PEOPLE EXERT MORE EFFORT TO AVOID LOSSES THAN TO OBTAIN GAINS

SUPPLEMENTAL TEXT

Ana C. Farinha and Tiago V. Maia

Institute for Molecular Medicine, Faculty of Medicine, University of Lisbon

Limitations in the Control for Risk Discounting in the Effort Task

As noted in the main text, the high-effort (HE) option is associated with a greater probability of failing, so, to reduce the possible impact of risk discounting on choice, we allow participants to repeat a trial if they fail to conclude it in time. In fact, we allow participants to continue repeating a trial as long as they want if they consecutively fail to conclude it in time. This feature of the design is aimed at giving participants confidence that they can always complete a trial with approximately 100% probability of success, regardless of whether they choose the HE or low-effort (LE) option, so that probability discounting does not affect their choices. In this way, we control for risk discounting—an important confound that is typically ignored in other effort-discounting studies (Chong et al., 2016).

One limitation of our procedure to control for risk discounting is that repeating a trial is itself associated with two costs: the additional effort and the additional time involved. The anticipated additional effort involved in case the participant fails to successfully complete a HE choice presumably simply amplifies the expected effort of the HE option, so it should not really change anything. The additional time involved in repeating a trial may be considered an opportunity cost (relative to other things that the participant might do outside the laboratory), so it might have a small effect on making HE choices less desirable through a process unrelated to effort. This effect seems likely to be small for most participants, as participants typically want to perform well on tasks, even if that takes them a little longer. More importantly, however, such potential opportunity costs apply equally to HE choices in gain and loss-avoidance trials, so they seem unlikely to have any bearing on our conclusions (which focus on comparing gain vs. loss-avoidance trials).

Analysis of Failed Trials

Introduction

In this section, we analyze the trials in which participants chose the HE option but failed to complete it successfully (i.e., failed to inflate the balloon in the available time). We focus on two questions. First, we assess whether the probability of failing to successfully complete a HE option differs for gain vs. loss-avoidance trials (and, secondarily, whether it is modulated by the magnitude of the trial). Second, we assess whether, after failing to successfully complete a HE option, participants are more likely to retry it in loss-avoidance than in gain conditions. We analyze

only failures to complete the HE option because failures to complete the LE option were negligible (< 1.5% of LE trials in the experiment with adults and < 0.5% in the experiment with children and adolescents).

Method

We investigated the effects of valence and magnitude on the probability of failing to successfully complete a HE trial by using a mixed-effects logistic regression with the proportion of failed HE trials as the dependent variable and with valence (gain vs. loss) and magnitude (1, 2, . . ., 6) as independent variables. Specifically, the model was the following:

$$\log\frac{\mathrm{p(failure)}}{1-\mathrm{p(failure)}} = \beta_{\mathrm{i}}' + \beta_{\mathrm{i,diff}}' \times LossTrial + \beta_{\mathrm{s}}' \times Magnitude + \beta_{\mathrm{s,diff}}' \times LossTrial \times Magnitude,$$

where the "i" and "s" subscripts represent intercepts and slopes, respectively, the "diff" subscript represents a difference between loss-avoidance trials and gain trials, *LossTrial* is 1 in loss-avoidance trials and 0 in gain trials, *Magnitude* represents the absolute value of the trial loss or gain, and all coefficients have an apostrophe to distinguish them from the similar coefficients in the mixed-effects logistic analysis of choices in the main text. We determined whether the coefficients differed significantly from 0 using likelihood ratio tests (see, e.g., Barr et al., 2013; Singmann & Kellen, 2020). We also investigated whether, after failing to successfully complete a HE choice, participants would be more likely to retry the HE choice in loss-avoidance than in gain trials, by using a paired *t*-test. We conducted exactly the same analyses in the experiment with adults and the experiment with children and adolescents.

Results

In the analyses of the failure to successfully complete a HE trial, the main effects of magnitude and valence, as well as their interaction, were all small and nonsignificant, in both the experiment with adults, $\beta_{\mathrm{s}}^{'}$ = –0.01, 95% CI [–0.03, 0.02], $\chi^2(1) = 0.21$, $p = .519$, $\beta_{\mathrm{i,diff}}^{'}$ = –0.02, 95% CI [–0.15, 0.11], $\chi^2(1) = 0.03$, $p = .821$, $\beta_{\mathrm{s,diff}}^{'}$ = 0.01, 95% CI [–0.03, 0.04], $\chi^2(1) = 0.10$, $p = .660$, and the experiment with children and adolescents, $\beta_{\mathrm{s}}^{'}$ = 0.01, 95% CI [–0.02, 0.03], $\chi^2(1) = 0.10$, $p = .650$, $\beta_{\mathrm{i,diff}}^{'}$ = 0.17, 95% CI [–0.02, 0.24], $\chi^2(1) = 1.27$, $p = .111$, $\beta_{\mathrm{s,diff}}^{'}$ = –0.02, 95% CI [–0.05, 0.02], $\chi^2(1) = 0.40$, $p = .371$ (Figure S13). Following failure to successfully complete a HE choice, participants were more likely to retry the HE choice in loss-avoidance than in gain trials (73% vs.

48%, respectively), with a large effect size, $t(19) = 3.65$, $p = .002$, Cohen's $d = 0.82$, 95% CI for the difference [11%, 39%], in the experiment with adults, but not in the experiment with children and adolescents, where participants were about equally likely to retry the HE choice in loss-avoidance and in gain trials (69% and 67%, respectively), with no significant difference between the two, $t(17) = 0.30$, $p = .769$, Cohen's $d = 0.07$, 95% CI for the difference [–12%, 16%] (Figure S14).

Discussion and Conclusions

The lack of effect of magnitude and valence on the probability of failing to successfully complete HE trials suggests that such failure may not have been mediated by motivation. Both motivational manipulations—magnitude and valence—strongly affected the likelihood of choosing the HE option (Figure 2); however, once participants had committed to the HE choice, the probability that they would successfully complete it was, for the most part, no longer modulated by these motivational manipulations. The lack of effect of valence on the probability of successfully completing HE trials also suggests that our findings could not have been confounded by differential probabilities of failure in gain vs. loss-avoidance conditions. These conclusions are particularly compelling in the experiment with adults, in which the null statistical results are accompanied by largely overlapping plots for gain and loss-avoidance conditions (Figure S13a). In the experiment with children and adolescents, although none of the effects are statistically significant, the plots suggest the possibility of increased probability of failing in the loss-avoidance condition (Figure S13b). We suspect that this effect, if real, results from participants attempting the HE choice more often for that condition (Figure 2b) even when they may be tired and therefore unable to then successfully complete it.

In the experiment with adults, participants were more likely to retry the HE choice after failing to successfully complete it in the loss-avoidance than in the gain conditions. This finding provides further evidence, in the experiment with adults, that participants exerted more effort in the loss-avoidance than in the gain conditions. Interestingly, in the experiment with children and adolescents, the likelihood of retrying the HE choice did not seem to differ for loss-avoidance and gain conditions. Speculatively, these different findings in the two experiments might reflect an increased ability by adults to strategically adjust their behavior following a failure, persevering

more for the more motivationally relevant loss-avoidance condition, whereas the children and adolescents might, less flexibly, simply tend to stick with their prior choice.

References

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