Other's Pain Drives Optimal Decisions

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Abstract

Decision-making under uncertainty may be different for monetary self-gains than when someone else's pain is at stake. We use a three-armed bandit task in self-gain and other-pain conditions, and observe that participants show better performance when trying to avoid pain for another individual. Differences in behaviour stem from overstaying decisions in the condition of self-gain. Computational modeling reveals higher consideration of value in pain decisions than in gain ones.

Keywords: learning; decision-making; explore-exploit; self-gain; social pain

Introduction

Decision-making under uncertainty may not differ between monetary gains and losses (Aberg, Toren & Paz, 2022). However, some studies report equal exploration across domains but greater uncertainty seeking for losses (Krueger, Wilson & Cohen, 2017), and others found increased exploration specifically in the loss domain (Lejarraga & Hertwig, 2016). Yet, real-life decisions may carry aversive consequences not for oneself, but for others—such as causing them pain. How such socially aversive outcomes shape behavior remains unclear. Here, we test decision-making when choices result in monetary self-gain or electrical shocks to another person.

Methods

Participants

93 participants (43 men, 47 women, 2 non-binary, 1 self-described; 25.2 ± 0.63 (SEM) years) performed the experiment. 7 subjects were excluded for poor performance (>2 SD from the mean), and 1 for an extreme model-fitted parameter (>3 SD from the mean). Data from 85 participants were analyzed.

Task

The task, adapted from Aberg et al. (2022), was a restless three-armed bandit performed under two conditions: self-gain (Fig. 1A) and other-pain (Fig. 1B). Outcome probabilities followed three sine-wave functions with different periods and phase shifts (Fig. 1C). On each trial, participants selected a bandit and received a point outcome. In the gain condition, they aimed to increase their monetary reward by maximizing points; in the pain condition, they aimed to reduce shock intensity for another participant by minimizing points. Final outcomes were based on five randomly selected trials per condition. Each condition had 200 trials across two randomized blocks, preceded by a practice round.

Behavioural modeling

We used the models from Aberg et al. (2022) with parameters learning rate (α), three decision weights for expected value (βQ), random switching (βU), and uncertainty reduction (βT).

Results

Better performance for others' pain

As expected, on average participants collected more points in the Gain (vs. Pain) condition ($t(84)=46.535$, $p<.001$, Cohen's $d=5.047$; Fig. 1D). More interestingly, a normalized performance index (proportion of optimal outcomes; Fig. 1E), showed better outcomes in the Pain condition ($t(84)=5.492$, $p<.001$, Cohen's $d=0.596$). This suggests more optimal performance when preventing harm to others than for self-gain.

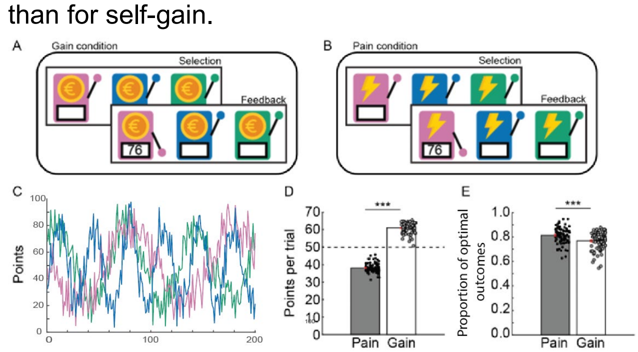

Figure 1: Experimental task and performance. Decision and outcome in the A) Gain, and the B) Pain conditions. C) Example outcome distributions for each bandit. D) Average points

per trial across conditions. E) Proportion of optimal outcomes across conditions. *** p<.001.

Overstaying in self-gain mediates performance differences

Modeling allows us to estimate the expected value (EV) for each bandit at each trial, and thus to define the putatively optimal bandit (with the highest EV). Thus, a decision can be classified as exploratory (putatively suboptimal) or exploitative (putatively optimal), and as stay or switch (from the previous bandit). Pairwise comparisons revealed that participants exploited a previously selected bandit more frequently in the Pain (vs. Gain) condition ($t(84)=3.083$, *p*=.003, Cohen's d=0.334), while they also explored a previously selected bandit less in the Pain condition ($t(84)=3.784$, *p*<.001, Cohen's d=0.410; Fig. 2A). Mediation analyses with bootstrap procedure show that the proportion of Stay & Explore choices mediated the difference in performance between conditions (Fig. 2B).

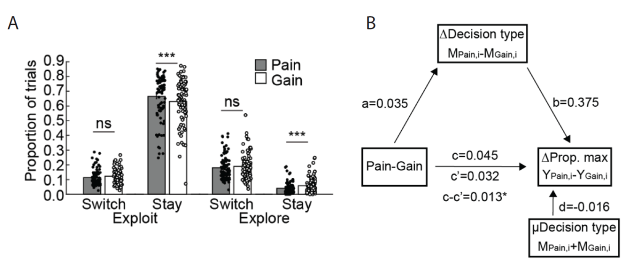

Figure 2: Decision types. A) Proportion of trials per decision type. B) Mediating effect of decision type on the difference in proportion of optimal outcomes between Pain and Gain conditions.

Higher value and more random switching for pain decisions

We compared the model parameters between Pain and Gain conditions (Fig. 3A-D). The decision weight for expected value (βQ; Fig. 3B) was larger for the Pain condition ($t(84)=4.335$, *p*<.001, Cohen's d=0.470), indicating a stronger emphasis on value for Pain decisions. The decision weight for random switching (βS; Fig. 3C) was more positive for Pain ($t(84)=4.795$, *p*<.001, Cohen's d=0.520), suggesting more perseverance in Gain. There were no differences for the learning rate (α; Fig. 3A) nor for uncertainty reduction (βT; Fig. 3D), both *p*>.05. In addition, there were positive correlations between performance and βQ in Pain (Fig. 3E) and Gain conditions (Fig. 3F).

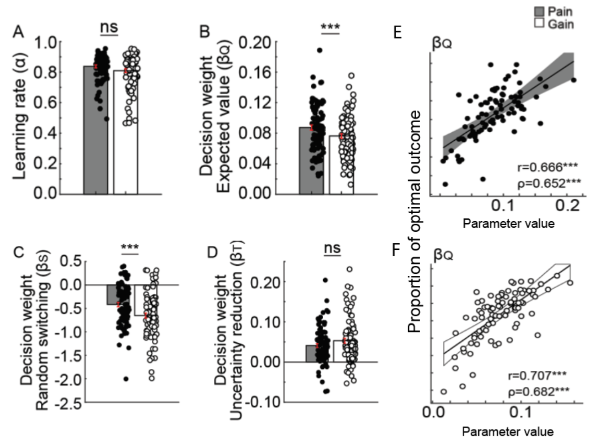

Figure 3: Model parameters. A) Learning rates (α). Decision weights for B) expected value (βQ), C) random switching (βS), and D) uncertainty reduction (βT). E) Correlations between the proportion of optimal outcomes and βQ in Gain, and F) Pain conditions.

Conclusions

We observed more optimal behavior when individuals tried to prevent painful outcomes for another person versus monetary self-gains. This suggests that minimizing aversive social outcomes is more valued than maximizing appetitive monetary ones.

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