Supplemental Online Materials for:

Anti-Social Motives Explain Risk Aversion for Others in Decisions from Experience

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Supplemental Online Material: Introduction

This supplemental material presents analyses of additional choice situations and sampling behavior in the two experiments. All presented analyses were pre-registered, but were omitted from the main manuscript due to space and clarity concerns. Analyses of inequity aversion and sample sizes are provided for both experiments, whereas social aspiration levels were only examined in the first experiment. The numbers for the choice situations refer to Tables 1 and 2 (for Experiments 1 and 2 respectively) in the main manuscript. The pre-registration documents for the two experiments can be found at https://osf.io/kn6dy/ and https://osf.io/nrfz3/.

Experiment 1: Supplemental Results

Inequity Aversion

To examine first-order (disadvantageous) inequity aversion, as pre-registered, choices for the *other* participant were compared when the choice options were the same for both self and other (Equal: 18, 19, & 5) against those when the other participant had a higher expected value (EV) option than the decision maker (Unequal: 12-14). Inequity aversion here would manifest as the decision maker choosing the higher EV option for the other participant more often when choice options were equal than when they were unequal. Figure S1A shows that there was a slight trend toward such inequity aversion: participants chose the higher EV option for the other participant 4.6 ± 5.6% more often under equality compared to unequal choice situations, $d = 0.21$, $t(57) = 1.60$, $p = .116$ as pre-registered, but $W(n=58) = 158.5$, $p = .049$ with a Wilcoxon signed-rank tests as the choice proportions were not normally distributed. Using a logistic regression with subject random effects this effect was significant ($\beta = -0.38$, $SE = 0.17$, $p = .025$). In a follow-up exploratory analysis, Figure S1B shows how this effect was driven by the prosocial participants. In a regression, the interaction between the prosocials and the choice sets was significant above the main effects ($\beta = -1.11$, $SE = 0.43$, $p = .010$).

To examine second-order (advantageous) inequity aversion, as pre-registered, we compared choices for *oneself* in situations with identical choice options (Equal: 18, 19, & 5) against those made when the decision maker had a higher EV option for oneself compared to the choice options for the other participant (Unequal: 15-17). Here, we hypothesized that people would choose the higher EV option for themselves more often in equal than in unequal choice situations. Figure 3C shows how people chose the higher EV option for themselves 4.4 ± 3.4% more often under equality than when the choice set was unequal, $d = 0.33$, $t(57) = 2.55$, $p = .013$, W(n=58) = 75, p = .018. These inferences were corroborated by a logistic regression with a significant group difference $\beta = -0.52$, $SE = 0.21$, $p = .016$. In a follow-up exploratory analysis, this effect also appeared larger for those classified as prosocials than those classified as competitive. This interaction between classification and choice set, however, was not significant ($\beta = -0.81$, $SE = 0.49$, $p = .093$). Finally, contrary to our initial hypothesis, the level of risk did not reliably influence either form of inequity aversion (Wilcoxon Test: $W(n = 58)_{first.order} = 152$, $r = 0.03$, $d = 0.06$, $p = .785$; $W(n = 58)_{second.order} = 254$, $r = 0.15$, $d = 0.30$, $p = .236$).

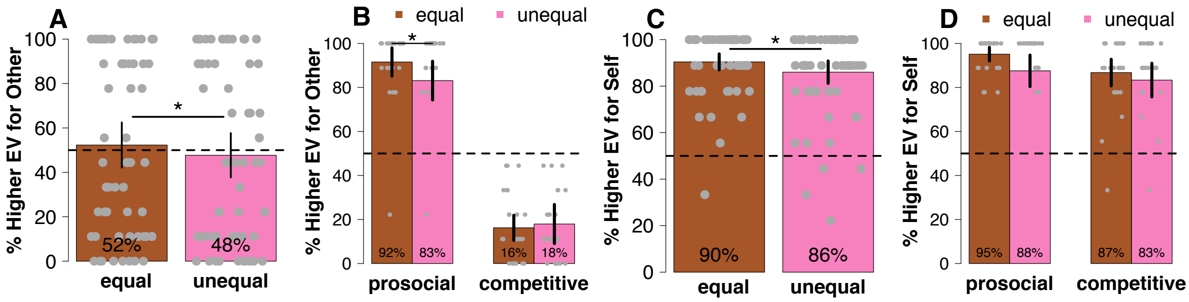

Figure S1: (A) Mean percentage (± 95% CI) of higher EV choices for the other participant depending on the presence of equal (5,18-19) or unequal (disadvantageous for decider) EV options (12-14) for oneself and the other participant. (B) Mean percentage (± 95% CI) of higher EV choices for the other participant based on classification as prosocial or competitive (see main manuscript). (C) Mean percentage (± 95% CI) of higher EV choices for oneself depending on the presence of equal (5,18-19) or unequal (advantageous for decider) EV options (15-17) for oneself and the other participant. (D) Mean percentage (± 95% CI) of higher EV choices for oneself split by classification. In all panels, grey points represent choice percentages for individual participants using horizontal jitter. * = p < .05 in a logistic regression.

Social Aspiration Level

A second pre-registered hypothesis was that the relative reward level of the second participant would set a social aspiration level for the decision-maker and thereby alter risk preference. To test this hypothesis, we compared situations where participants made risky choices for themselves, but where the other participant had the same options (1-3), worse options (6-8) or better options (9-11) in terms of EV. If participants used the higher EV options of the other participant as an aspiration level, they would choose the riskier option more often in cases where they choose from a lower EV choice set than when both participants have the same choice set. Yet, Figure S2 shows how this pattern did not emerge either in choices for oneself, nor in choices for the other participant. In a logistic regression, neither the higher nor the lower EV choices for the other participant had a reliable effect on the tendency to choose the riskier option for oneself (β_{higher} = -0.18, *SE* = 0.14, *p* = .189; β_{lower} = - 0.13, *SE* = 0.15, *p* = .391). The same held true when looking at choices for the other participant given higher EV options for the decision maker (β = 0.03, *SE* = 0.16, *p* = .828). Surprisingly, and against the preregistered hypothesis, there was a small but significant effect to choose the less risky option for the other participant, if the decision maker had a higher EV choice set (β = - 0.33, *SE* = 0.15, *p* = .030). Overall, the EV of the options available for one person did not consistently influence risky choice for the other person.

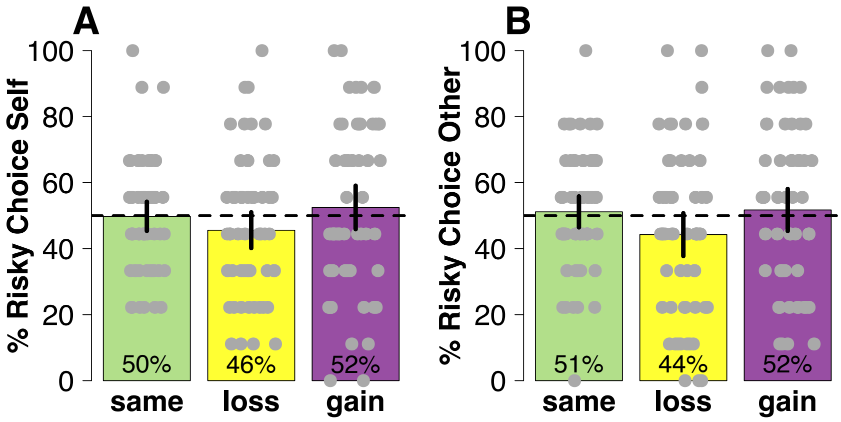

Figure S2: (A) Percentage (± 95% CI) of risky choices for different aspiration levels. Same – options for oneself and the other have same expected values (1-3). Loss – The other has higher EV options (6-8) and gain – oneself has higher EV options (9-11). (B) Choices for other with loss – higher EV options for oneself than for the other (9-11) and gain – higher EV options for the other than oneself (6-8). In all panels, grey points represent individual participants using horizontal jitter.

Sampling

The total sample size was fixed at 40 for each block, so we compared how those 120 samples were distributed between decks. As can be seen in Figure S3, there were no differences in sampling between different levels of variance for same EV decks (adjacent boxes; e.g., 4.5L vs. 4.5M). In contrast, the EV influenced sample size, as the high EV decks (6.5L & 6.5M) were sampled more often than the others. This difference was confirmed by a regression of the logarithm of sample size on the decks' theoretical characteristics with subject random effects: the high-variance and low-variance decks did not reliably differ (β = 0.02, *SE* = 0.04, *p* = .900), but high-EV decks were sampled more often (β = 8.36, *SE* = 0.76, *p* < .001) and low-EV decks less often (β = -1.83, *SE* = 0.75, *p* = .016) than the medium-EV decks. Finally, we hypothesized that participants took the target (self or other) of the decks into account, but there was no difference between the sample size for the medium-EV decks relevant only for the decision maker and the medium-EV decks relevant only to the other participant (for sample blocks 2 and 3 to allow for learning: β = 0.06, *SE* = 0.05, *p* = 0.24). Moreover, this effect was not moderated by the classification results; there was no difference in sampling across participants classified as prosocial or anti-social (β = 0.09, *SE* = 0.08, *p* = .261)[1].

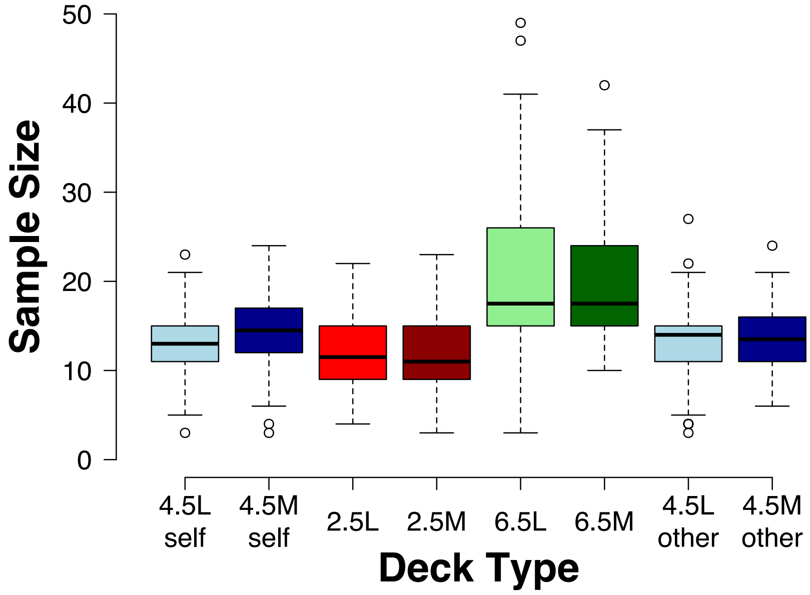

Figure S3: Boxplot with median, quartiles and whiskers as first quartile minus 1.5 times the interquartile range and third quartile plus 1.5 times the interquartile range of sample size for each of the 8 decks. Sample size was aggregated across all three rounds of sampling. Dots are individual outliers below or above the whiskers. Deck Types are as described in Table 1 of the main paper: The first number of each option is the EV and the letter symbolizes the ranges: L = ± 0.5, M = ± 2.0. The first two decks appeared only in choices for self and the last two decks only in choices for other.

Experiment 2: Supplemental Results

Inequity Aversion

As in Experiment 1, we examined first- and second-order inequity aversion (IA) by comparing situations where the decision maker and the other participant selected from the same choice set with situations where either the other (first-order) or the decision maker (second-order) had one high EV option. In terms of first-order IA, Figure S4A shows how people chose the higher EV option 9.1 ± 5.9% more often for the *other participant* when the deciders had the same options as compared to when they had worse options ($W(n=67) = 243$, $p = .003$; $\beta = -0.67$, $SE = 0.15$, $p < .001$). In terms of second-order IA, Figure S4C shows how

[1] A full analysis as stated in the preregistration was not possible because deck target was nested within the different levels of EV.

people chose the better option for *themselves* 5.8 ± 4.4% more often when the choice options were the same than when the other person had worse options available, ($W(n{=}67) = 143$, $p = .014$; $\beta = -0.52$, $SE = 0.17$, $p = .003$).

Splitting up participants into those classified as prosocial and competitive, Figure S4B and S4D show that both types of inequity aversion were mainly expressed by the prosocial participants. Similar to the first study, the interaction between choice sets and classification was significant above the main effects for first-order ($\beta = -1.10$, $SE = 0.46$, $p = .017$), but not second-order inequity aversion ($\beta = -0.22$, $SE = 0.54$, $p = .69$). Hence, both first- and second-order inequity aversion were observed in this task. As in the first experiment and in line with our classification interpretation, inequity aversion was mainly expressed by participants classified as prosocial in other choice situations.

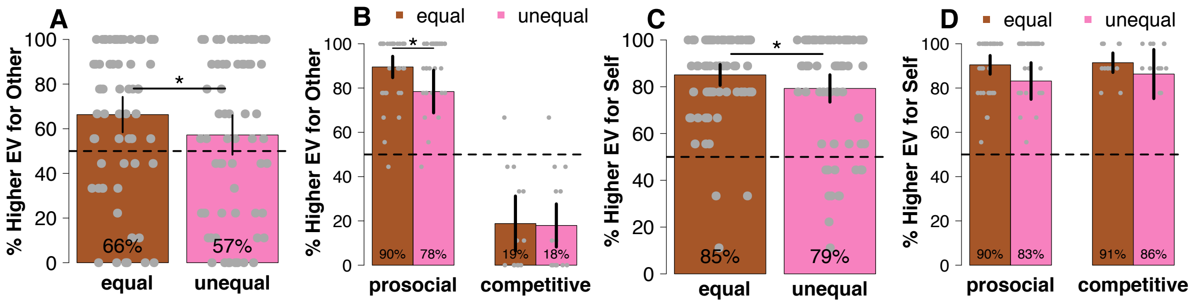

*Figure S4: (A) Mean percentage (± 95% CI) of higher EV choices for the other participant depending on the presence of equal (16-18) or unequal (disadvantageous for decider) EV options (10-12) for oneself and the other participant. (B) Mean percentage (± 95% CI) of higher EV choices for the other participant based on classification as prosocial or competitive (see main manuscript). (C) Mean percentage (± 95% CI) of higher EV choices for oneself depending on the presence of equal (16-18) or unequal (advantageous for decider) EV options (13-15) for oneself and the other participant. (D) Mean percentage (± 95% CI) of higher EV choices for oneself split by classification. In all panels, grey points represent choice percentages for individual participants using horizontal jitter. * = p < .05 in a logistic regression.*

Sampling

The total sample sizes in Exp. 2 were set at 80 in the first sampling block and 30 in each of the second and third blocks. The relative distribution of samples was analysed together for all blocks. Figure S5 shows how the EV influenced sample size: High-EV decks (green) were sampled more often than the low-EV decks (blue). The different levels of variance (indicated by hue variation), however, did not affect sample size. This pattern was confirmed by a regression of log frequencies on mean and variance as well as random subject effects, where only the mean EV had a significant effect ($\beta = 0.36$, $SE = 0.04$, $p < .001$). There were no obvious differences in the sampling pattern for participants classified as prosocial or antisocial. In sum, these results are in line with the first experiment and suggest that participants sampled more from high-EV options than from low-EV options.

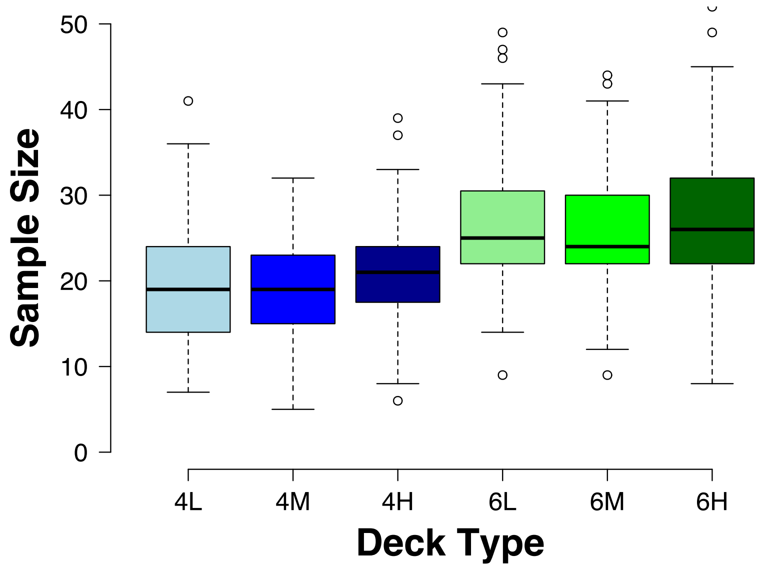

Figure S5: Boxplot with median, quartiles and whiskers as first quartile minus 1.5 times the interquartile range and third quartile plus 1.5 times the interquartile range of sample size for each of the 8 decks. Sample size was aggregated across all three rounds of sampling. Dots are individual outliers below or above the whiskers. Deck details are as described in Table 2 of the main paper: The first number of each option is the EV and the letter symbolizes variance levels: L = ± 0.5, M = ± 2.0, H = ± 4.0.