The complaint bias in subjective evaluations of incentives

Eldad Yechiam and Ariel Telpaz, Technion – Israel Institute of Technology

Guy Hochman, Duke University

Loss aversion, the standard model for understanding the effect of losses, is often interpreted to suggest that losses result in more extreme feelings, and this leads to overweighting losses in behavioral decisions. In three experiments, we question this interpretation by examining rated feelings in experience-based and description-based decisions. Experiments 1 and 2 focused on experience-based decisions with equiprobable gains and losses. The results showed that participants reported more extreme feelings for losses than for equivalent gains. For example, the feelings associated with a loss of 5 tokens were on average 2.6 times more extreme (i.e., distant from the scale's midpoint) than the feelings for a gain of 5 tokens. At the same time, however, these extreme ratings were not associated with behavioral loss aversion. Furthermore, in Experiment 2 the asymmetry in subjective ratings was practically eliminated when participants were incentivized to give truthful reports, implying that it is the result of a self-serving response bias. Finally, in Experiment 3 we focused on one-shot description-based decisions. In this setting the asymmetry between losses and gains was reversed. Possibly, the tendency to complain about losses and to minimize praise of gains only takes place when it affects subsequent interactions.

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Corresponding author: Eldad Yechiam, Max Wertheimer Minerva Center for Cognitive Studies, Faculty of Industrial Engineering and Management, Technion - Israel Institute of Technology, Haifa 32000, Israel. Phone: (972) 4-829-4420, Fax: (972) 4-829-5688, Email: yeldad@tx.technion.ac.il

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Loss aversion (Kahneman & Tversky, 1979), the idea that losses carry greater subjective importance than gains of the same value, is one of the most influential ideas in Psychology in the last 40 years, and has been incorporated as a basic assumption in a range of prominent theories in behavioral sciences, such as mental accounting theory (Thaler, 1985), the inequality aversion model (Fehr & Schmidt, 1999), and connectionist and reinforcement learning models (e.g., Usher & McClelland, 2004; Erev & Barron, 2005). A common interpretation of loss aversion is that losses lead to more extreme feelings than gains, and this results in increased weighting of losses compared to gains. As noted by Kahneman and Tversky "The aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount" (p. 279). This line of reasoning was detailed in a paper by McGraw, Larsen, Kahneman, and Schkade (2010) who demonstrated this asymmetry in predicted feelings to gains and losses of $200. Similar findings have been observed by others (e.g., Kermer, Driver-Linn, Wilson, and Gilbert, 2006; Harinck et al., 2007). Most recently, Wu, Markle, Sackett, and White (2010) have demonstrated this kind of asymmetry in marathon runners' satisfaction compared to their goal level. Runners expressed more disappointment with negative deviations from their expected finishing time, than pleasure for positive deviations. None of these studies, however, have established a causal relation between the asymmetry in subjective feelings and the behavioral phenomenon of loss aversion. Examining this relation is the goal of the current study

Under the traditional account of loss aversion (Kahneman & Tversky, 1979), and as explicitly stated in McGraw et al. (2010), a correlation is expected between the feelings associated with losses and the behavioral responses contingent upon these outcomes. Thus, self-reported feelings concerning losses should be associated with behavioral loss aversion, defined by Kahneman and Tversky as a state where a) "most people find symmetric bets of the form (x, .50; -x, .50) distinctly unattractive", and b) "if $x > y \geq 0$, then (y. 50; -y. 50) is preferred to (x. 50; -x. 50)" (p. 279).

In contrast, we suggest that the asymmetry in reported feelings may be a product of response distortion aiming to present the person in a manner believed to be desired by an observer (Ellingson, Smith, & Sackett, 2001). Specifically, the more extreme rating of feelings for losses than for gains reflects a tendency to complain about losses and minimize praise of gains. Complaining about losses can yield greater empathy and sympathy from the environment (Bertrand & Mullainathan. 2001; Rozin & Royzman, 2001). Complaints tend to be more effective when accompanied by negative feelings (Van Kleef, De Dreu, & Manstead, 2004; Hareli et al., 2009). For example, in Hareli et al.’s (2009) study, the perceived validity of a complaint was enhanced when it was voiced in an angry tone compared to a neutral or friendly tone. Additionally, minimizing praise of obtained gains may communicate the desire for additional rewards (Bertrand & Mullainathan. 2001). Hence, our view is that the accentuated report of feelings in response to losses versus gains, which we refer to as the complaint bias, represents in part a strategic attempt to be portrayed in a manner that would serve to reduce future losses and enlarge future gains.

We administered three simple laboratory experiments to examine whether indeed people tend to complain about negative outcomes more than they praise symmetric positive events, and if this tendency is independent from loss aversion. Our first two experiments used experience-based decision tasks, in which participants obtain small negative payoffs (monetary losses) in a repeated manner. Previous studies show that loss aversion does not emerge for small payoffs (see review in Yechiam & Hochman, 2013). For example, in Harinck et al. (2007) loss aversion only started to emerge for losses of 30 Euro. Hence, in Experiment 1, we examined whether in the same setting where no behavioral loss aversion is expected, individuals would report more extreme feelings concerning the experienced losses. Put differently, asymmetric rating of feelings for losses and gains simultaneously with no behavioral loss aversion implies that the former is an independent phenomenon that differs from the actual weighting of gains and losses.

Experiment 2 examined the argument that the asymmetry in self reports of feelings is due to response distortion and could thus be curbed when participants are encouraged to provide truthful subjective reports. Finally, Experiment 3 examined the generality of our results to one-shot description based decisions. In this experiment we also explicitly controlled the payoff magnitude and examined the effect of this manipulation both on loss aversion and on the complaint bias.

Experiment 1: Asymmetric reports of feelings with behavioral loss neutrality

We examined whether in experience-based decisions, people would report more extreme feelings concerning losses even in the absence of loss aversion. Two decision problems were administered, one contrasting a safe alternative with no losses to a risky alternative with equivalent gains and losses (Problem 1) and a more complex problem where alternatives differed in the size and frequency of losses (Problem 2). In each problem participants were required to make 80 repeated selections between two choice alternatives. On randomly determined trials, they were further asked to report their feelings concerning the payoff obtained on that trial. The choice outcomes were as follows:

Problem 1:

S 0 with certainty

R -5, or 5 with equal probability

Problem 2:

S -5, 0, or 5 with equal probability

R -25, -20, -15, 15, 20, or 25 with equal probability

The two choice alternatives are referred to as the Safe (S) and Risky (R) options. As can be seen, these alternatives have equal expected values, but the variance of the outcome distribution is larger for R. Under loss aversion participants should avoid R in Problem 1 because it includes losses while S does not include losses (Kahnman & Tversky, 1979). They should also avoid R in Problem 2 because it incorporates relatively larger and more frequent losses (Kahnman & Tversky, 1979; see also Cachon & Camerer, 1996). By contrast, in Yechiam and Telpaz (2013) individuals who performed Problem 2 selected equally from S and R, thus showing no loss aversion in their behavioral decisions. As noted above, this is a common pattern in decisions involving small stakes (Yechiam & Hochman, 2013). Thus, we predicted that in these two decision problems, participants would not exhibit behavioral loss aversion but would still provide higher subjective ratings to losses versus gains.

Method

Participants. Sixty Technion undergraduates (30 males and 30 females) took part in the experimental study (sample size was determined in advance). Their mean age was 25.4 (*SD* = 5.1). Thirty of the participants performed Problem 1 and the other 30 performed Problem 2. Participants were given a basic fee of 20 New Israeli Shekels (NIS) and were additionally paid based on the total amount earned in the decision task. If participants lost money in the experimental task, it was deducted from their basic fee.

Procedure and Task. Participants were endowed with an initial amount, and were asked to operate a “money machine” with two choice alternatives presented as blank virtual buttons (see Hertwig, Barron, Weber, & Erev, 2004; Rakow & Newell, 2010; Erev & Haruvy, in press). They were only informed that their assignment would be to repeatedly select buttons and that their choices would affect their payment. Additionally, participants were informed that they would be asked to rate their feelings concerning some of the outcomes. On each trial they selected one of the two virtual buttons using a standard computer mouse. Upon pressing a button the obtained payoff was presented on the button face and on an obtained-payoff counter for 2 seconds (see Supplementary Figure 1). After a 1 second interval the next trial began. The outcomes from the two buttons were drawn from the payoff distributions for the S and R options in each choice problem. Outcomes were randomly sampled from the payoff distributions in each trial. This was done separately for each participant.

During some of the trials participants were also asked to rate their feelings concerning the outcomes. For Problem 1 the evaluation covered all possible payoffs (-5, 0, +5). For Problem 2, the evaluation focused on the amounts +5 and -5 of the safe alternative, and +25 and -25 of the risky alternative, the most extreme outcomes of the two alternatives. In both problems, the evaluation screen appeared with a probability of 1/6 upon each risky choice and with a probability of 1/6 upon each safe choice. This random assignment of evaluations to trials controlled for any effect of order.

On trials in which subjective evaluation was required, after the obtained outcome was presented for 2 seconds, participants were asked to rate their feeling regarding the outcome on a 7-point scale ranging from "Very Negative" to "Very Positive", using a sliding bar (see example in Supplementary Figure 1). There was no time limit for the response. Upon completing the rating, participants pressed a button to move to the next trial. There were few missing cases of no evaluation for a given amount (10 out of 210). At the end of the task, the participants were paid according to the total number of points earned, using a conversion rate of NIS 1 per 100 points. No additional measures or experimental conditions beyond those reported were included in this and all subsequent experiments.

The behavioral dependent variable was the rate of selections from alternative R throughout the task. For the subjective evaluation part, the main variable was the deviation of the score from the scale’s midpoint (positive deviation for gains and negative for losses). Namely, the raw subjective evaluation E was converted to the deviation score D as follows: for gains, $D = E - 4$; and for losses (or zero), $D = 4 - E$.

Results

The average proportion of risky choices across all trials was 0.48 (SD = 0.15) in Problem 1, and 0.52 (SD = 0.20) in Problem 2, with no significant difference between choice problems ($t(58)$ =

0.83, $p = 0.41$). In both problems the selection rate was not significantly different from equal choice of the two alternatives (i.e., the 50% rate; Problem 1: $t(29) = 0.56$, $p = 0.58$; Problem 2: $t(29) = 0.63$, $p = 0.53$). Therefore, participants exhibited no loss aversion in their behavioral decisions. Moreover, this pattern of results remained stable throughout the task (see Figure 1).

Given that the outcomes were randomly drawn, one could argue that participants tended to take risk only when they had prior accumulated gains (e.g., due to a house money effect; Thaler & Johnson, 1990) or previous losses (due to the reflection effect; Kahneman & Tversky, 1979). To examine this possibility, we compared three types of contingent choices: Choices made after the participants have accumulated a loss (total amount below zero), choices made after they have accumulated a gain (total amount above zero), and choices made with zero earnings. The results of this analysis appear in Table 1. As can be seen, participants did not exhibit loss aversion in each of the three types of choices, and in fact there was a weak reverse tendency to prefer the alternative with high symmetric gains and losses in some trial types.

Figure 2 shows the average ratings of feelings concerning losses and gains of different values. As opposed to the behavioral decisions, the findings show an asymmetric response, with ratings being more extreme for losses than for gains. For Problem 1 the feelings associated with a loss of 5 were 2.13 times more extreme (i.e., distant from the scale's midpoint) than the feelings for a gain of 5. A paired-sample t-test revealed that the difference between the ratings for +5 and -5 was highly significant ($t(24) = 3.51$, $p = 0.002$). Interestingly, the evaluation for the outcome of zero was significantly below the midscale ($t(29) = 3.14$, $p = 0.004$), suggesting that participants were somewhat dissatisfied with this outcome.[1]

For Problem 2 as well, we observed more extreme ratings of feelings for losses. For example, the feelings associated with a loss of 5 were 3.05 times more extreme than the feelings for a gain of 5. For this problem we conducted an all-within ANOVA comparing payoff valence

[1] Yet the asymmetry for the loss outcome was stronger than this "zero deduction" (D(-4) - D(0) was 42% higher than the positive evaluation D(+4)). When controlling for D(0), the difference between D(+4) and D(-4) remained significant, $F(1,23) = 5.61$, $p = .03$.

(gains versus losses) and payoff size (5 versus 25). The results showed a main effect for payoff valence ($F(1, 24) = 13.75$, $p < 0.001$) as well as for payoff size ($F(1, 24) = 65.50$, $p < 0.001$). No interaction was observed ($F(1, 24) = 0.36$, $p = 0.56$). Note that loss aversion also implies an interaction effect because the gap between losses and gains is expected to grow with the payoff size. The absence of this interaction may, however, be due to a floor effect with respect to the ratings of the lowest payoff of -25. The absolute rating of this payoff was 1.36, while the standard deviation was 0.53, implying that some of the actual variance was beyond the scale we provided.[2]

We next examined whether at the individual level the extreme feelings reported for losses were related to the tendency to pick the alternative that minimizes these losses. First, we created for each participant, a "loss-gain sensitivity" score, calculated as the feelings rating for a loss (of 5 or 25) minus a gain of the same value (D(-X) – D(X)). Under loss aversion, higher loss-gain sensitivity for payoffs from a given option is expected to be associated with fewer choices from the option with the largest losses. Hence, loss aversion implies a negative correlation between loss-gain sensitivity and choices from the risky alternative. In Problem 1 the correlation between D(-5) - D(5) and P(R) was small and not significant ($r = -0.22$, $p = 0.30$). In Problem 2 the correlation between D(-25) - D(25) and P(R) was also quite small and non-significant ($r = 0.13$, $p = 0.54$) while the correlation between D(-5)- D(5) and P(R) was, surprisingly, positive and marginally significant ($r = 0.31$, $p = 0.10$). Across problems and payoff types the correlation was not significant (r = 0.10, p = 0.37). We also examined a strict "loss sensitivity" score in Problem 1, calculated as the distance of the subjective ratings for -5 and zero (D(-5) – D(0)). This score also showed no significant correlation with the rate of choices from the safe option (r = -0.004, p = 0.99). Therefore, there was no correlation between individuals' inflated reports of feelings following losses and their tendency to show behavioral loss aversion, which further suggests that these two phenomena are independent.

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[2] In both problems there was no substantial habituation in the asymmetric ratings of gains and losses. Across problems, the feelings for a loss of 5 were 3.70 times more extreme than for a gain of 5 in the first half of the task, and 2.83 more extreme in the second half. The feelings for a loss of 25 in Problem 2 were 1.43 times more extreme than for a gain of 25 in the first half and 1.56 times more extreme in the second half of the task.

Experiment 2: Asymmetric reports of feelings and response distortion

In a second experiment we examined the argument that asymmetric reports of feelings are in part a product of strategic response distortion. This assertion implies that if participants truthfully report their feelings, their ratings for gains and losses should be symmetric. We examined this by using a mock polygraph setting. All participants in this experiment performed a decision making task (Problem 2 above) while being attached to an eye tracker. Participants in the experimental ("Lie detection") condition were further told that the eye tracker would be used for detecting lies, and that their payoffs would be reduced based on the number of identified lies. This mock polygraph setting was based on a classic technique in Social Psychology designed to encourage participants to respond truthfully to questions regarding their affect and attitude. Social psychologists refer to this manipulation as the "bogus pipeline". Since it was introduced by Jones and Sigall (1971), it was found to be effective in numerous studies (Roese & Jamieson, 1993). We predicted that in the Lie-detection condition participants' ratings of their feelings concerning gains and losses would be more symmetric.

We also used the eye tracker to take actual measurements of pupil size. Pupil size is considered an immediate and direct index of autonomic activation (Granholm & Steinhauer, 2004). In line with previous studies (e.g., Hochman & Yechiam, 2011) we expected increased arousal to emerge following losses compared to gains, even with no loss aversion. Additionally, we examined whether the arousal following losses compared to gains would be associated with the difference in subjective ratings for these outcomes.

Method

Participants. Forty-Eight Technion undergraduates (24 males and 24 females) took part in the experimental study (sample size was determined in advance). Their average age was 24.9 (*SD* = 2.5). Participants were randomly divided into the Control condition (n = 24) and Lie-detection condition (n = 24), while keeping an equal proportion of men and women in each condition (12 males and 12 females). The participants' payoff was a basic fee of NIS 40 and an additional payment contingent on the amount earned in the experimental task. If they lost money, it was deducted from their basic fee.

Procedure and Task. In the Control condition participants performed Problem 2 in the same manner as in Experiment 1. They were given the same instructions as in Experiment 1 with the following extension: “During the experiment you will wear a device for measuring eye movements and pupil size, made by Arrington Research Company. On the basis of changes in the size of the pupil, this device enables us to assess the level of activation of the Autonomic Nervous System (an indicator of arousal level) during the task.” In the Lie-detection condition, the following was also added: “Changes in the level of activation of the Autonomic Nervous System enable to detect lies. For example, a lie detection polygraph machine is based on assessing changes in the activation of the Autonomic Nervous System.” Also in this condition, the instructions ended with the statement: “Please notice that you need to provide truthful answers to the questions about your feelings concerning outcomes. Through the eye tracking device, we will assess whether your answers are truthful or not. For every untruthful answer, we will reduce 3% of your total payment for the experiment.”

The instructions were followed by attaching the eye tracking device, which was then calibrated. Next, participants performed the experimental task. Since physiological data requires multiple observations (Andreassi, 2000), the number of trials was increased to 160 (hence, in this experiment there were no missing values for ratings across trials). Participants were then paid according to their total number of points, with a conversion rate of NIS 1 per 100 points. At the end of the experiment, 14 of the participants were quizzed about the lie detection manipulation. All of them indicated that they believed we had examined the truthfulness of their responses.

Eye tracking apparatus. Pupillometry data was collected using ViewPoint PC 60 EyeFrame system (Arrington Research, Scottsdale, Arizona). The system operates with a single tiny camera and an infrared illuminator mounted on a lightweight frame facing toward the participant's dominant eye, and supported by comfortable head straps. It records pupil data at approximately 30 frames per second (fps). We recorded the physiological responses before and after gains and losses, starting from the onset of where a gain/loss outcome was presented. We did not study the physiological responses associated with the reported feelings since the use of the sliding bar did not enable determining the exact time at which the rating was made. Pupil data was averaged to produce a data step every 200 milliseconds.

Results

The average proportion of risky choices across all trials was 0.49 (*SD* = 0.16) in the Control condition, and 0.45 (*SD* = 0.13) in the Lie-detection condition. The rates of risky choices were not significantly different between conditions ($t(46) = 0.80$, $p = .43$) or from equal choice of the two alternatives ($t(47) = 1.44$, $p = 0.15$). Therefore, the behavioral results in both conditions replicate those of Experiment 1, showing no loss aversion for the average participant. This pattern of results remained stable throughout the task (see Figure 1). Also, it was evidenced in trials where participants' accumulated outcome was zero (see Table 2).

We next examined the reported feelings associated with gains and losses (see Figure 3). In the Control condition, losses were given more extreme ratings than equivalent gains, as in Experiment 1. However, this pattern was substantially attenuated in the Lie-detection condition. For instance, in the Control condition the change from scale's midpoint was 2.08 times larger for a loss of 5 than for a gain of 5. In the Lie-detection condition this ratio shrunk to only 1.35 (Cohen's d of 0.39 for the difference between conditions). To examine the statistical significance of this pattern, we conducted a mixed between and within ANOVA, with payoff valence (gains versus losses) and payoff size (5 versus 25) as within-subject factors and experimental condition as a between-subject factor. The results showed a main effect of payoff valence ($F(1, 46) = 28.26$, $p < 0.001$) denoting more extreme feelings for losses than for gains. There was also a significant effect of payoff size ($F(1, 46) = 111.90$, $p < 0.001$), but no interaction between these variables

(*F*(1, 46) = 0.17, *p* = 0.68) and no main effect of experimental condition (*F*(1, 46) = 0.001, *p* = 0.98).

However, as predicted, there was a significant interaction between experimental condition and payoff valence (*F*(1, 46) = 4.36, *p* = 0.042). Post-hoc tests using paired t-tests and Bonferroni corrections showed that in the Control condition the difference between the magnitude of rated feelings for gains and losses was significant for the outcomes of 5 (*t*(23) = 3.36, *p* = 0.012) and 25 (*t*(23) = 3.91, *p* = 0.008), replicating the results of Experiment 1. By contrast, in the Lie-detection condition the same effects were not significant (5 outcome: *t*(23) = 2.11, *p* = 0.19; 25 outcome: *t*(23) = 2.18, *p* = 0.16). Some minor differences emerged between conditions as a function of payoff size (e.g., a larger effect of condition for the loss of 25 than for the loss of 5), but since the three-way interaction of condition by valence by payoff size was not significant (*F*(1, 46) = 0.13, *p* = 0.72) we did not proceed to conduct additional post-hoc tests.

We next examined the effect of losses on the participants' pupillary responses. The approximated pupil diameters for gains and losses in the two conditions are presented in Figure 4. As indicated in the figure, in both conditions losses led to increased pupillary responses compared to equivalent gains, in the two time epochs between 750 ms and 1250 ms. To examine the significance of this pattern, we conducted a mixed between and within ANOVA for these time windows, with outcome valence as a within-subject factor and experimental condition as a between subject factor. The results showed a significant effect of valence for the 750-1000 ms epoch (*F*(1, 46) = 7.32, *p* = 0.01) and for the 1000-1250 ms epoch (*F*(1, 46) = 16.39, *p* < 0.001). In both time windows, there was no effect of condition or interaction between condition and outcome valence. Pupil diameters in the Lie-Detection condition were higher compared to the Control condition 500 to 250 ms prior to outcome presentation but this difference was not significant (F (1,46) = 0.46, p = 0.50). This suggests that participants in the Lie-detection condition did not damp down their autonomic responses in an attempt to stay as calm as possible, as their physiological response to losses was virtually the same as in the Control condition.

Hence, the effect of the experimental manipulation on subjective ratings was not due to changes in the arousal pattern.

Finally, we examined the correlation between the feelings ratings for gains and losses, pupil diameters, and behavioral choices. The subjective ratings for the different payoffs were not correlated with risky choices in the Control condition (D(-25) - D(25): $r = -0.21$, $p = 0.33$; D(-5) - D(5): $r = -0.001$, $p = 1.0$). In the Lie-detection condition the expected negative correlation was marginally significant for D(-25) - D(25): $r = -0.34$, $p = 0.10$; and non-significant for D(-5) - D(5): $r = 0.29$, $p = 0.17$. Again, across conditions and payoff types the correlation was near zero ($r = 0.04$, $p = 0.68$). Pupil diameters following losses and gains (PD(-25) – PD(25); PD(-5) – P(5)) in the 750-1000 ms epoch and 1000-1250 ms epoch were not significantly correlated with the behavioral response to losses, or with the subjective ratings. Possibly, the increased arousal following losses reflects the attentional orienting response elicited by losses (see review in Yechiam & Hochman, 2013), which is not necessarily related either to the tendency to overweight losses or to complain about them.[3]

Experiment 3: One-shot description based tasks

In our final study we wanted to clarify the relation between our findings and previous research. Harinck et al.'s (2007) study of one-shot description-based decisions did not find a tendency to accentuate subjective reports for small losses such as the ones we used, and in fact they report a reversed bias, with more extreme reports of feelings for gains than losses. This suggests an experience-description gap in the complaint bias. Our theoretical framework is consistent with this gap: Once additional future outcomes are not expected, there is no point in complaining over past outcomes that were already determined. We therefore set out to verify whether in our sample of Israeli students the inclination to report more extreme feelings following losses would not emerge in one-shot description based decisions. In addition, we also examined the effect of

[3] Similar results from the pain literature is that arousal response to pain is not correlated with "pain catastrophizing", the tendency to exaggerate the threat value or seriousness of pain during the pain experience (see e.g., Kunz et al., 2008).

payoff magnitude in this setting. In line with previous literature, we expected more loss aversion with greater payoffs (see review in Yechiam & Hochman, 2013).

Method

Participants. One-hundred Technion undergraduates (50 males and 50 females) took part in the experimental study. Due to the scarcity of data following risky choices, we added 50 observations after analyzing the first 50. The participants' average age was 24.7 (*SD* = 2.4). Fifty of the participants performed Problem 1 and the remaining 50 performed Problem 3. Their payoff was a basic fee of NIS 50 and an additional payment contingent on the amount earned in the experimental task. If they lost money, it was deducted from their basic fee.

Procedure and Task. Participants were endowed with an initial amount, and were then asked to perform a decision task. For half of the participants the task payoffs conformed to Problem 1 described above. For the other half, the task involved higher payoffs, as follows:

Problem 3:

S 0 with certainty

R -40, or 40 with equal probability

Differently from the previous study, there was no points-to-money conversion, and the outcomes were described in NIS (see Supplementary Figure 2). Participants were told that they would make a single decision followed by three questions. After they made their selection, participants were informed that the outcome for their decision has been finalized. Next, they were asked to rate their feelings in the event of getting each of the possible outcomes (e.g., for Problem 3: +40, -40, or 0; see Supplementary Figure 3). This was followed by the presentation of the obtained outcome, which for the risky alternative, was randomly determined. Finally, participants were asked to rate their feeling concerning the amount they got.

Results

The average proportion of risky choices was 0.52 in Problem 1 and 0.40 in Problem 3, with no significant difference between choice problems ($Z = 1.20$, $p = 0.23$). Though the trend in Problem 3 was towards more loss aversion, the rate of selections was not significantly below 50% (one tailed Binomial test $p = 0.10$).

The participants' subjective ratings for each outcome appear in Figure 5. As can be seen, the pattern was different from that found in our previous experiments, with more extreme ratings for gains than for losses in Problem 1 ($t(23) = 2.37$, $p = 0.03$), and similar rating for gains and losses in Problem 3 ($t(18) = 0.43$, $p = 0.67$). We also examined the participants' beliefs about how they would feel upon getting each of the three outcomes (see Supplementary Figure 4). In both decision problems these hypothetical ratings were more accentuated for gains than losses (Problem 1: $t(49) = 4.31$, $p < 0.001$; Problem 3: $t(49) = 3.50$, $p = 0.001$).[4]

Discussion

In three experiments, we studied whether participants report more extreme feelings following losses compared to gains and whether this is associated with the behavioral indications of loss aversion. The results of our first two experiments, which focused on experience-based decisions, showed that participants did not tend to avoid or overweight losses in their behavioral decisions. At the same time, there was a substantial bias in reported feelings following the experience of gain and loss outcomes. For example, across the two problems of Experiment 1, the average rated feelings for a loss of 5 were 2.6 times more extreme than for a gain of 5. This pattern was replicated in the control condition of Experiment 2. Thus, the findings indicate that the tendency to report more extreme feelings in response to losses is independent from loss aversion.

We suggested that the asymmetry in subjective ratings represents a self-serving distorted response. This was further examined in Experiment 2, where participants were prompted to

[4] For these hypothetical ratings we could also calculate a "loss-gain sensitivity" score (e.g., D(-40) – D(40)) as in the previous studies. The results showed no correlation between this score and P(R) in both problems (Problem 1: $r = -0.002$, $p = 0.99$; Problem 3: $r = -0.17$, $p = 0.24$).

provide truthful subjective ratings. In this condition the asymmetry in rated feelings for gains and losses reduced considerably, and was not statistically significant. The results of this experiment suggest that there is a strategic element in the tendency to asymmetrically rate one's feeling concerning gains and losses, and that this tendency may be curbed when the participants are encouraged to respond truthfully. Additional experiments should verify this using completely non-voluntary lie detection techniques (e.g., with fMRI; Langleben et al., 2002).

Note that our results suggest that in some conditions inflated affective responses following losses may occur together with loss aversion. Especially, in the condition of Experiment 2 where participants were encouraged to tell the truth we observed a marginally significant negative correlation between the subjective response to losses and individuals' tendency to choose the alternative that produced these losses. Similar correlations might emerge in real world situations involving losses where there are no strategic reasons to complain.

Our final experiment focused on description-based decisions. In this experiment the behavioral results also showed no evidence for loss aversion. Possibly, the payoff size was not large enough for this behavioral pattern to emerge. A second notable finding is that the complaint bias disappeared. In fact, the results demonstrated a reversed complaint bias for small payoff magnitudes (+5, -5), as in Harinck et al. (2007). Harinck et al. suggested that this behavioral pattern emerges because of the psychological tendency to trivialize small negative payoffs. Yet even for larger payoffs, we did not find a complaint bias in the one-shot setting. Presumably, the reason that complaints disappear in this setting is that they are no longer useful for strategic purposes since the relevant social interaction has ended. At any respect, the results demonstrate a description-experience gap in people's subjective ratings of gains and losses. In experience based decisions we observed the complaint bias, while in one-shot description based decisions it was not observed.

Conclusions

Returning to the question of loss aversion, our findings suggest that indeed as argued by McGraw et al. (2010) in some settings losses lead to more extreme ratings of feelings than equivalent gains. However, this pattern of self-report can be independent from behavioral decisions involving losses. Hence, the suggestion that this self-report bias explains loss aversion seems imprecise. We refer to this bias as the “complaint bias” because it implies that individuals’ reports of their feeling concerning gains and losses is more negative compared to a) how they make choices, and b) how they respond when they are encouraged to truthfully state their feelings. Therefore, what appears as a kink in the subjective evaluation function (e.g., in Figure 2 and 3) is simply the product of an overall tendency to “paint things black”.

Our findings also have implications to the use of self-report indices as comparative indicators. For example, satisfaction levels are increasingly utilized as an index of economic welfare (e.g., Van Praag & Ferrer-i-Carbonell, 2004), but if there are considerable individual and situational differences in people’s complaint bias, then it is difficult to infer differences in this type of index. Our results suggest that this problem can be avoided by making use of incentive schemes that promote the elicitation of truthful statements.

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Table 1: Behavioral results in three types of trials in Experiment 1: Choices made after the participants have accumlated a loss, a gain, or with zero earnings. The rate of each trial type in Problem 1 and 2 is followed by the mean proportion of risky selections (P(R)) and the standard deviation across participants (in parenthesis).

	Problem 1		Problem 2	
Trial type	Rate	P(R)	Rate	P(R)
Accumulated loss	0.47	0.53 (0.21)	0.43	0.60* (0.19)
Accumulated gain	0.37	0.65* (0.25)	0.48	0.42 (0.29)
No accumulated gain or loss	0.15	0.62* (0.27)	0.10	0.59* (0.22)

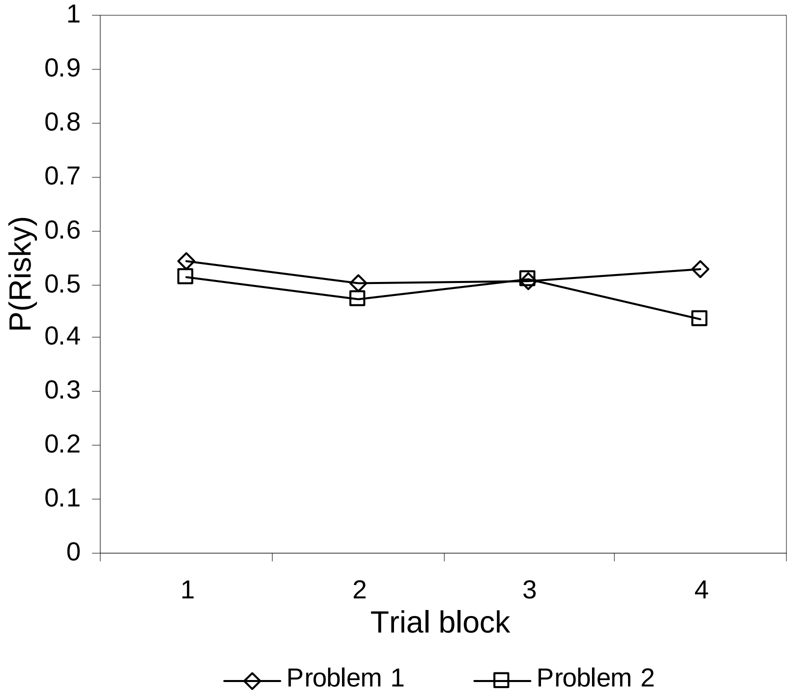
* One-sample t-test results for the distance from 0.5: $p < 0.5$.

Table 2: Behavioral results in three types of trials in Experiment 2: Choices made after the participants have accumlated a loss, a gain, or with zero earnings. The rate of each trial type in the two experimental conditions is followed by the mean proportion of risky selections (P(R)) and the standard deviation across participants (in parenthesis).

	Control condition		Lie-detection condition	
Trial type	Rate	P(R)	Rate	P(R)
Accumulated loss	0.41	0.59* (0.15)	0.46	0.55 (0.19)
Accumulated gain	0.52	0.38* (0.20)	0.47	0.41* (0.20)
No accumulated gain or loss	0.07	0.42 (0.25)	0.07	0.43 (0.28)

* One-sample t-test results for the distance from 0.5: $p < 0.5$.

Figure 1: Proportion of selections from the risky option in blocks of 20 trials in Experiments 1 and 2. Top: Experiment 1, Problems 1 and 2. Bottom: Experiment 2 (Problem 2), Control and Lie-detection conditions.



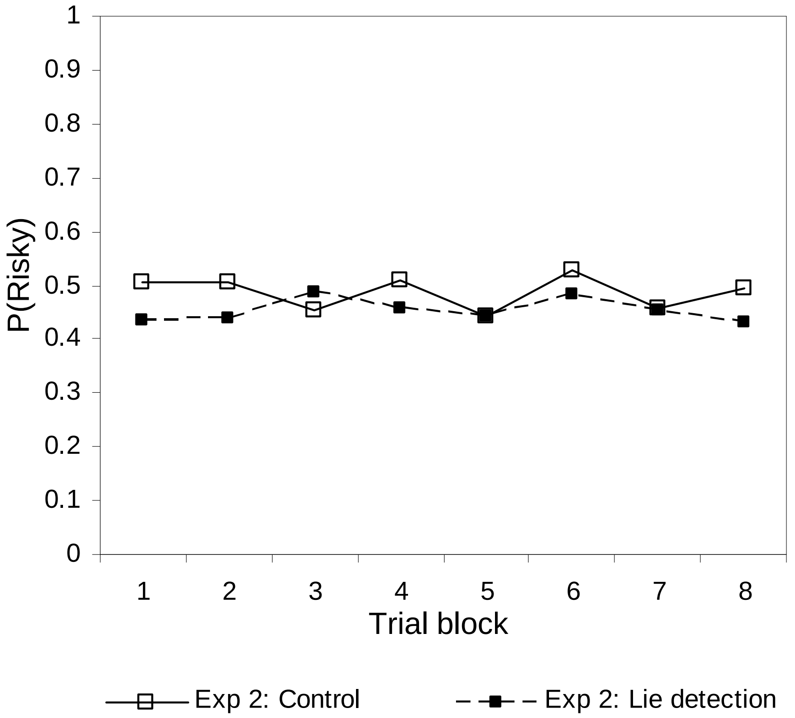
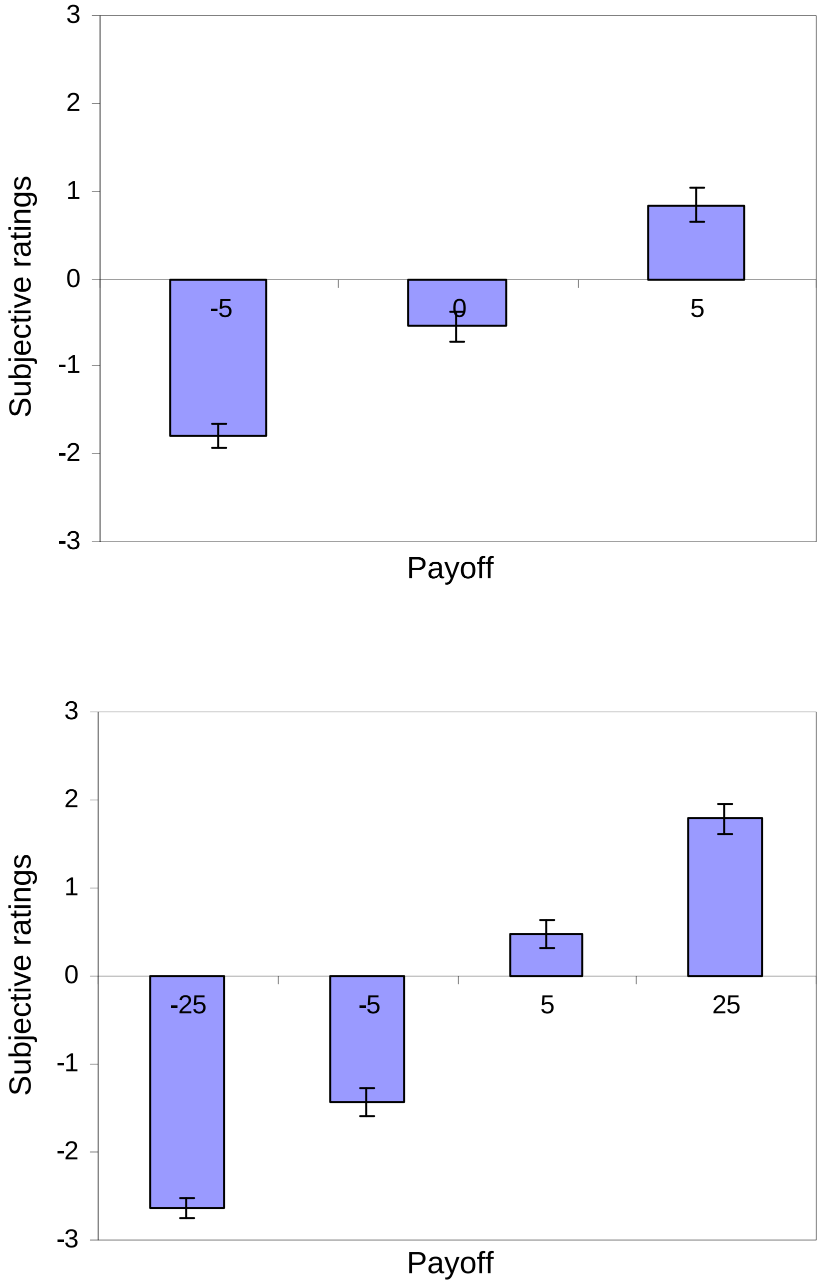
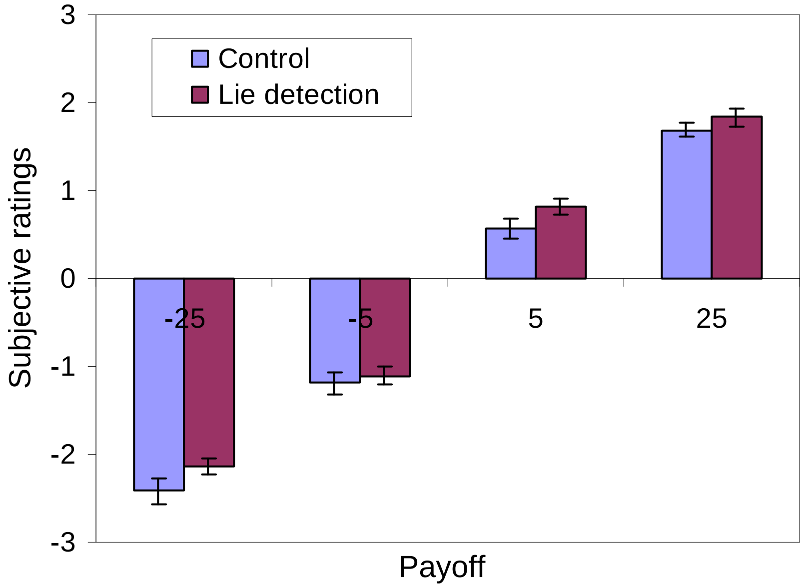


Figure 2: Subjective ratings of feeling as a function of valence (gains versus losses) and payoff size in Experiment 1. Top: Problem 1 outcomes. Bottom: Problem 2 outcomes. The numbers on the ordinate represent deviations from the scale's midpoint. Error terms denote the within-subject corrected standard error (Cousineau, 2005).



* - In Problem 1 (top panel), the evaluation was based on 3.6, 6.6, and 3.9 trials on average for the outcomes of -5, 0, and +5, respectively. In Problem 2 (bottom panel) the evaluation was based on 3.1, 3.7, 3.7, and 3.0 trials for the outcomes of -25, -5, 5, and 25, respectively.

Figure 3: Subjective ratings of feeling as a function of valence (gains versus losses) and payoff size in the two conditions of Experiment 2. The numbers on the ordinate represent deviations from the scale's midpoint. Error terms denote the within-subject corrected standard error (Cousineau, 2005).



* - In the Control condition the evaluation was based on 5.2, 6.3, 7.5, and 6.5 trials on average for the outcomes of -25, -5, 5, and 25, respectively, while in the Lie-detection condition it was based on 6.0, 6.8, 7.9, and 5.8 trials for these payoffs.

Figure 4: Approximated pupil diameter for gains and losses in the two conditions of Experiment 2. Time zero denotes the outcome presentation onset.

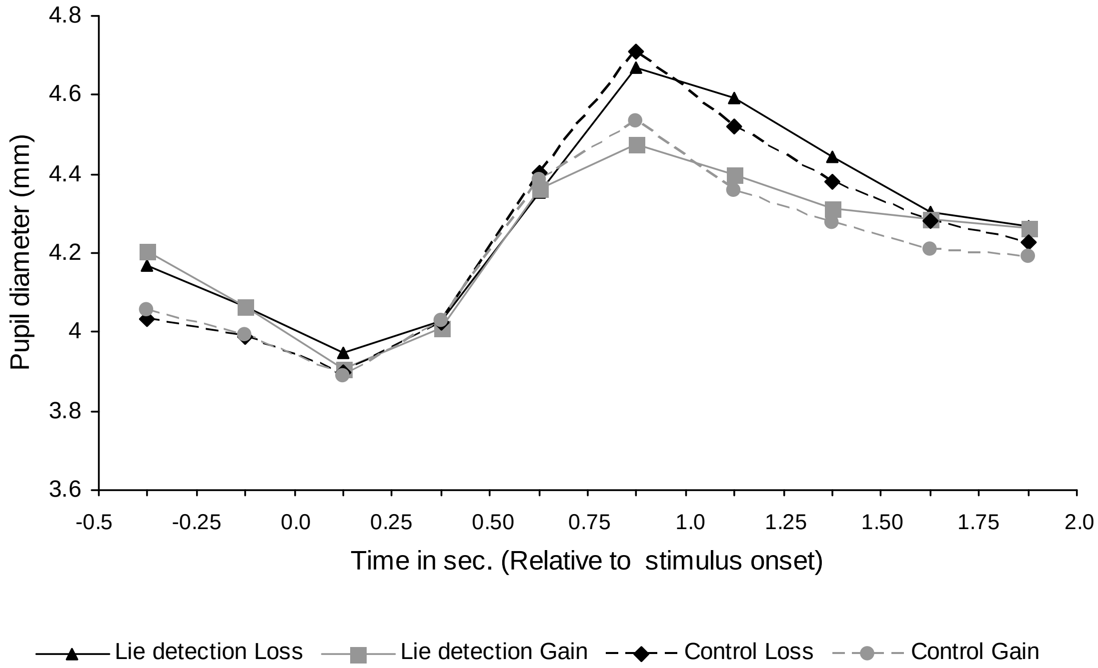


Figure 5: Subjective ratings of feeling as a function of valence (gains versus losses) and payoff size in Experiment 3 of one-shot decisions. Top: Problem 1 outcomes (n =13 for -5; n = 24 for 0; n = 12 for +5). Bottom: Problem 3 outcomes (n =8 for -40; n = 29 for 0; n = 12 for +40). The numbers on the ordinate represent deviations from the scale’s midpoint. Error terms denote the standard error.