) remained low as in the preceding phase for the group earning no alternative reinforcers across the last two phases (Group EXT).

**Experiment 2**

Results of the mixed-effects analysis of alternative responding indicated significant fixed effects of Bin (χ2[1.00] = 4.88, *p* = .027), Phase (χ2[2.00] = 222.93, *p* < .001), a significant Bin x Group interaction (χ2[2.00] = 6.17, *p* = .046), a significant Phase x Group interaction (χ2[4.00] = 69.76, *p* < .001), a significant Bin x Phase interaction (χ2[2.00] = 204.44, *p* < .001), and a significant Bin x Phase x Group interaction, χ2(4.00) = 161.17, *p* < .001. The Group factor was not significant, *p* = .103. Solid and dashed lines in the bottom panel of Figure 3 show the predictions from the final mixed-effects model. Table S2 shows beta coefficients and standard errors for each factor in the final model.

To further examine the significant three-way interaction among Bin, Phase, and Group, we first evaluated differences in alternative responding between phases within each group. Response rates were lower in the last bin of Phase 1 compared to the last bin of Phase 2 within Groups Low Mag and High Mag (*t*s > 12.57, *p*s < .001), and there was strong evidence for these differences, BF10 > 1.62E+14. In contrast, rates were similar across these two timepoints for Group EXT (*p* = .999), but there was only anecdotal evidence for this null effect, BF01 = 2.59. These findings suggest that arranging reinforcement for the alternative response in Phase 2 produced higher rates of alternative responding compared to arranging reinforcement only for the target response in Phase 1. Response rates were also lower in the first bin of Phase 3 compared to the last bin of Phase 2 in Groups Low Mag and High Mag, (*t*s > 7.30, *p*s < .001), and there was strong evidence for these differences, BF10 > 5.14E+6. Rates were similar across these two timepoints for Group EXT (*p* = .999), and there was moderate evidence for this null effect, BF01 = 6.43. These findings indicate that alternative responding decreased with the removal of both higher- (six stars) and lower-magnitude alternative reinforcement (one star).

Finally, we observed no between-group differences in alternative responding in the last bin of Phase 1, *p*s = .999. There was moderate evidence for this null effect in the comparison between Groups Low Mag and High Mag (BF01 = 4.61), and anecdotal evidence for null effect in the remaining comparisons, BF01 < 2.80. These findings likely indicate comparable levels of responding in the presence of identical reinforcement conditions. In the last bin of Phase 2 and first bin of Phase 3, Groups Low Mag and High Mag responded at higher rates on the alternative button compared to Group EXT (*t*s > 6.11, *p*s < .001), and there was strong evidence for these differences, BF10 > 5.20E+5. Levels of responding in Groups Low Mag and High Mag were similar at each of these timepoints, *ps* = .999. There was anecdotal evidence for this null effect in Phase 2 (BF01 = 2.55), and moderate evidence for this null effect in Phase 3, BF01 = 3.11. These results indicate that alternative responding (1) likely increased (Phase 2) and then decreased (first bin of Phase 3) to similar levels between groups experiencing the removal of higher-magnitude and lower-magnitude alternative reinforcement, and (2) remained low for the group receiving no alternative reinforcers across the last two phases (Group EXT).

**Experiment 3**

Results of the mixed-effects analysis of alternative responding indicated significant fixed effects of Bin (χ2[1.00] = 7.13, *p* = .008), Phase (χ2[2.00] = 247.18, *p* < .001), a significant Bin x Group interaction (χ2[2.00] = 13.96, *p* < .001), a significant Bin x Phase interaction (χ2[2.00] = 387.12, *p* < .001), and a significant Bin x Phase x Group interaction, χ2(4.00) = 23.64, *p* < .001. The Group factor was not significant, *p* = .125. Solid and dashed lines in the bottom panel of Figure 4 show the predictions from the final mixed-effects model. Table S3 shows beta coefficients and standard errors for each factor in the final model.

To further examine the significant three-way interaction among Bin, Phase, and Group, we first evaluated differences in alternative responding between phases within each group. Response rates were lower in the last bin of Phase 1 compared to the last bin of Phase 2 (*t*s = 18.65, *p*s < .001), and there was strong evidence for these differences, BF10 > 5.62E+20. These findings indicate that alternative responding occurred at higher rates when arranging reinforcement for that response in Phase 2 compared to arranging reinforcement only for the target response in Phase 1. Response rates were also lower in the first bin of Phase 3 compared to the last bin of Phase 2 (*t*s = 11.01, *p*s < .001), and there was strong evidence for these differences, BF10 > 9.15E+11. Thus, alternative responding decreased with the removal of alternative reinforcement.

Finally, we observed no between-group differences in responding in the last bin of Phase 1, last bin of Phase 2, or first bin of Phase 3 (*p*s = .999), and there was moderate evidence for these null effects, BF01 > 4.67. Overall, these findings suggest that the involvement of Group in the three-way interaction between Bin, Phase, and Group was driven by differences among groups at other timepoints. By the end of Phases 1 and 2, groups responded at similar levels when arranging identical contingencies (Phase 1) but also when arranging differences in the magnitude of alternative reinforcement (Phase 2). Differences in alternative-reinforcer magnitude also did not affect alternative responding during the beginning of the test in Phase 3 – that is, responding decreased to similar levels across groups following the removal of alternative reinforcement.

**Experiment 4**

Results of the mixed-effects analysis of alternative responding indicated significant fixed effects of Phase (χ2[2.00] = 283.87, *p* < .001), a significant Phase x Group interaction (χ2[6.00] = 45.18, *p* < .001), a significant Bin x Phase interaction (χ2[2.00] = 349.21, *p* < .001), and a significant Bin x Phase x Group interaction, χ2(6.00) = 48.04, *p* < .001. The Bin and Group factors were not significant, *p* > .215. Solid and dashed lines in the bottom panel of Figure 5 show the predictions from the final mixed-effects model. Table S4 shows beta coefficients and standard errors for each factor in the final model.

To further examine the significant three-way interaction among Bin, Phase, and Group, we first evaluated differences in alternative responding between phases within each group. Response rates were lower in the last bin of Phase 1 compared to the last bin of Phase 2 within each group (*t*s > 5.11, *p*s < .001), and there was strong evidence for these differences, BF10 > 3.48E+3. Thus, alternative responding occurred at a higher rate when arranging reinforcement for that response in Phase 2 versus arranging reinforcement only for the target response in Phase 1. Response rates were also lower in the first bin of Phase 3 compared to the last bin of Phase 2 for three of four groups (*t*s > 2.18, *p*s < .030), but rates were comparable across these two timepoints for Group Low Rate, Low Mag, *p* = .272. There was strong evidence for these differences in the high-rate groups and Group Low Rate, High Mag (BF10 > 22.99), and anecdotal evidence for a difference between these two timepoints in Group Low Rate, Low Mag, BF01 = 1.34. Overall, these findings indicate that alternative responding generally decreased with the removal of alternative reinforcement.

Regarding between-group comparisons, response rates were comparable among groups by the end of Phase 1, *p*s > .090. There was anecdotal evidence for a difference between Group Low Rate, Low Mag and Group High Rate, High Mag, BF10 = 2.84. There was moderate evidence for a difference between (1) Group Low Rate, Low Mag and High Rate, Low Mag and (2) the low-rate groups, BF10 > 3.56. There was also moderate evidence for the remaining null effects, BF01 > 4.56. Thus, alternative responding likely did not differ in the presence of identical reinforcement contingencies.

In the last bin of Phase 2, the Group High Rate, High Mag responded at higher rates on the alternative button compared to all other groups (*t*s > 3.82, *p*s < .004), and there was strong evidence for these between-group differences, BF10 > 102.92. Differences in responding among the remaining groups were not significant, *p* < .065. There was anecdotal evidence for differences at the end of Phase 2 between the low-rate groups (BF10 = 1.95), moderate evidence for differences between the low-magnitude groups (BF10 = 7.81), and moderate evidence for a null effect in the comparison between Groups Low Rate, High Mag and High Rate, Low Mag, BF01 > 3.97. Overall, these findings suggest that the combination of higher-rate (VI 1) and higher-magnitude alternative reinforcement (six stars = 600 points) produced greater alternative responding by the end of Phase 2 compared to all other combinations of alternative reinforcer rate (VI 1 or VI 6) and magnitude (one star = 100 points or six stars = 600 points).

In the first bin of Phase 3, Group High Rate, High Mag responded at higher rates compared to Group Low Rate, Low Mag (*t*[267.00] = 3.16, *p* = .029), and there was strong evidence for this difference, BF10 = 11.76. All other comparisons were not significant, *p* > .158. There was anecdotal evidence for a difference between the high-rate groups (BF10 = 1.45) and moderate evidence for a difference between the low-rate groups (BF10 = 3.21). Additionally, there was moderate evidence for a null effect between the high-magnitude groups (BF01 = 3.90) and anecdotal evidence for null effects in the remaining comparisons, BF01 < 2.86. Thus, alternative responding in Phase 3 likely persisted to a greater extent only in the group experiencing a combination of higher-rate (VI 1) and higher-magnitude alternative reinforcement (six stars = 600 points) compared to the group experiencing lower-rate (VI 6) and lower-magnitude alternative reinforcement (one star = 100 points) in the preceding phase.

**Table S1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Factor** | ***β* (SE)** | ***df*** | ***t*** | ***p*** |
| Intercept | 16.19 (8.44) | 173.56 | 1.92 | .057 |
| Bin | -0.35 (1.30) | 839.38 | -0.27 | .785 |
| Phase (1) | -3.14 (7.84) | 240.72 | -0.40 | .689 |
| Phase (3) | 2.66 (7.66) | 178.19 | 0.35 | .729 |
| Group (VI 1) | 122.35 (11.61) | 173.56 | 10.54\*\*\* | <.001 |
| Group (VI 6) | 57.81 (11.88) | 173.56 | 4.87\*\*\* | <.001 |
| Bin \* Phase (1) | -2.25 (1.76) | 1721.00 | -1.28 | .202 |
| Bin \* Phase (3) | -2.00 (1.76) | 1721.00 | -1.13 | .258 |
| Bin \* Group (VI 1) | 14.98 (1.79) | 839.38 | 8.37\*\*\* | <.001 |
| Bin \* Group (VI 6) | 8.48 (1.83) | 839.38 | 4.63\*\*\* | <.001 |
| Phase (1) \* Group (VI 1) | -121.81 (10.78) | 240.72 | -5.67\*\*\* | <.001 |
| Phase (3) \* Group (VI 1) | -80.67 (10.54) | 178.19 | -7.65\*\*\* | <.001 |
| Phase (1) \* Group (VI 6) | -62.54 (11.03) | 240.72 | -5.67\*\*\* | <.001 |
| Phase (3) \* Group (VI 6) | -24.09 (10.78) | 178.19 | -2.23\* | .027 |
| Bin \* Phase (1) \* Group (VI 1) | -14.94 (2.43) | 1721.00 | -6.16\*\*\* | <.001 |
| Bin \* Phase (3) \* Group (VI 1) | -23.10 (2.43) | 1721.00 | -3.99\*\*\* | <.001 |
| Bin \* Phase (1) \* Group (VI 6) | -9.90 (2.48) | 1721.00 | -9.53\*\*\* | <.001 |
| Bin \* Phase (3) \* Group (VI 6) | -11.36 (2.48) | 1721.00 | -4.58\*\*\* | <.001 |
| *Note.* \**p* < .05 \*\*\**p* < .001. The Phase (2) and Group (EXT) factors served as the individual contrasts. | | | | |

*Experiment 1: Results of Linear Mixed-Effects Regression for Alternative Responding*

**Table S2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Factor** | ***β* (SE)** | ***df*** | ***t*** | ***p*** |  |
| Intercept | 22.94 (8.05) | 162.04 | 2.85\*\* | .005 |  |
| Bin | -2.32 (1.14) | 916.07 | -2.04\* | .042 |  |
| Phase (1) | -11.34 (8.08) | 198.63 | -1.40 | .162 |  |
| Phase (3) | -0.99 (6.44) | 179.40 | -0.15 | .878 |  |
| Group (Mag 1) | 96.47 (11.39) | 162.04 | 7.59\*\*\* | <.001 |  |
| Group (Mag 6) | 99.95 (11.39) | 162.04 | 8.78\*\*\* | <.001 |  |
| Bin \* Phase (1) | -1.11 (1.52) | 1791.00 | -0.73 | .465 |  |
| Bin \* Phase (3) | 2.67 (1.52) | 1791.00 | 1.76 | .078 |  |
| Bin \* Group (VI 1) | 8.87 (1.61) | 916.07 | 5.49\*\*\* | <.001 |  |
| Bin \* Group (VI 6) | 16.18 (1.61) | 916.07 | 10.02\*\*\* | <.001 |  |
| Phase (1) \* Group (Mag 1) | -91.62 (11.43) | 198.63 | -8.02\*\*\* | <.001 |  |
| Phase (3) \* Group (Mag 1) | -46.06 (9.11) | 179.40 | -5.05\*\*\* | <.001 |  |
| Phase (1) \* Group (Mag 6) | -106.26 (11.43) | 198.63 | -9.30\*\*\* | <.001 |  |
| Phase (3) \* Group (Mag 6) | -53.10 (9.11) | 179.40 | -5.83\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (Mag 1) | -7.98 (2.14) | 1791.00 | -3.73\*\*\* | <.001 |  |
| Bin \* Phase (3) \* Group (Mag 1) | -17.84 (2.14) | 1791.00 | -8.33\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (Mag 6) | -14.99 (2.14) | 1791.00 | -7.00\*\*\* | <.001 |  |
| Bin \* Phase (3) \* Group (Mag 6) | -26.49 (2.14) | 1791.00 | -12.36\*\*\* | <.001 |  |
| *Note.* \**p* < .05 \*\**p* < .01 \*\*\**p* < .001. The Phase (2) and Group (EXT) factors served as the individual contrasts. | | | | | | |

*Experiment 2: Results of Linear Mixed-Effects Regression for Alternative Responding*

**Table S3**

*Experiment 3: Results of Linear Mixed-Effects Regression for Alternative Responding*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Factor** | ***β* (SE)** | ***df*** | ***t*** | ***p*** |  |
| Intercept | 117.89 (6.53) | 218.31 | 18.06\*\*\* | <.001 |  |
| Bin | 6.18 (1.37) | 938.96 | 4.52\*\*\* | <.001 |  |
| Phase (1) | -110.64 (5.93) | 197.85 | -18.65\*\*\* | <.001 |  |
| Phase (3) | -50.68 (4.61) | 176.07 | -11.01\*\*\* | <.001 |  |
| Group (Mag 10) | -0.85 (4.66) | 414.29 | -0.18 | .855 |  |
| Group (Mag 30) | -0.28 (4.66) | 414.29 | -0.60 | .952 |  |
| Bin \* Phase (1) | -10.78 (1.80) | 1887.09 | -5.99\*\*\* | <.001 |  |
| Bin \* Phase (3) | -17.02 (1.82) | 1876.44 | -9.32\*\*\* | <.001 |  |
| Bin \* Group (Mag 10) | 10.57 (1.92) | 912.21 | 5.51\*\*\* | <.001 |  |
| Bin \* Group (Mag 30) | 1.53 (1.92) | 912.21 | 0.80 | .426 |  |
| Bin \* Phase (1) \* Group (Mag 10) | -7.54 (2.47) | 1746.12 | -3.06\*\* | .002 |  |
| Bin \* Phase (3) \* Group (Mag 10) | -10.79 (2.53) | 1855.39 | -4.27\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (Mag 30) | 0.15 (2.47) | 1746.12 | 0.06 | .952 |  |
| Bin \* Phase (3) \* Group (Mag 30) | -2.17 (2.53) | 1855.39 | -0.86 | .392 |  |
| *Note.* \*\**p* < .01 \*\*\**p* < .001. The Phase (2) and Group (Mag 1) factors served as the individual contrasts. | | | | | | |

**Table S4**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Factor** | ***β* (SE)** | ***df*** | ***t*** | ***p*** |  |
| Intercept | 54.60 (7.91) | 220.20 | 6.91\*\*\* | <.001 |  |
| Bin | 2.73 (1.25) | 1102.42 | 2.19\* | .029 |  |
| Phase (1) | -40.21 (7.87) | 284.10 | -5.11\*\*\* | <.001 |  |
| Phase (3) | -13.62 (6.22) | 245.99 | -2.19\* | .030 |  |
| Group (Low Rate, High Mag) | 25.20 (11.18) | 220.20 | 2.25\* | .025 |  |
| Group (High Rate, Low Mag) | 32.27 (11.18) | 220.20 | 2.89\*\* | .004 |  |
| Group (High Rate, High Mag) | 74.96 (11.18) | 220.20 | 6.71\*\*\* | <.001 |  |
| Bin \* Phase (1) | -3.33 (1.63) | 2388.00 | -2.05\* | .041 |  |
| Bin \* Phase (3) | -6.14 (1.63) | 2388.00 | -3.78\*\*\* | <.001 |  |
| Bin \* Group (Low Rate, High Mag) | 6.05 (1.77) | 1002.42 | 3.43\*\* | .001 |  |
| Bin \* Group (High Rate, Low Mag) | 6.31 (1.77) | 1002.42 | 3.57\*\*\* | <.001 |  |
| Bin \* Group (High Rate, High Mag) | 9.46 (1.77) | 1002.42 | 5.36\*\*\* | <.001 |  |
| Phase (1) \* Group (Low Rate, High Mag) | -35.94 (11.13) | 284.10 | -3.23\*\* | .001 |  |
| Phase (3) \* Group (Low Rate, High Mag) | -7.74 (8.80) | 245.99 | -0.88 | .380 |  |
| Phase (1) \* Group (High Rate, Low Mag) | -43.83 (11.13) | 284.10 | -3.94\*\*\* | <.001 |  |
| Phase (3) \* Group (High Rate, Low Mag) | -24.81 (8.80) | 245.99 | -2.82\*\* | .005 |  |
| Phase (1) \* Group (High Rate, High Mag) | -85.26 (11.13) | 284.10 | -7.66\*\*\* | <.001 |  |
| Phase (3) \* Group (High Rate, High Mag) | -52.86 (8.80) | 245.99 | -6.01\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (Low Rate, High Mag) | -8.76 (2.30) | 2388.00 | -3.81\*\*\* | <.001 |  |
| Bin \* Phase (3) \* Group (Low Rate, High Mag) | -10.45 (2.30) | 2388.00 | -4.54\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (High Rate, Low Mag) | -10.86 (2.30) | 2388.00 | -4.72\*\*\* | <.001 |  |
| Bin \* Phase (3) \* Group (High Rate, Low Mag) | -10.48 (2.30) | 2388.00 | -4.56\*\*\* | <.001 |  |
| Bin \* Phase (1) \* Group (High Rate, High Mag) | -12.68 (2.30) | 2388.00 | -5.51\*\*\* | <.001 |  |
| Bin \* Phase (3) \* Group (High Rate, High Mag) | -12.15 (2.30) | 2388.00 | -5.28\*\*\* | <.001 |  |
| *Note.* \**p* < .05 \*\**p* < .01 \*\*\**p* < .001. The Phase (2) and Group (Low Rate, Low Mag) factors served as the individual contrasts. | | | | | |

*Experiment 4: Results of Linear Mixed-Effects Regression for Alternative Responding*