Losses change the experience of inequality*

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Abstract

Does inequality sting more when losses contrast with gains? Here we show that when two people each toss a die for a better or worse individual payoff, inequality has a significant emotional cost when the worse outcome is a loss, but not when both outcomes are gains. These results reveal a novel link between aversion to losses and how people experience inequality. They provide a psychological explanation for the attractiveness of Rawls's Difference Principle, and suggest that the prominence of inequality in the public debate may be due to the concurrence of economic anxiety at the bottom with continued gains at the top, rather than simply with increasing income gaps.

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1 Introduction

Losses loom larger than gains when people evaluate their own payoffs. But does loss aversion also affect comparisons with others? An unequal outcome may involve gains of different magnitude, losses of different magnitude, or a combination of both. Loss aversion suggests that social comparisons may have more bite when losses contrast with gains. We ask whether that is indeed the case.

There are two important variants of this question: one concerns the choices people make when it is in their power to determine outcomes; the second concerns their feelings when outcomes are not under their control. We are motivated in part by the widespread perception that many people are experiencing falling living standards while others are doing better than before. We therefore focus on the second question: is the emotional impact of inequality stronger when some lose while others gain?

We conducted an experiment to study this question in a controlled lab environment. Each session consisted of two subjects tossing a die for a high or low individual outcome. There were thus four possible joint outcomes: two equal and two unequal (Figure 1). In the first of two die tosses, subjects could win \$6 or \$3. In the second, subjects could win another \$3 or lose \$2. Immediately following each die toss, outcomes were settled in cash, and subjects completed a detailed affect questionnaire. Analysis focused on the change in affect that resulted from each of the two die tosses, relating it to the subject's own outcome and to that of the other subject.

Nor surprisingly, positive affect was higher in subjects who obtained the better outcome. More interestingly, we found (i) an increase in negative affect following the loss outcome in the second die toss, but not following the relatively small gain in the first one, (ii) an increase in negative affect when one lost money while the other made a gain, and (iii) no increase in negative affect when the outcome was unequal but both subjects made a gain. We thus conclude that loss aversion does indeed affect social comparisons, mak-

ing inequality of losses vs. gains very different from that of gains of different magnitude.

Loss aversion was introduced by Kahneman and Tversky in modelling choice under risk (Kahneman & Tversky, 1979), and later used to explain a variety of phenomena in riskless choice (Tversky & Kahneman, 1991). It is also the central ingredient in Kőszegi and Rabin's model of reference-dependent preferences (Kőszegi & Rabin, 2006). Importantly for our present purposes, these authors understood loss aversion in choices as a prediction of the quality of experience of future gains and losses. Subjects in our experiment experience such gains and losses, and we measure the change in their emotions. We indeed find a gains-losses asymmetry, and locate it specifically in the impact on negative affect.[1]

The asymmetry in the experience of gains and losses extends to social comparisons. Only inequality between gains and losses caused negative affect to go up. This asymmetry in how social comparisons are experienced may contribute to the asymmetry in fairness perceptions that was documented by Kahneman et al. (1986). In their study, observers considered it acceptable for a company to take advantage of a business opportunity to raise profits without passing the gains to its customers and workers, but saw it as unfair if a company took advantage of a business opportunity to raise prices or reduce wages. Both actions increase inequality, but only the second creates a contrast between gainers and losers.

Choices in social settings are harder to relate to our results, because decision makers in such settings have a variety of motives that are only partially related to how distributional consequences are experienced. Consider a donation to charity that reduces inequality. As Olson (1965), Becker (1974) and Andreoni (1990) note, people may donate money not only because of how they

[1] A related strand of literature focuses not on loss aversion, but on elation and regret (Bell, 1982; Loomes & Sugden, 1982). But while the asymmetry between gains and losses is relevant to both endogenous and exogenous outcomes, elation and regret only attach to those outcomes for which the decision maker is personally responsible.

expect to feel about the distributional outcomes (what is sometimes referred to as 'pure altruism') but because they derive pleasure from helping others ('warm glow') or are otherwise concerned with their actions as distinct from their distributional consequences.[2] We should therefore be careful about interpreting a preference for an equal distribution as the decision maker's prediction of the emotional experience of equal and unequal distributions, let alone evidence about the actual experience of such distributions.

Somewhere in between experiments on choices and our own experiment are neuroeconomic studies that present subjects with a large number of distributions and ask them to report their feelings. Rutledge et al. (2016) presented subjects with 150 distributions in quick succession, and asked them to make 85 happiness ratings. Reported happiness was higher in equal trials, and answers were correlated with choices in a Dictator Game (Kahneman et al., 1986). Such studies are similar to our experiment in that subjects have no choices to make and are asked to report their emotions. But whereas subjects in our experiment experience only one actual outcome, in Rutledge et al. (2016) subjects experience many possible outcomes in quick succession. Their happiness reports thus become a comparative judgement that may be more closely related to choice.[3]

[2]Such additional motives include signalling to others or even to themselves (Benabou & Tirole, 2005) and beliefs about the punishment or reward that follow moral choices. Interestingly, Crumpler and Grossman (2008) show that people donate even when their donations have no distributional outcomes, and DellaVigna et al. (2012) find that people informed in advance of a door-to-door fund raiser for charity are less likely to be at home.

[3]Subjects may feel 'warm glow' from reporting higher happiness in equal trials than in unequal ones, or may wish to signal their generosity in their comparative ratings. These are also possibilities in our experiment, but are made less likely by the fact that each subject only experiences a single outcome.

2 Experimental Design

The experiment is described in Figure 1. The key manipulations are two die tosses that can each result in one of two possible monetary payoffs. In the first *gains-only die-toss*, the possible payoffs are \$6 or and \$3. In the second *gains/losses die toss*, the payoffs are an additional gain of \$3 or a loss of \$2. The gains/losses die toss was optional, but over 80% of subjects chose to take part. In order to maximise the emotional impact of the outcome, we did not wait for the experiment to end before paying subjects, and instead settled the payoff for each die toss in cash immediately after both subjects tossed their die.

Our sample included 287 subjects divided into three conditions. In the main *independent earnings* condition ($N = 182$), two subjects were in a room together with the research assistant who conducted the session. The subjects tossed the die independently for their own individual payoff, but could observe the other subject's payoff. There were thus four possible outcome, two of which are equal and two unequal (Figure 1). In the *single* condition a single subject was in a session on their own ($N = 81$). Finally, in the *matched earnings* condition ($N = 24$) two subjects tossed the die as a team for an equal joint outcome. Emotions were measured using the Positive and Negative Affect Schedule[4] (PANAS), which includes 10 positive and 10 negative emotions. Subjects completed the PANAS questionnaire before, between, and after the die tosses.

Minimising experimenter demand effect (Orne, 1962; Zizzo, 2010) was an important consideration in the design. We wanted subjects to report the emotions that they felt—not the emotions that they thought they should have felt. Our key design choice was to use a between subjects design, in which each subject experiences only one outcome of each die toss. A within subject design in which subjects experience multiple outcomes of each die toss

[4]Included in Appendix A.2. PANAS was introduced by Watson et al. (1988) and shown to be reliable and valid in non-clinical populations by Crawford and Henry (2004).

would have given us more data, but it might have influenced subjects to report different emotions in different outcomes, even if their actual emotions were the same. In particular, subjects might have wanted to signal that they care about the other subject's outcome, whether or not it made a difference to their emotions.[5] The between subjects design addresses this problem, since there is no way to separate any particular individual's response to the other subject's outcome from her response to her own outcome. A second advantage of the between subjects design is the salient emotional impact of each die toss, further enhanced by the immediate cash payment. Also important was the use of PANAS with its 20 different emotions. Since the questionnaire includes so many questions, subjects were unlikely to remember their answers from earlier in the experiment, and would anyhow have found it difficult to give a misleading report of the change in their emotions.

Appendix A provides further details on the logistics of the experiment, including copies of the questionnaires. The data are available upon request.

3 Analysis

Our analysis focused on the change in affect resulting from each of the two die tosses. We analysed the change in affect—rather than the levels—since different individuals may have a different underlying level of affect for reasons that have nothing to do with their outcomes in the experiment. This choice is equivalent to including person fixed effects in the analysis. PANAS includes ten positive emotions and ten negative emotions, each rated on a 1–5 scale. We averaged these to obtain separate measures of the change in positive and in negative affect. These were normalised to have a standard deviation of 1 across the sample, in order to facilitate comparison of effect sizes.

[5] A more subtle problem with a within subjects design is that people focus on differences. Thus, a person whose emotions are overwhelmingly dependent on their own outcome may nonetheless focus on the other person's outcome when evaluating the difference between two situations that differ only in the other person's outcome.

The change in affect was regressed against three separate features of the joint outcome borrowed from the Fehr-Schmidt model of inequity aversion (Fehr & Schmidt, 1999): (i) the subject's own payoff, (ii) the degree of disadvantageous inequality—the amount by which the subject's own payoff falls below that of the other subject, and (ii) the degree of advantageous inequality—the amount by which the subject's own payoff exceeds that of the other subject:

$$\Delta\text{affect}_i = \alpha + \beta_1 \underbrace{x_i}_{\substack{\text{Own}\\ \text{payoff}}} + \beta_2 \underbrace{\max(x_j - x_i, 0)}_{\substack{\text{Disadvantageous}\\ \text{inequality}}} + \beta_3 \underbrace{\max(x_i - x_j, 0)}_{\substack{\text{Advantageous}\\ \text{inequality}}} + \epsilon_i. \quad (1)$$

We estimated this equation separately for the change in positive and negative PANAS emotions. Since positive and negative affect are not simply mirror images of each other (Diener et al., 1985), it is possible that an emotionally powerful experience would lead to a simultaneous increase in both. This seems most likely if an empathetic subject obtains the good outcome, but the other subject did not. Analysing positive and negative affect separately makes it possible to distinguish this situation from one with little or no emotional response. The regression also makes it possible to identify other responses to inequality, such as indifference, or an aversion to disadvantageous inequality combined with the enjoyment of advantageous inequality.

4 Results

Figure 2 illustrates the results. In the gains-only die toss (Figure 2a) inequality makes no significant difference to either positive or negative affect; positive affect is increasing with the subject's own payoff ($t_{(272)} = 2.3, P = 0.02$), but negative affect is unchanged. In the gains/losses die toss (Figure 2b) positive affect is similarly increasing in the subject's own payoff ($t_{(271)} = 3.9, P < 0.01$), but the results for negative affect could not be more different. Negative affect decreases with the subject's own payoff ($t_{(273)} = -2.8, P = 0.03$), and

increases with both disadvantageous inequality ($t_{(273)} = 2.1, P = 0.04$) and advantageous inequality ($t_{(273)} = 2.3, P = 0.03$). We thus find strong aversion to inequality in the gains/losses die toss, and no aversion to inequality in the gains-only die toss.

Figure 3 illustrates the dependence of both forms of affect on the joint outcome of the two subjects. In the gains-only die toss, both positive and negative affect depend only on the subject's own outcome. In the gains/losses die toss, positive affect is similarly a function of the subject's own outcome, but negative affect is more complicated: it is highest (worst) for a subject who loses while the other gains, and is lowest (best) if both subjects win.

While both advantageous and disadvantageous inequality increase negative affect, they are likely to elicit different particular emotions. Advantageous inequality may lead to guilt and shame, and disadvantageous inequality may lead to envy and other negative emotions (Camerer, 2003). Table 1 reports a regression test of this hypothesis. Guilt and shame increase selectively and strongly with advantageous inequality ($t_{(282)} = 3.1, P < 0.01$), as do the remaining components of negative affect with disadvantageous inequality ($t_{(274)} = 2.9, P < 0.01$).

We conducted a number of robustness tests for the key finding that inequality increases negative affect in the gains/losses die toss, but not in the gains-only die toss. Table 2 repeats the analysis of Table 1 on the more homogeneous subsample of subjects in the independent earnings condition who opted into the gains/losses die toss. The regression estimates are not much different, and the coefficients on guilt and shame and on the other negative affect components remain statistically significant. Table 3 is the analogue for Table 1 for the gains-only die toss. In contrast with the results in Table 1, there is no increase in guilt and shame in response to advantageous inequality, nor is there an increase in other negative affect components in response to disadvantageous inequality. Finally, Table 4 reports regressions of positive and negative affect on the subject's own payoff and on the payoff dif-

ference between the two subjects—regardless of which subject does better. Consistent with our other results, this combined measure of inequality is associated with a significant increase in negative affect in the gains/losses die toss ($t_{(273)} = 3.0, P < 0.01$), and a statistically insignificant decrease in the gains/only die toss ($t_{(272)} = -1.0, P < 0.32$).

Looking at the change in affect over the entire course of the experiment, we can test whether subjects are made unhappy not only by an actual unequal outcomes, but also by being in a situation that can result in an unequal outcome. Inequality is a possible outcome in the independent earnings condition, but not in either the matched earnings or single conditions. Table 5 compares the overall change in affect for subjects in these conditions. Net affect is significantly higher if a subject earns more money ($t_{(265)} = 5.0, P < 0.01$) and is lower if the subject has taken part in the independent earnings condition—the one in which inequality is possible ($t_{(265)} = 3.4, p < 0.01$).

5 Conclusion

Our results show a qualitative difference in how gains and losses are experienced. Lower gains lowered positive affect relative to higher gains, but made no difference to negative affect. Losses made a difference to both: they lowered positive affect and caused negative affect to go up. There was, if anything, an even clearer difference in how social comparisons were experienced. If both subjects made a gain, the other person's outcome had no measurable impact. But if one subject made a loss and the other made a gain, negative affect was higher for both.

The results for how individual outcomes are experienced refine our understanding of loss aversion. Loss aversion in choices is measured on a utility scale, and the idea that 'losses loom larger than gains' translates into larger intervals for each dollar of losses as compared with each dollar of gains. These differences in the utility for choices can be rationalised if there are correspond-

ing differences in how gains and loss outcomes are experienced. Our results suggest that this is indeed the case and that, moreover, the difference in experience is qualitative rather than merely quantitative.

The results for the emotional impact of inequality are stark. We find that inequality between gains and losses affects both parties, but that inequality between larger and smaller gains has no measurable emotional impact at all. In interpreting this result, it is important to remember that it was obtained in a highly artificial environment, which was designed to isolate the emotional impact of inequality from that of confounds such as fairness. In the real world such confounds are unavoidable. Different people come from different backgrounds, exert more or less effort, and feel deserving of better or worse outcomes. Someone is always going to feel that the outcome is unfair. Moreover, inequality has many implications other than its direct emotional costs, and these may themselves exert an emotional cost. A more reasonable interpretation, therefore, is that inequality of gains vs. losses is likely to result in *more* negative emotions than inequality between different gain amounts. In both cases there would be people who feel the outcome is unfair, but when losses are involved there would be an additional component that is otherwise absent.

In particular, there may well be something special about an economy in which some people experience falling living standards while others are doing better than ever.[6] Losses are bad, and inequality is bad, but the combination is worse than the sum of its parts. This perhaps is not an unreasonable description of the present state of affairs.[7] We close by noting that Rawls's Difference Principle (Rawls, 1971) justifies inequality if and only if it benefits everyone.

[6]It is presumably sufficient that this would be a common perception, whether or not it is justified.

[7]For a recent discussion of US data see Saez and Zucman (2016). From 1980 to 2014, the bottom 50% of the population experienced a growth of only 1% in pre-tax income, and subgroups have experienced a drop. Comparisons of living standards across time are thorny (e.g. even relatively poor people now enjoy products that were science fiction in the 1980s.), but what presumably matters for emotions is perceptions. In 2014, 28% of Americans perceived themselves to be worse off than 5 years earlier (Larrimore et al., 2015).

Our results, if confirmed in our settings, suggest that Rawls had important psychological as well as philosophical insights.

References

Aknin, L. B., Mayraz, G., & Helliwell, J. F. (2017). The emotional consequences of donation opportunities. *Journal of Positive Psychology*, *12*(2), 169–177.

Andreoni, J. (1990). Impure altruism and donations to public goods: A theory of warm-glow giving. *Economic Journal*, 464–477.

Becker, G. S. (1974). A theory of social interactions. *Journal of Political Economy*, *82*(61).

Bell, D. (1982). Regret in decision making under uncertainty. *Operations research*.

Benabou, R. & Tirole, J. (2005). *Incentives and Prosocial Behavior*. National Bureau of Economic Research Cambridge, Mass., USA.

Camerer, C. (2003). *Behavioral game theory: Experiments in strategic interaction*. Princeton University Press.

Crawford, J. R. & Henry, J. D. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, *43*(3), 245.

Crumpler, H. & Grossman, P. J. (2008). An experimental test of warm glow giving. *Journal of Public Economics*, *92*(5), 1011–1021.

DellaVigna, S., List, J., & Malmendier, U. (2012). Testing for altruism and social pressure in charitable giving. *Quarterly Journal of Economics*, *127*(1), 1.

Diener, E., Larsen, R. J., Levine, S., & Emmons, R. A. (1985). Intensity and frequency: Dimensions underlying positive and negative affect. *Journal of personality and social psychology*, *48*(5), 1253.

Fehr, E. & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly journal of Economics*, 817–868.

Kahneman, D. & Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica*, *47*(2), 313–327.

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1986). Fairness and the assumptions of economics. *Journal of business*, S285–S300.

Kőszegi, B. & Rabin, M. (2006). A Model of Reference-Dependent Preferences. *Quarterly Journal of Economics*, *121*(4), 1133–1165.

Larrimore, J., Arthur-Bentil, M., Dodini, S., & Thomas, L. (2015). Report on the economic well-being of us households in 2014. Board of Governors of the Federal Reserve (May 2015).

Loomes, G. & Sugden, R. (1982). Regret theory: An alternative thery of rational choice under uncertainty. *Economic Journal*, *92*(368), 805–824.

Olson, M. (1965). *The logic of collective action: public goods and the theory of groups*. Harvard University Press.

Orne, M. T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American psychologist*, *17*(11), 776.

Rawls, J. (1971). *A theory of justice*. Belknap Press.

Rutledge, R. B., de Berker, A. O., Espenhahn, S., Dayan, P., & Dolan, R. J. (2016). The social contingency of momentary subjective well-being. *Nature communications*, *7*.

Saez, E. & Zucman, G. (2016). Wealth inequality in the united states since 1913: Evidence from capitalized income tax data. *Quarterly Journal of Economics*, *131*(2), 519–578. doi:10.1093/qje/qjw004

Tversky, A. & Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *Quarterly Journal of Economics*, *106*(4), 1039–1061.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of personality and social psychology*, *54*(6), 1063.

Zizzo, D. J. (2010). Experimenter demand effects in economic experiments. *Experimental Economics*, *13*(1), 75–98.

Table 1: Separate affect components in the gains/losses die toss. Both forms of inequality increase negative affect, but advantageous inequality selectively increasing guilt and shame, and disadvantageous inequality increasing other negative affect components. Positive affect depends only on the subject's own payoff.

	Positive Affect	Negative Affect	Guilt or shame	Other Neg. Affect
Own payoff	0.147***	−0.089**	−0.116***	−0.051
x_i	(0.038)	(0.041)	(0.040)	(0.041)
Disadvantageous inequality	−0.071*	0.087**	−0.023	0.123***
$\max(x_j - x_i, 0)$	(0.039)	(0.042)	(0.042)	(0.042)
Advantageous inequality	0.026	0.106**	0.145***	0.060
$\max(x_i - x_j, 0)$	(0.044)	(0.047)	(0.047)	(0.047)
Observations	272	274	283	275

All regressions include a constant. Standard errors are in parentheses. *, ** and *** represent the 10%, 5%, and 1% significance levels of a double-sided test.

Table 2: Separate affect components in the gains/losses die toss with the sample restricted to sessions in the *independent earnings* conditions in which the subject opted to toss the die. Results are similar to the ones obtained for the entire sample. Both forms of inequality increase negative affect, but advantageous inequality selectively increasing guilt and shame, and disadvantageous inequality increasing other negative affect components. Positive affect depends only on the subject's own payoff.

	Positive Affect	Negative Affect	Guilt or shame	Other Neg. Affect
Own payoff	0.187^{***}	-0.082	-0.161^{***}	-0.021
x_i	(0.052)	(0.057)	(0.061)	(0.053)
Disadvantageous inequality	-0.056	0.077	-0.035	0.114^{**}
$max(x_j - x_i, 0)$	(0.051)	(0.055)	(0.059)	(0.052)
Advantageous inequality	0.015	0.099^{*}	0.144^{**}	0.051
$max(x_i - x_j, 0)$	(0.050)	(0.054)	(0.058)	(0.051)
Observations	113	114	116	114

All regressions include a constant. Standard errors are in parentheses. *, ** and *** represent the 10%, 5%, and 1% significance levels of a double-sided test.

Table 3: Separate affect components in the gains-only die toss. Individual payoff increases positive affect, but inequality has no statistically significant impact on either positive or negative affect.

	Positive Affect	Negative Affect	Guilt or shame	Other Neg. Affect
Own payoff	0.106**	0.029	0.024	0.026
x_i	(0.047)	(0.047)	(0.047)	(0.047)
Disadvantageous inequality	−0.057	−0.083	−0.030	−0.076
$max(x_j - x_i, 0)$	(0.063)	(0.064)	(0.063)	(0.064)
Advantageous inequality	−0.099	−0.006	0.014	−0.010
$max(x_i - x_j, 0)$	(0.064)	(0.065)	(0.064)	(0.065)
Observations	273	273	283	275

All regressions include a constant. Standard errors are in parentheses. *, ** and *** represent the 10%, 5%, and 1% significance levels of a double-sided test.

Table 4: Combined measure of inequality only matters in the gains/losses die toss. Inequality increases negative affect in the gains/losses die toss, but not in the gains-only die toss. The measure of inequality used in the table is the payoff difference between the two subjects, combining advantageous and disadvantageous inequality into a single regressor.

	Gains-only Die Toss		Gains/losses Die Toss	
	Positive Affect	Negative Affect	Positive Affect	Negative Affect
Own payoff	0.095**	0.050	0.194***	−0.080***
x_i	(0.040)	(0.040)	(0.025)	(0.027)
Inequality	−0.078*	−0.045	−0.028	0.096***
$\|x_i - x_j\|$	(0.045)	(0.045)	(0.029)	(0.032)
Observations	273	273	272	274

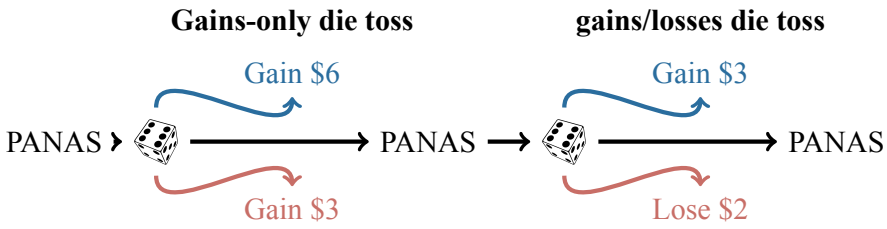
All regressions include a constant. Standard errors are in parentheses. *, ** and *** represent the 10%, 5%, and 1% significance levels of a double-sided test.

Table 5: The dependence of affect on the possibility of inequality. The table shows the coefficients in a regression of affect on (i) the combined earnings in the experiment, and (ii) whether the subject is in the independent earnings condition—the only condition in which inequality is a possible outcome. Controlling for individual payoff, subjects are less happy in the condition in which inequality is possible.

	Positive Affect	Negative Affect	Net Affect
Overall	0.126***	0.009	0.109***
Payoff	(0.021)	(0.023)	(0.022)
Independent earnings	−0.388***	0.063	−0.420***
Condition	(0.119)	(0.127)	(0.123)
Observations	274	278	264

All regressions include a constant. Standard errors are in parentheses. *, ** and *** represent the 10%, 5%, and 1% significance levels of a double-sided test.

a



b

	Dice outcome			
	Chance	Own	Other	Resulting inequality
Joint outcome	1 in 4	Bad	Bad	None
	1 in 4	Bad	Good	Disadvantageous
	1 in 4	Good	Bad	Advantageous
	1 in 4	Good	Good	None

Figure 1: Experimental design. **a**, There are two die tosses with monetary consequences. In the gains-only die toss subjects win one of two possible prizes: $6 or $3. In the gains/losses die toss subjects either gain a further $3 or *lose* $2. The Positive Affect Negative Affect Schedule (PANAS) is administered at the start, middle, and end, making it possible to examine the change in positive and negative affect following each of the two die tosses. **b**, In the main independent earnings condition two subjects toss each die independently in each other's presence, resulting in four possible joint outcomes. Two of the possible outcomes are equal and two are unequal.

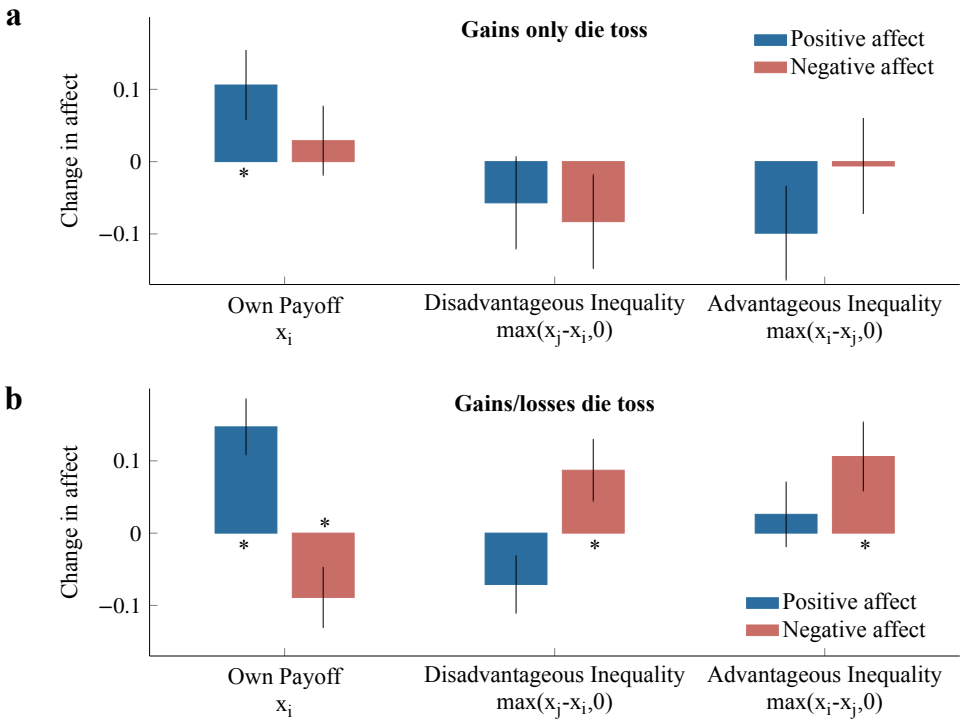


Figure 2: Change in affect following the die tosses: Fehr-Schmidt equation. a, In the gains-only die toss, positive affect increases in a subject's own payoff, but there is no significant dependence of either positive or negative affect on the other subject's payoff. **b**, In the gains/losses die toss, negative affect decreases in the subject's own payoff and increases with both disadvantageous and advantageous inequality. Error bars indicate the standard error of the mean and stars indicate statistical significance.

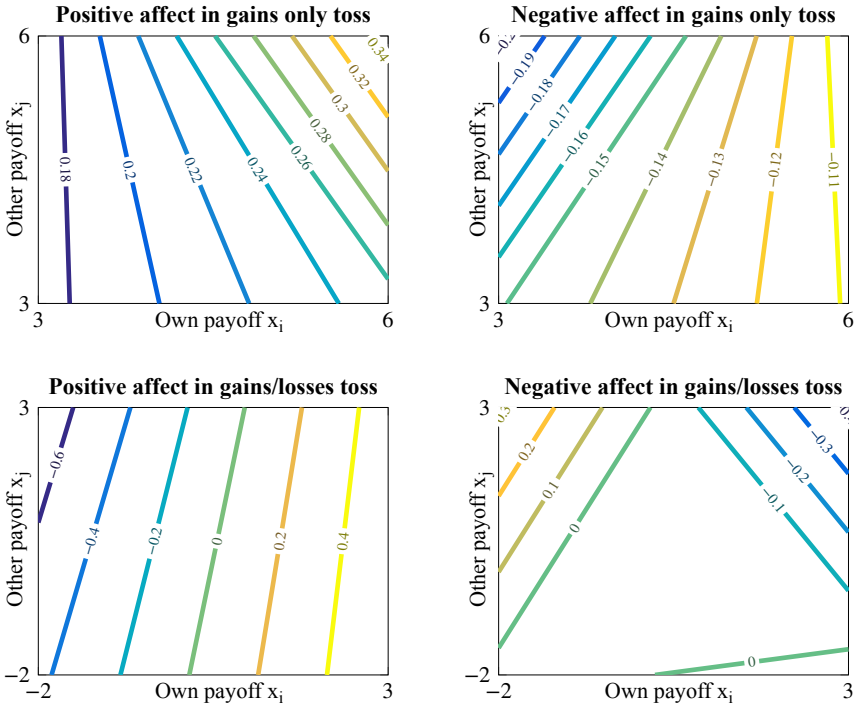


Figure 3: Change in affect following the die tosses: heat map. Both positive and negative affect in the gains-only die toss are independent of the other subject's payoff, and the same is true for positive affect in the gains/losses die toss. Only negative affect in the gains/losses die toss is a function of both subjects' payoff. It is lowest (best) when both win \$3, and highest (worst) for a subject who loses \$2 when the other subject wins \$3. Controlling for a subject's own payoff, negative affect is lower (better) if the other subject's payoff is the same. The chart averages sessions in the independent earnings condition in which both subjects chose to toss the die a second time.

A Logistics, instructions, and questionnaires

The general structure of the experiment is explained in Section 2 and illustrated in Figure 1. The experiment was conducted by a research assistant at Simon Fraser University. 287 subjects (Mean age = 19.75, SD = 2.90, 65% female) are included in our analysis. Data from five additional subjects who withdrew consent are not reported. Subjects did not know each other before taking part in the experiment. Testing sessions could accommodate two subjects, each of whom registered for the study independently. If only one subject attended the testing session, that subject completed the study in the *single* condition ($N = 81$). When two subjects registered to the same session, they were allocated to either the independent earnings condition ($N = 182$ individuals) or the matched earnings condition ($N = 24$ individuals). Assignment to the two pair conditions was initially random, but after we realised we would have enough subjects in the single condition to control for the possibility of unequal outcomes, we decided to allocate all subject pairs to the independent earnings condition.

The experiment began with subjects independently completing an initial questionnaire assessing their baseline affect using the PANAS questionnaire. After reporting their baseline affect, the research assistant told subjects that they would have the chance to roll a six-sided die for a monetary payoff. Subjects in the independent earnings condition and in the single condition were told that if they rolled 1, 2, or 3 they would earn $3 cash, and if they rolled 4, 5, or 6 they would earn $6. Subjects in the matched earnings condition were told that their payoff would be determined by the sum of their die rolls. If it is in the 2–6 range they would each earn $3, and if it is in the 8–12 range they would earn $6. If the sum of the rolls is 7, they would roll again. The research assistant showed subjects cash in a money box to indicate that the earnings were real. Subjects rolled the die and were paid accordingly. Afterwards, subjects were asked to independently complete a second questionnaire assessing their current positive and negative affect on the same PANAS scale.

Subjects were informed that they had the option of rolling the die again for a monetary gain or loss. Specifically, subjects in the independent earnings condition and single condition were told that if they rolled in the 1–3 range they would lose $2 cash, and if they rolled in the 4–6 range they would earn $3. Subjects in the matched earnings condition were told that if the sum of their rolls is in the 2–6 range they would lose $2 each, and if it is in the 8–12 range they would earn $3 each. If the sum is exactly 7 they would roll again. Subjects made their decision individually in the independent earnings condition and single condition, and together in the matched earnings condition. About 81% of the subjects chose to take part in the gains/losses die toss (63 of 82 in the single condition, 147 of 182 in the independent earnings condition, and 22 of 24 in the matched earnings condition). Earnings were adjusted in cash immediately after subjects rolled the die. To assess the impact of gains and losses on well-being, subjects were asked to complete a third questionnaire assessing their current positive and negative affect on the same PANAS scale. In addition, subjects were asked to provide their demographic information (e.g., age, gender, GPA, income).

This final part of has been analysed separately (Aknin et al., 2017) and is not part of the present paper. The research assistant indicated that the study was nearly complete and told subjects that the lab was collecting money for Spread the Net, a charity affiliated with the United Nations Children's Fund (UNICEF) that purchases bed nets to stop the spread of malaria through Africa. The research assistant explained that every ten dollars donated buys a bed net that could save a child. Therefore, if subjects wanted to support the charity, they could put a donation in a small envelope and put the envelope in a box labelled "Spread the Net". The research assistant then left the room to prepare the final questionnaire; this ensured that subjects could make their donation decision without pressure from the researcher. Envelopes provided for donations were surreptitiously marked with each subject's unique identifier so that we could determine how much money, if any, each subject donated to charity.

When the research assistant returned, subjects were asked to complete a final emotions questionnaire, which allowed us to assess the impact of donation on well-being.

A.1 Instructions

The instructions to the research assistants conducting the experiment are included here. The instructions to subjects were given orally as per the script provided to the research assistants.

Procedure (for the research assistants)

Before the study

1. Post TWO time slots on RPS system for all times when you and the lab room are free.
2. Arrive at the lab at least 20 minutes before your first participant.
3. Arrange chairs in the room. Two chairs should be seated next to one another (2 feet apart; for participants) and across the table from another chair (for the experimenter).
4. Collect two copies of all the paperwork (consent forms, questionnaires, debriefing forms, etc.) and the "Payoff information sheets".
5. Put out the cashbox
6. Pre-mark donation envelopes. A = 1 small mark inside envelope, B = 2 small marks inside the envelope.
7. Open the RPS system – take note of who should be coming in (e.g., Harry and Sally are scheduled for 1pm) so you can confirm that the correct participants are taking part in our study.

When one or both participants arrive

8. **Greet** them by saying: *"Hi, thanks for taking part in our study today. This study is being conducted to understand the consequences of various daily actions. As part of this study, you will be asked to make several decisions and answer questions about your current state of mind. Specifically, you'll be asked to roll a die, make a decision based on the outcome, and answer a series of questions about your experience and your current state of mind. We expect this study to take approximately 30 minutes to complete. In exchange for your time, you will be reimbursed with one RPS credit. You will get this payment after the study is complete, but you have already earned this payment for simply showing up today. On the desk in front of you is a consent form. Please take a minute to read over that, and if you agree to participate, sign on the sheet."*
9. When the participant finishes with the **consent form**, ask the participant if they'd like to keep a copy by saying, *"Thank you. Would you like a copy of this consent form for your records? You're more than welcome to have one, although we offer you the opportunity to decline a copy to save paper."*
10. Give participants the **first questionnaire**. Make sure the questionnaires are labelled with the *same* participant number but distinguished by a unique letter: A or B (e.g., 1A and 1B, 2A and 2B, etc.).
11. Tell the participants, *"The first part of the study involves completing a short questionnaire by yourself. I'll leave you alone for a few minutes as you go through these questions, but I will be nearby, so please don't hesitate to let me know if you have any questions or concerns. Please complete these questionnaires independently and do your best to answer all questions as openly and honestly as possible."*

12. Refer to the **Condition Assignment** sheet to find out what condition participants are in (Independent Earnings or Match Earnings) and collect the appropriate "Payoff Information sheet".
    a. Independent Earnings: Roll 1, 2, 3 → $3; Roll 4, 5, 6 → $6
    b. Matched Earnings: Rolls sum 2-6 → $6 ($3 each); Roll 8-12 → $12 ($6 each); 7 → roll again
13. When both participants complete the baseline questionnaire, **take them into the large lab room** and ask them to take a seat in the designated chairs.
14. Put out the appropriate "Payoff information sheet" and tell *participants*

    IN THE INDEPENDENT EARNINGS CONDITION: "In the next part of this study both of you will have a chance to roll this six-sided die for a monetary payoff. The payoff structure is simple: If you roll a 1, 2, or 3, you will earn $3 cash. If you roll a 4, 5 or 6, you will earn $6 cash. [Show participants the cashbox with coins inside to clearly indicate that the payoff is real.] Do you have any questions?

    IN THE MATCHED EARNINGS CONDITION: "In the next part of this study both of you will have a chance to roll this six-sided die for a monetary payoff. The payoff structure is simple: If both of you –together as a team - roll numbers that sum between 2-6, your team will earn $6 cash to split equally. If both of you roll numbers that sum between 8-12, you will earn $12 cash to split equally. If your rolls sum to 7, you'll both roll again. [Show participants the cashbox with coins inside to clearly indicate that the payoff is real.] Do you have any questions?
15. Then say, *"Only one person will roll the die at a time so we'll randomly determine who gets to roll first. Each of you will roll this die in a practice round. Whoever rolls the lowest number will roll first. Do you have any questions?*
16. Let both participants roll the die to determine who rolls the die first for payoffs. MAKE NOTE OF WHO ROLLS THE LOWEST NUMBER AND WILL BE THE FIRST ROLLER MOVING FORWARD- PARTICIPANT A OR B. When determined, say "So you will be our first roller [point to person who rolled the lowest number] and you will be our second roller [point to the person who rolled the highest number]."
17. Remind participants of the payoff scheme.
18. First roller rolls the die. Record their roll: What number did the participant roll?
19. Second roller rolls the die. Record their roll: What number did the participant roll?
20. Pay participants the correct amount for their roll. Give them their money now.
21. Give participants the second part of the questionnaire to complete independently.
22. Tell participants,

    IN THE INDEPENDENT CONDITION: *"Now you have the option of rolling the die once again. This time, however, if you roll a 1, 2, or 3 you will lose $2. If you roll a 4, 5, or 6 you will earn $3. Please don't blurt out your answer; I'm going to ask for your decision. Would you like to roll the die again? [turn to the first roller] What is your decision? [record choice]. [turn to the second roller] What is your decision? [record choice]"*

IN THE MATCHED EARNINGS CONDITION: *"Now, as a team, you have the option of rolling the die once again. This time however, if your summed value is between 2-6 your team will lose $4. If your summed value is between 8-12 you will earn $6. Please don't blurt out your answer; I'm going to ask for your decision. The decision must be unanimous, so if there is disagreement, you will have the opportunity to discuss [turn to the first roller]. Would you like to roll the die again? What is your decision? [record choice]. [turn to the second roller] What is your decision? [record choice]."*

23. If both participants want to roll the die again, the first roller should go first.
24. Allow one or both participants to roll the dice if decided. Record their roll.
25. Take or give money payoffs as needed. Then announce each participant's/team's take home pay (initial roll value +/- second wager).
26. Have participants sign a receipt for their TOTAL payment earned (initial roll value +/- second wager).
27. Give participants the third part of the questionnaire to complete independently.
28. Tell both participants, "*Before you leave, we wanted to let you know that our lab is collecting money for Spread the Net, a charity affiliated with the United Nations International Emergency Fund (UNICEF) that purchases bed nets to stop the spread of malaria through Africa. Every ten dollars donated buys a bed net and saves a child. If you'd like to support this charity, please put your donation in this envelope and put it in that box labelled 'Spread the Net' by the door."*
29. Tell participants: I have one final page for you to complete. Give the participant the final questionnaire.
30. While they finish the questionnaire, prepare a copy of the debriefing form to debrief the participant.
31. During the debriefing, ask the participants if they had heard about the study or the procedure before attending the session. If so, what had they heard? (Take note of what they heard and list this info in the comments column of the Participant Log). Thank the participants for participating in the study.

<u>After the study</u>

32. Award the participant one RPS credit.
33. Check to see if either participant made a donation to Spread the Net. If so, log the details on the participant log. Make sure to note the complete participant number (e.g., 13A) and the donation amount (e.g., $3).
34. Clean up the lab and turn off the computers.

A.2 Questionnaires

The version of PANAS we used appears below as 'Questionnaire — Part 1', and includes one additional emotion ('happy') that is not part of the standard PANAS, and which we did not include in the analysis.[8] The questionnaire was administered prior to the first die toss, and was administered again following each of the two die tosses, with the title changed to 'Questionnaire — Part 2' and 'Questionnaire — Part 3', respectively. The demographic questionnaire was administered after the experiment ended.

[8] We thought that happiness could be used as a sort of summary measure, but it turned out to be much less informative than the respective average of the positive and negative emotions.

Participant Number: _____

Questionnaire – Part 1

Please indicate how you are feeling ***right now*** in respect to these words by circling the appropriate number on the scale below.

	Very slightly or not at all	**A little**	**Moderately**	**Quite a bit**	**Extremely**
1. Interested	1	2	3	4	5
2. Happy	1	2	3	4	5
3. Distressed	1	2	3	4	5
4. Excited	1	2	3	4	5
5. Upset	1	2	3	4	5
6. Strong	1	2	3	4	5
7. Guilty	1	2	3	4	5
8. Scared	1	2	3	4	5
9. Hostile	1	2	3	4	5
10. Enthusiastic	1	2	3	4	5
11. Proud	1	2	3	4	5
12. Irritable	1	2	3	4	5
13. Alert	1	2	3	4	5
14. Ashamed	1	2	3	4	5
15. Inspired	1	2	3	4	5
16. Nervous	1	2	3	4	5
17. Determined	1	2	3	4	5
18. Attentive	1	2	3	4	5
19. Jittery	1	2	3	4	5
20. Active	1	2	3	4	5
21. Afraid	1	2	3	4	5

Participant Number: _____

Demographics Questionnaire

Are you: _male _female _ other: _____

How old are you? _____

What is your ethnicity? _____ What language do you speak at home? _____

All things considered, how satisfied are you with your life as a whole these days?

0	1	2	3	4	5	6	7	8	9	10
Dissatisfied										Satisfied

Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

0	1	2	3	4	5	6	7	8	9	10
Completely unwilling										Completely willing

Imagine you had won $125,000 in a lottery. Almost immediately after you collect, you receive a financial offer from a reputable bank, the conditions of which are as follows: There is the chance to double the money within two years. It is equally possible that you could lose half of the amount invested. What share of your lottery winnings would you be prepared to invest in this financially risky, yet lucrative investment?

a) 0 b) $25,000. c) $50,000. d) $75,000 e) $100,000. f) $125,000.

There are three versions of this study, one of which you have done. Which version do you think you would most enjoy? and least enjoy?

a) You and another participant roll dice to determine whether your team receives $6 or $12, with the proceeds split equally.
b) You and another participant each roll your own die to determine your own payment. Four combinations are possible (you and the other participant get $3 each, you get $3 and the other participant $6, you get $6 and the other participant $3, or you and the participant get $6 each)
c) You roll you own die to determine whether you are paid $3 or $6. No other participants are present.

Most enjoy? _____ Least enjoy_____

Participant Number: _____

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

1	2	3	4	5	6	7
Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly

I see myself as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

How well do you know the other participant in this study?

1	2	3	4	5	6	7
Not at all						Very well

How would you characterize your relationship with the other participant in this study (e.g., friend, stranger, classmate, etc.)? _____