Losses induce consistency in risk taking even without loss aversion

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Losses induce consistency in risk taking even without loss aversion

Abstract

It is posited that due to the attentional effect of losses, individuals would show more behavioral consistency in risk taking tasks with losses; even in the absence of loss aversion. In two studies the consistency of risky choices across different experience-based tasks was evaluated for gain, loss, and mixed (gain loss) tasks. In both studies losses facilitated the consistency across tasks: the correlation between risk-taking choices in different tasks increased when the tasks involved frequent losses. Study 2 also showed a positive effect of losses on temporal consistency. Losses increased the correlation between risk taking levels across two sessions that were 45 days apart. Also in Study 2, losses induced consistency between experiential risk taking choices and self-reported ratings of risky behavior. In both studies the positive effect of losses on consistency were observed even when the average participant did not exhibit loss aversion. Taken together the results indicate that losses increase the consistency of risk taking behavior, and suggest that this is due to the effect of losses on attention.

Keyword: decision making; individual differences; risk; experience.

1. Introduction

Although risk taking was postulated by various authors to be stable across situations (e.g., Sitkin & Weingart, 1995; Busemeyer & Stout, 2002; Byrnes, Miller, & Schafer, 1999) experimental studies have found inconsistency in risky behaviors exhibited in different contexts (Hanoch, Johnson, & Wilke, 2006; Schoemaker, 1990; Slovic, 1972; Weber, Blais, & Betz, 2002) and even in different administrations of the same task (Kindlon, Mezzacappa, & Earls, 1995). According to some theories of risk taking, this construct constitutes a behavioral trait at the individual level (e.g., Busemeyer & Stout, 2002; Lauriola, Levin, & Hart, 2007; Yechiam & Ert, 2011). Therefore, even when on average there are different risk taking levels in different settings (due to situational factors), the differences between individuals across settings are consistent (see e.g., Yechiam & Ert, 2011; Yechiam & Busemeyer, 2008). We examine the effect of losses on these individual level consistencies.

Two different theories of losses suggest that losses may facilitate the consistency of risky behavior at the individual level. Under loss aversion (or a negativity bias), losses are considered to have a larger effect on subjective evaluations than equivalent gains (Kahneman & Tversky, 1979). For example, in a controlled laboratory setting, Kahneman and Tversky (1984) had participants perform thought experiments in which they either gained or lost similar amounts of money. The retrospective distress people reported about losing was larger than the excitement about winning. In the context of decisions under risk and uncertainty, the assertion of loss aversion leads to two testable predictions. One involves avoiding risky outcomes with symmetric gains and losses (i.e., of the form .5 to win x and .5 to lose x).[1] Another

[1] For example, in a gamble A where there is an equal chance to win or lose $10, the loss would loom larger, and therefore the gamble’s certainty equivalent (in this case, getting zero) would be more attractive than the gamble. Similarly, if in gamble B there is an equal chance to win or lose $1, this gamble B will be preferred over A because it involves smaller losses.

implication of loss aversion can be derived under the additional assumption that people tend to be more reliable in reporting attitudes and performing tasks that are of importance to them (Judd & Krosnik, 1989; Chaiken & Maheswaran, 1994; Kanfer et al., 1994). Thus, as losses have larger subjective significance than respective gains, they are expected to increase the reliability of risk taking behavior. If individuals indeed show consistency in risk taking across different settings (as previously postulated) then increased reliability implies elevated consistency as well.

A similar effect of losses on consistency is predicted under an alternative model of losses, proposed by Yechiam and Hochman (2011). Under this model, losses do not have a larger effect than gains on subjective evaluations, but they do increase the allocation of attentional resources to the task. The model's two basic arguments are as follows: (a) Losses lead to an orienting response characterized by a momentary increase in arousal, which results in sustained attention. (b) The heightened attention increases the sensitivity to the task reinforcements and decreases random responses. This model capitalizes on the argument that losses signal an important situation for the organism's immediate survival and therefore increase attention (Rozin and Royzman, 2001; Taylor, 1991) but it suggests that when gains and losses are presented concurrently the attentional effect of losses is not specific to the loss component, and extends to other outcomes besides losses. This attention-based account is supported by two sets of findings. First, brain studies show increased physiological arousal (Hochman & Yechiam, 2011; Hochman, Glöckner, & Yechiam, 2010; Sokol-Hessner et al., 2008) and frontal cortical activation (Gehring & Willoughby, 2002; Yeung & Sanfey, 2004) following losses than following equivalent gains, even when no loss aversion is observed. Second, behavioral results show that losses lead to greater adjustment processes in the course of learning (Bereby-Meyer & Erev, 1998; see also Fischer, Jonas, Frey, & Kastenmüller, 2007) and increased maximization (e.g., Bereby-Meyer & Erev, 1998; Erev, Bereby-Meyer, & Roth, 1999), even in tasks where typically no loss aversion is observed (e.g., Erev, Ert, & Yechiam, 2008).

Importantly, this attention-based model also predicts that losses increase behavioral consistency because decreased random responses imply increased behavioral consistency; yet it predicts that the effect of losses on behavioral consistency can be demonstrated independently of loss aversion, and would therefore emerge even in contexts where no loss aversion is observed.

The first and major goal of the current study was to examine whether indeed losses improve the consistency of individuals' risk-taking behavior, as predicted by both the loss aversion account and the attention-based model. The effect of losses on temporal consistency was previously studied by Vlaev, Chater, and Stewart (2009) and by Baucells and Villasis (2010) in descriptive gambles (i.e. where the participants have full information about the outcome distributions). Their studies used a battery of prospects administered in two sessions that were set three months apart. The results of both studies showed that across two sessions risky choices were only consistent in loss gambles and were not significantly consistent in gain gambles (Vlaev et al: Losses: r = 0.33, $p < .01$; Gains: r = 0.20, *NS*; Baucells & Villasis: Losses: r = 0.20, p = .02; Gains: r = 0.06, *NS*), supporting the prediction that losses have a positive effect on consistency.

The present study goes beyond these studies in trying to clarify the mechanisms implicated in the effect of losses on individual consistency, as well as the boundary conditions for this phenomenon. Our second major goal was therefore to examine whether the positive effect of losses on consistency emerges even in the absence of behavioral loss aversion, as implied by the attention-based model of losses. For this purpose, we examined experience-based decision tasks (Hertwig, Barron, Weber, & Erev, 2004). In these tasks the participants do not get initial descriptive information on the relevant outcome distributions, but rather learn these distributions through choice and feedback. In several previous studies using experience-based tasks, participants were found to exhibit no loss aversion in this type of task, namely they did not reject gambles of the form .5 to win x, .5 to lose x (see Erev et al., 2008; Yechiam & Ert, 2011; Silberberg et al., 2008). Erev et al. (2008) suggested that in the experience-based paradigm, where losses are repetitive and of low stakes, they are not overweighed compared to respective gains (see also Samuelson, 1963). The use of experience-based tasks thus enables to examine whether the consistency induced by losses can be observed even in the absence of loss aversion. By contrast, the findings in descriptive tasks have been mixed (No loss aversion in Battalio, Kagel, & Jiranyakul, 1990; Birnbaum & Bahra, 2007; Ert & Erev, 2008; Koritzky & Yechiam, 2010; Yechiam & Ert, 2011; Loss aversion in Redelmeier & Tversky, 1992; Schmidt & Traub, 2002; Sokol-Hessner et al., 2008; Tom et al., 2007; Tversky & Kahneman, 1992; Wedell & Bockenholt, 1994), with some suggesting that they are highly affected by the particular phrasing of the items (Ert & Erev, 2008).

In Study 1 the participants performed three simple decision tasks in the gain, loss, and mixed (gain-loss) domains, and the effect of losses on consistency across different tasks was evaluated. In Study 2 the participants performed somewhat more complex tasks in two sessions conducted at an interval of about 45 days apart. In this study we examined the consistency across tasks and also temporal consistency. To enable comparison to real world behaviors, the participants in Study 2 also completed a self report test of risk taking, the *do*main *spe*cific *r*isk *t*aking (DOSPERT) scale (Weber et al., 2002).

Despite the different approaches to risk preferences, behavioral measures of risk taking tend to be quite uniform. In the vast majority of the aforementioned studies risk taking was typically operationalized as the rate of choice in (or preference for) the option associated with the higher outcome variability. We follow this convention in our studies and analyses as well. Therefore, “risk taking” will be referred to as the rate of choice in the option with the higher variance. Still, there are different approaches to this issue (Duxbury & Summers, 2004), with some arguing that losses are an inherent part of risk. Our aim was to clarify the effect of losses on individuals’ risk taking behavior.

2. Study 1: The Effect of Losses on Consistency across Risk Taking Tasks

The participants performed three experience-based tasks. Each task consisted of 60 trials in which they had to select one of two virtual buttons (representing a pair of alternatives) on each trial. Their outcomes were randomly sampled from two payoff distributions, which remained constant throughout the task, as follows:

1. Mixed Condition

S	-5, 0, or 5 with equal probability (0.33)	
R	+25, +20, +15, -15, -20, or -25 with equal probability (0.17)	P(R) = 0.53

2. Gain Condition

S	25, 30, or 35 with equal probability (0.33)	
R	55, 50, 45, 15, 10, or 5 with equal probability (0.17)	P(R) = 0.55

3. Loss Condition

S	-25, -30, or -35 with equal probability (0.33)	
R	-5, -10, -15, -45, -50, or -55 with equal probability (0.17)	P(R) = 0.50

The choice alternatives are referred to as the Safe (S) and risky (R) options. As can be seen, alternatives S and R have equal expected values in all three conditions, but the variance of the outcome distribution is larger for R. In the Mixed condition the outcomes included both gains and losses. In the Gain (Loss) condition a constant of 30 was added to (deducted from) all payoffs so that the outcomes did not include losses (gains) (following Payne, Laughhunn, & Crum, 1980). The dependent variable in all three tasks was the average proportion of selections from the risky alternative across 60 trials (this is referred to as (P(R)).

To enable the assessment of individual consistency, the study used a within-subject design and the participants performed all three tasks in random order. Our first prediction was that losses (in the mixed and loss domain tasks) would facilitate cross-task consistency. Thus, the correlation between risk taking in the Mixed and Loss conditions was expected to be higher than for the Mixed and Gain conditions (and for the Loss and Gain conditions). This prediction is implied by both loss aversion and the attention-based model of losses. Our second prediction was that the increased consistency would be observed even without an effect of losses on risk taking, as implied by the attentional effect of losses.

Our third and final prediction pertained to response time. Previous studies have used response time as an indirect index for attention (Bettman, Johnson, & Payne, 1990; Porges, 1992), and have found increased response times in the loss domain compared to the gain domain (Porcelli & Delgado, 2009; Xue et al., 2009), and more generally in the face of negative versus positive stimuli (Derryberry, 1991; Leppänen, Tenhunen, & Hietanen, 2003). We expected to replicate these findings, which are consistent with the attentional model. Moreover, we expected that individuals with longer response times following losses would be more consistent in their behavioral choices across tasks.

2.1. Method

Participants: Eighty-seven undergraduate students (45 men and 42 women) participated in the study. Their average age was 23.7 (ranging between 19 and 32). The participants received a basic fee of 40 New Israeli Shekels per session (NIS 3.6 = $1). Additionally, they received payoff according to the total score in one randomly selected decision task at a rate of NIS 1 per 1000 points.

Design and procedure: Each participant performed all three choice tasks in random order. The complete instructions appear in the Appendix section. Briefly, the participants were not given any prior information about the outcomes contingent upon selecting the buttons. They were told that their task was to repeatedly select between the two buttons, and that some of their choices might be followed by gains and others by losses. They were also informed that they would perform three tasks and that their final take home amount would be determined by the accumulating score in one randomly determined task.

Measures: The participants made 60 repeated choices from each of the three decision tasks. The tasks were presented on 19-inch computer screens, with the button size being 2 by 3.5 cm. Button clicking was performed using a standard computer mouse. Upon pressing a button with the mouse, the image of the button changed to a "pressed" form. The payoffs in each task were contingent upon the button chosen and were randomly drawn from the relevant distributions described above. The randomization was done separately for each participant, ensuring no effect of the pattern of outcomes on the results of the study. Two types of feedback immediately followed each choice: (1) The basic payoff for the choice, which appeared on the selected button for two seconds and below the two buttons until the next choice was made, and (2) an accumulating payoff counter, which was displayed constantly. The order of the three tasks was separately randomized for each participant. The location of alternatives S and R was also randomized across different participants. An examination of the actual distributions of S and R outcomes showed no significant differences in expected value between these alternatives for all three choice tasks.

2.2. Results

Effect of losses on risk taking

As indicated on the right hand side of the description of the payoff distributions, the choice proportions in all three conditions were close to 0.50. An all-within ANOVA showed no statistically significant differences between the three conditions (F (2, 172) = 2.29, p = .11).

Interestingly, losses had an effect on the variance of the choices across participants. The standard deviation of the risk taking level (across participants) in the Gain condition was 0.21 while in the Mixed and Loss conditions it was 0.16 and 0.18 respectively. A Levene F test comparing the variance in Gain task to the other two tasks was significant (p = .04). This implies that any positive effect of losses on the consistency across tasks is not because of range restriction, as the variability between individuals was lower with losses. Possibly, the negative effect of losses on the variability across participants was due to increased sampling of the available alternatives and more strategy changes with losses (as found by Schneider, 1992), which led to fewer cases of narrow selection from one of the alternatives.[2]

Effect of losses on cross-task consistency

The effect of losses on cross-task consistency was studied by examining the correlation in the pair of tasks with losses (Mixed and Loss) compared to the pairs where one of the tasks did not include losses (Mixed and Gain, and Gain and Loss). The examination of the Mixed and Gain pair is of particular importance because it is a symmetric mirror image of the Mixed and Loss pair. The mixed task includes both gains and losses and the examination of consistency between this task and a pure gain or loss domain task allows the assessment of which of these components (gain or loss) exerts a larger effect on individuals' consistency.

The Pearson correlation between risk taking on the Mixed and Loss task was 0.50 (p < .01). The correlation between the Mixed and Gain task was only 0.19 (p = .08). Finally, the correlation between the Gain and Loss task was 0.12 (p = 0.28). Thus, having losses facilitated the consistency of individuals' behavior across different risk taking tasks. This was also replicated using non-parametric Spearman rank correlations ($r_{(\text{Mixed-Loss})} = 0.48$, $p < .01$; $r_{(\text{Mixed-Gain})} = 0.20$, $p = .06$; $r_{(\text{Gain-Loss})} = 0.12$, $p = .27$).

To examine the differences between the dependent correlations, we used a test designed by Williams (1959) to specifically address contrasts of two among three dependent correlations. The results showed that the difference between $\mathrm{r}_{(\text{Mixed-Loss})}$ and $\mathrm{r}_{(\text{Mixed-Gain})}$ was marginally significant ($t(84) = 1.81$, $p = .07$) while the difference

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[2] Indeed, cases of extreme preferences of over 90% from one of the alternatives were more frequent in the Gain condition (7.0%) than in the Mixed and Loss conditions (3.5% and 0% respectively).

between $r_{(Mixed-Loss)}$ and $r_{(Gain-Loss)}$ was significant ($t(84) = 2.28$, $p = .03$).

To verify that the difference between tasks reflects sensitivity to risk and not to expected value, we correlated the individual participant's choice at trial *t* to the relative expected values at trial *t*-1 starting from the second trial (trials with equal expected values were omitted). This produced a correlation for each participant which was then aggregated for the entire sample. The results showed that the participants' choices were not correlated with the expected value difference in the Gain and Loss conditions (average $r = 0.05$, -0.04; both not significantly different from zero). In the Mixed condition the results showed that the average correlation was small but significantly higher than zero (average $r = 0.14$; $t(86) = 5.08$; $p < .01$). These findings, which replicate previous results (Erev et al., 1999) indicate that the difference found between the Loss and Gain conditions in consistency does not reflect the sensitivity to expected value in these conditions.

Effects of losses on response time

As discussed in Porges (1992), response time (RT) captures an extended attentional component rather than the extent of the acute orienting response. We therefore expected to have generally longer response times in the conditions with losses. A comparison of the average RT in the three conditions appears in Figure 1. As can be seen, slower RTs were registered in the conditions with losses. An all-within ANOVA indicated that the difference between the three conditions was significant ($F(2, 172) = 3.83$, $p = .04$). Furthermore, paired-sample t-tests showed that RT in the Mixed and Loss tasks was significantly longer than in the Gain task (t (86) = 2.59, p = .01; t (86) = 2.56, p = .01, respectively), while the difference in RT between the Mixed and Loss task was not significant. This replicates previous findings (e.g., Porcelli & Delgado, 2009).

Furthermore, we also examined whether increased response times in the tasks with losses was conducive to increased consistency across tasks. Because of the relatively small number of participants we did not conduct a full moderator analysis, but rather compared the cross-task consistency for those participants who had longer response times in the two tasks with losses (RT(Loss) +RT(Mixed) > 2RT (Gain)), compared to those who did not. Fifty-nine participants fell into the first group and 28 into the second group. The results showed that the average correlation between tasks was higher for the participants who had longer response times with losses (average r = 0.29, compared to 0.19 for the remaining participants). This was replicated using Spearman's rank correlation (average r = 0.32, 0.18 respectively). To ensure that this result is not due to the respective difference in group size we also spitted the sample around the median (RT (Mixed) + RT (Loss) - 2RT (Gain)). The results were essentially the same, with higher correlations registered for participants who had longer response times in the tasks with losses (average r = 0.31, 0.20, respectively).

3. Study 2: The Effect of Losses on Temporal consistency

In this study we examined the effect of losses on the consistency across different sessions (i.e., temporal consistency). The advantage of assessing this type of consistency is that it is not affected by situation-specific variables that may lead to consistency in a given experimental session (Deinzer et al., 1995). We examined consistency using a battery of experience-based tasks, as presented in Table 1.

In this experiment as well we focused on three tasks.[3] Task 1 is a Mixed domain version with both gains and losses; Task 2 and 3 are a Gain domain and a Loss domain

[3] Additionally, we included two tasks with asymmetric risks. However (as we noticed in hindsight) in these tasks the availability of losses was confounded with the size of the outcome (the task with losses also had smaller average payoffs). Accordingly, we focus on the findings in the tasks with symmetric gains and losses.

version with the same differences in risk level. Under both loss aversion and the attention-based model of losses, it was predicted that the presence of losses in the Mixed and Loss tasks would facilitate temporal consistency across sessions. Furthermore, the consistency across tasks was examined as in Study 1, and it was predicted that losses would facilitate this type of consistency as well.

We made these tasks somewhat more complex by adding a noise factor randomly sampled in each trial from the set [-1,0,1] to every outcome in each of the three tasks. This ensured that the results would not be driven by the repeated outcome of zero in the Mixed task. Note that this also has the effect of producing rare minimal losses in the Gain condition and minimal gains in the Loss condition on 0.167 of the choices from the risky alternative. However, as this noise is symmetric, it was assumed to be cancelled out when comparing the two conditions. Furthermore, under any reasonable model of loss aversion and/or attention such infrequent small losses should have a much smaller effect than large frequent losses (e.g. the 0.5 chance to lose 200 in the Mixed condition).

The battery of tasks was administered in two versions: A Random version in which the payoffs were randomly pre-generated for each participant, and a Truncated-Random version in which we limited the number of consecutive gains/losses from the same alternative to four.[4] This minimizes rare streaks of gains or losses, and increases the similarity between the proportion of gains and losses experienced in each block by different participants. As in the Random version streaks of gains and losses occur irregularly, removing them increases the standardization of the choice outcomes. Various forms of outcome standardization are common in studies of individual

[4] In the Mixed Truncated-Random condition, for example, there could be no five consecutive losses drawn from the risky alternative; in occasions of four consecutive losses, the next risky choice produced a gain. This effectively truncates the conditional probability of consecutive (absolute or relative) losses/gains to a range of approximately 0.03 to 0.97.

differences (e.g., Bechara et al., 1994). The method we chose maintains the stochastic production of payoffs (and thus possibly increases the generality of the findings beyond a specific series of payoffs).

Finally, for examining the effect of losses on external validity, the participants filled in a self report test of risk taking, the *do*main *spe*cific *r*isk *t*aking (DOSPERT) scale (Weber et al., 2002). Unfortunately, as the response time analyses were added at a later phase we did not record the participants' reaction time in this task battery.

3.1. Method

Participants: One hundred and thirty undergraduate students (65 men and 65 women) participated in the study. Their average age was 23.5 (ranging between 18 and 28). The participants were randomly assigned to the two task versions. They received a basic fee of NIS 50 per session. Additionally, they received payoff according to the total score in one randomly selected decision task at a rate of NIS 1 per 1000 points. Final payoffs ranged from NIS 40 to NIS 72 for each of the two sessions.

Measures

Experience-based tasks: These were similar to the tasks used in Study 1. In each session, 60 repeated choices were made from each decision task. The order of the tasks was separately randomized for each participant in each session. The complete instructions appear in the Appendix section.

The *do*main *spe*cific *r*isk *t*aking (DOSPERT) scale (Weber et al., 2002): This questionnaire assesses the degree of involvement in risky activities in five different content domains (ethical, financial, health/safety, recreational, and social). In the current study the internal consistency of the domains, assessed using Cronbach's Alpha, was found to be adequate for ethical risks (Alpha = 0.83), financial risks (Alpha = 0.78), and recreational risks (Alpha = 0.81). Internal consistency was lower for healthy/safety risks (Alpha = 0.62) and social risks (Alpha = 0.62).

Procedure

The participants were provided with initial instructions (see Appendix). In Session 1 they first completed the battery of experience-based decision tasks, and filled in the DOSPERT scale. They also completed a second set of tasks which included the Iowa Gambling task (Bechara et al., 1994) and some additional questionnaires, both for a different study (Yechiam et al., 2010). In Session 2, participants completed the experience-based tasks, and were then paid, thanked, and dismissed. The average time interval between sessions was 46 days (with a standard error of ±0.72 days).

3.2. Results

Risk-taking levels

The average proportions of risky choices in each task and session appear in Table 1 and the individual choices are plotted in Figure 1. As can be seen, the participants exhibited mild risk aversion in the Mixed task in both sessions. Specifically, the proportion of R choices was 0.43 in Session 1 and 0.39 in Session 2. However, risk levels were quite similar in the Mixed, Gain and Loss tasks, with the differences all but disappearing in Session 2: A repeated measures ANOVA of risk-taking levels across sessions revealed no significant differences between tasks (F (2, 258) = 2.62, p = .08) and no interaction between session and task (F (2, 258) = 1.13, p = .33). Thus, having losses did not increase risk aversion significantly. There was also no significant effect of losses on the variance of choices across participants. The increased risk aversion in this study, in comparison to study 1, could be a consequence of the larger nominal outcomes used in the current study, as found previously (Erev et al., 2008; Hogarth & Einhorn, 1990; Holt & Laury, 2002).

Temporal consistency

We next examined the temporal consistency across sessions. The highest consistency was in the Mixed task (r = 0.36, p < .01), followed by the Loss task (r = 0.26, p < .01), whereas the consistency in the Gain task was lower and not statistically significant (r = 0.12, p = .16). Thus, having losses increased the consistency within individual decision makers across a long time interval. The significances were replicated using Spearman's rank correlation (r_{Mixed} = 0.34, p < .01; r_{Loss} = 0.30, p < .01; r_{Gain} = 0.21, p = .08). A ZPF test (Raghunathan, Rosenthal, & Rubin, 1996; Steiger, 1980) was used to examine the contrasts between each pair of dependent correlations. The results showed that the difference between the cross-session correlations of the Mixed and Gain tasks was significant (Z = 2.04; p = .04) while the contrast between the Loss and Gain tasks was not significant (Z = 1.17; p = .24).

To verify the cross-validity of this finding we separately examined the Random and Truncated-Random versions of the tasks. The results (appearing in Table 1) showed that for the Mixed task the correlation between sessions was high in both versions (Random: r = 0.32, p < .01; Truncated: r = 0.42, p < .01). For the Gain task the correlation was low and insignificant in both versions (Random: r = 0.15, p = .23; Truncated: r = 0.10, p = .41). For the Loss task there was an interaction with the task version, with high consistency in the Random version (r = 0.36, p < .01) and much lower consistency in the Truncated-Random version (r = 0.13, p = .28). Thus, it appears that the consistency in the Loss task was impaired in the version where we had truncated the conditional probability distribution.

Consistency across tasks

As in Study 1, the within subject design allowed the assessment of the consistency across tasks. In this analysis risky selections were averaged across the two sessions to eliminate situational effects associated with a particular session (see Deinzer et al., 1995). The results appear in Table 2. As can be seen, the correlation between the Gain and Mixed task was close to zero (r = 0.06; p = .51). In contrast, the correlation between the Loss and Mixed task was positive and significant (r = 0.23, p < .01). This indicates that losses facilitated consistency in risk taking levels. The correlation between the Gain and Loss task was also small (r = 0.13, p = .12) which is in line with our hypothesis since only one of these tasks includes frequent losses. A Williams (1959) test was again used to evaluate the contrasts. The results showed that the difference between $r_{(Mixed\text{-}Loss)}$ and $r_{(Mixed\text{-}Gain)}$ was not significant ($t(127) = 1.39$, p = .16), though the pattern was similar to that found in Study 1. Also, the difference between $r_{(Mixed\text{-}Loss)}$ and $r_{(Gain\text{-}Loss)}$ was not significant ($t(127) = 0.75$, p = .45).

Given the fact that the task version interacted with the consistency across sessions, we also examined the inter-task correlation by task version. The results showed that for the Truncated version no correlation was significant (average r = 0.08). For the Random version we obtained the same pattern of difference between task pairs ($r_{(Mixed\text{-}Loss)}$ = 0.34, p < .01; $r_{(Mixed\text{-}Gain)}$ = 0.07, p = .59; $r_{(Gain\text{-}Loss)}$ = 0.21, p = .09). Additionally, in the William's test the contrast between $r_{(Mixed\text{-}Loss)}$ and $r_{(Mixed\text{-}Gain)}$ was significant ($t(62) = 2.19$, p = .03).

External Validity

The final analysis assessed the consistency between risky choices in the experience-based tasks and self-reported risk taking on the DOSPERT scale. Again, risk taking proportions were averaged across the two sessions. For the Truncated-Random version no single correlation was significant! We therefore only include the detailed results from the Random version. These results are summarized in Table 3. As can be seen, the asymmetries with respect to gains and losses persisted: Risk taking levels in the Loss task were significantly correlated with self rated involvement in four risk-related domains: ethical (r = 0.50, p < .01), financial (r = 0.38, p < .01), health/safety (r = 0.32, p < .01), and social (r = 0.25, p = .04). In contrast, risk taking in the Gain task was not significantly correlated with any of the domains of the DOSPERT scale, and the size of the correlations for the Gain task was approximately zero. For the Mixed task the correlations were larger and positive but none reached significance.

4. General Discussion

The results of both our studies showed that losses facilitated the consistency across different decision tasks. Particularly, in Study 1 the correlation between risk taking in the mixed and loss domains (both including losses) was larger than for the mixed and gain domain and for the loss and gain domains (in which one of the tasks does not include losses). This was apparent even though the mixed domain task had losses and gains of the same magnitude and probability, implying that losses dominated gains with respect to facilitating consistency within the individual. This effect was also replicated in Study 2, where the existence of frequent losses in the Mixed and Loss tasks led to high consistency between these two tasks. Also, in Study 2 losses substantially increased the consistency across separate sessions. These two main results indicate that losses facilitate the consistency of individuals' risk taking choices, as predicted by the loss aversion account and by the attention-based model.

This effect of losses is interesting given past studies showing that losses increase the tendency of decision makers to switch between alternatives in a binary choice task (e.g., Schneider, 1992) and lead to stronger learning effects (e.g., Bereby-Meyer & Erev, 1998). These previous findings could be interpreted as implying that losses reduce the reliability of a person's choice behavior (Wakker, 2010). However, an alternative explanation of these findings is that actually losses increase attention and search behavior. This suggests that across tasks, as we have shown, losses have a positive effect on the consistency of individuals' choices.

Secondly, in both studies the effect of losses was found to emerge even when, on average, the participants did not exhibit loss aversion. The loss aversion argument has two main behavioral predictions: First, the original argument that participants should avoid risky alternatives containing symmetric gains and losses and instead select safer alternatives with lower losses and gains (Tversky & Kahneman, 1979); secondly, the suggestion that adding a constant to all outcomes until losses are eliminated should decrease risk aversion (Payne et al., 1980; Thaler et al., 1997). Both of these predictions were not supported in the present study of experience-based tasks. In Study 1, the participants were indifferent between mixed outcomes with higher gains and losses and those with lower gains and losses. In Study 1 and 2 the participants did not avoid risk to a greater extent when the risky alternative produced losses, than when it did not. A similar pattern of behavior was previously reported in other experience-based tasks (see Erev et al., 2008; Hochman & Yechiam, 2011; Silberberg et al., 2008; and see also Gehring & Willoughby, 2002; Yeung & Sanfey, 2004). In Study 2 (Mixed condition) a risky alternative with high nominal gains and losses was avoided. However, participants avoided an alternative with the same (high) variance level to a similar extent even when it did not produce losses. This suggests that the avoidance of the risky alternatives in Study 2 was a manifestation of risk aversion and not of loss aversion (for a similar finding, see Erev et al., 2008).

The attention allocation model of losses (Yechiam & Hochman, 2011; see also Hochman & Yechiam, 2011) provides sufficient conditions for simultaneous findings of no loss aversion and increased consistency. It suggests that while losses are not given more weight in behavioral decisions involving intermittent gains and losses, they still increase attention and behavioral consistency. Note that this explanation is different from the assumption that people are differentially sensitive to penalties and rewards (e.g., Gray, 1994; Higgins, 1997), as it assumes that losses lead to more reliable individual differences in risk taking and not in the specific response to mixed outcomes involving losses and gains. In fact, the current findings cannot be explained under the assumption that the sensitivity to losses versus gains is a consistent factor (as suggested by Yechiam & Busemeyer, 2008) because enhanced consistency also appeared for a pure loss domain (i.e., in the absence of gains).

Another alternative explanation of the current results is that the sensitivity to the magnitude of losses is more trait-based than the sensitivity to the magnitude of gains, and is thus more reliable. This explanation is, however, quite similar to the attentional model because it also posits that losses increase the reliability of responses and reduce random noise. Furthermore, it also implies that that the positive effect of losses on consistency is robust, and appears irrespectively of loss aversion.

Supporting our interpretation that the effect is due to attention, the participants in Study 1 took longer to make decisions in tasks with losses than with no losses. Although our analysis is limited because we did not separate the feedback information processing phase from the planning of the next decision, it is consistent with prior findings (e.g., Porcelli & Delgado, 2009; Xue et al., 2009). Interestingly, similar to the effect on consistency, response times were also increased in the tasks involving losses even in the absence of behavioral loss aversion.

Another finding that deserves comment is that only the loss domain tasks were associated with self reports of risky behavior on the DOSPERT scale. Risk taking with losses (in the experience-based tasks) was associated with reported risky behaviors in four content domains: ethical, financial, health/safety, and social. One interpretation of this finding is that losses increase consistency between abstract risk taking decisions and subjective ratings of involvement in risky behaviors. However, an alternative interpretation is that these content domains of the DOSPERT scale include items that remind people of losses, thereby triggering cognitive processes associated with the sensitivity to losses. Both interpretations suggest possible reasons for the previously reported inconsistency in risky behavior across different content domains (e.g., Weber et al., 2002; Hanoch et al., 2006; and the current study).

Similarly, reported inconsistencies in other measures of risk taking might also have stemmed from the use of gains and not losses (e.g., Greene, 1963; Kindlon et al. 1994; Weinstein, 1969). For example, Weinstein (1969) reported no correlation (average *r* around .15) between different measures of risk taking in the context of achievement (risk taking in problem solving, athletic, social and vocational situations). However, the choice options in his study were all phrased in terms of gains (e.g., choosing among three potential dates, problems to solve, or athletic tasks). Our findings suggest that in order to increase the ability to predict the person’s consistent risk propensity, evaluation and selection tool should include items, scenarios, or tasks involving losses. Indeed, laboratory tasks that were found to have some generalization to real life situations very commonly involve losses (examples include the Iowa Gambling Task; Bechara et al., 1994 and the Balloon Analogue Risk Taking Task; Lejuez et al., 2002). Additionally, our findings suggest that individuals' risk taking behaviors would be more consistent in real-world risk-taking contexts involving losses. For instance, individual stock brokers may response more predictably to risk in a loss compared to a gain day in the stock market. This is an interesting topic for future studies.

The current results are also informative concerning the range of situations where losses lead to consistency in risk taking. The effect of losses on consistency was more prominent in the full random condition than in the truncated-distribution version. Possibly, in a condition involving mostly losses there is a moderating effect when losses seem unavoidable and uncontrollable. In this case, people might invest less attention in the task (Rudski, Lischner, & Albert, 1999), resulting in reduced consistency. The truncated distribution version produced rather fixed patterns of numbers, which might have appeared uncontrollable, leading to impaired consistency in a task involving primarily losses. Still, even in the truncated distribution version gains did not dominate losses in their effect of consistency. The only significant trend in the effect of losses on consistency was a positive one.

5. Conclusions

Losses increased the consistency of risk taking behavior across symmetric-risk tasks and also increased temporal consistency. Thus, the availability of losses appears to be an important factor affecting consistency in human behavior. Additionally, simultaneously with the positive effect of losses on consistency, the average participant did not exhibit loss aversion. This suggests that an attention-based model of losses

(Yechiam & Hochman, 2011) provides sufficient conditions for the positive effect of losses on behavioral consistency.

There are some who have suggested that attentional effects of losses are a manifestation of a negativity bias because they imply increased vigilance to negative compared to positive stimuli (Rozin & Royzman, 2001). We cannot dispute this argument. Our research addresses the stronger assertion that the effect of losses on attentional processes is an inherent part of loss aversion and occurs simultaneously with it (e.g., Dunegan, 1993). The current findings suggest that the effect of losses on attention, as evidenced by increased behavioral consistency and response time, occur independently from a decision weight asymmetry of the form postulated by Kanheman and Tversky (1979).

Appendix: Instructions for the experience-based tasks

Initial instructions:

"In this experiment you will perform three/six decision making tasks.[5] Your basic payoff is NIS 50. This payoff will be updated based on the accumulated score in one randomly chosen task. This will be determined after you perform the three/six tasks by the throw of a die" (a die throw in a cup was demonstrated to the participant without showing the results).

Instructions for the experience-based tasks:

Before the first task: "This is the first of the three/six tasks that you will perform. In the form on the computer screen there are two buttons, labeled A and B. Your task is to choose between the two buttons by clicking any of them. You can click on a button several times in a row (as much as you want) or switch between buttons (as much as you like). The payment you receive for your choice will appear on the chosen button, and the accumulating payoff will appear below. You will not know the payment for each choice in advance. Some choices might be followed by gains and others by losses. For the task that would be randomly selected you will gain or lose NIS 1 for every 1000 game points. You will receive a message telling you when the task is ended and a new task begins."

After each task: "Task __ of three/six has now ended. The amount you earned for this task is ___. You are now moving to a new task. To remind you, the payoff at the end of the experiment will be for a randomly chosen task."

[5] In Study 1 it was three tasks and in Study 2 it was six tasks. Tasks 4 and 5 involved asymmetric risks (see footnote 4). The sixth task was the Iowa Gambling task.

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Table 1. The three decision tasks administered in Study 2. The task payoffs are presented on the left, followed by the proportion of risky selections in Session 1 and 2 and the temporal consistency using Pearson's correlation coefficient. The temporal consistency is shown for the entire sample and separately for the Random and Truncated-Random versions.

Condition	Payoff distributions for the two alternatives[a]		R choices		Temporal consistency (r)		
	S	R	Ses 1	Ses 2	All	Random	Truncated
1. Mixed	0	+200 or -200 with equal probability (0.5)	0.43	0.39	0.36*	0.32*	0.42*
2. Gain	+200	+400 or 0 with equal probability (0.5)	0.34	0.36	0.12	0.15	0.10
3. Loss	-200	-400 or 0 with equal probability (0.5)	0.41	0.37	0.28*	0.36*	0.13

Note a: A noise factor randomly sampled in each trial from the set [-1,0,1] was added to the outcomes.

Note: * = $p < .01$

Table 2. Study 2 results: Correlations between the proportions of risky selections in the different decision tasks.

	Mixed	Gain	Loss
1. Mixed	1.00	-	-
2. Gain	0.06	1.00	-
3. Loss	0.23*	0.13	1.00

Note: * = p < .01; + = p < .05

Table 3. Study 2 results: Correlations between risk-taking in the decision tasks and the content domains of the DOSPERT scale for the participants in the Random version.

	Ethical	Financial	Health/Safety	Recreational	Social
1. Mixed	0.22	0.18	0.11	0.02	0.12
2. Gain	0.02	-0.05	-0.13	0.01	0.09
3. Loss	0.50*	0.38*	0.32*	0.01	0.25+

Note: * = p < .01; + = p < .05

Figure 1. Study 1 results: Mean response times in the Mixed (loss gain), Gain, and Loss tasks. The error bars denote standard errors.

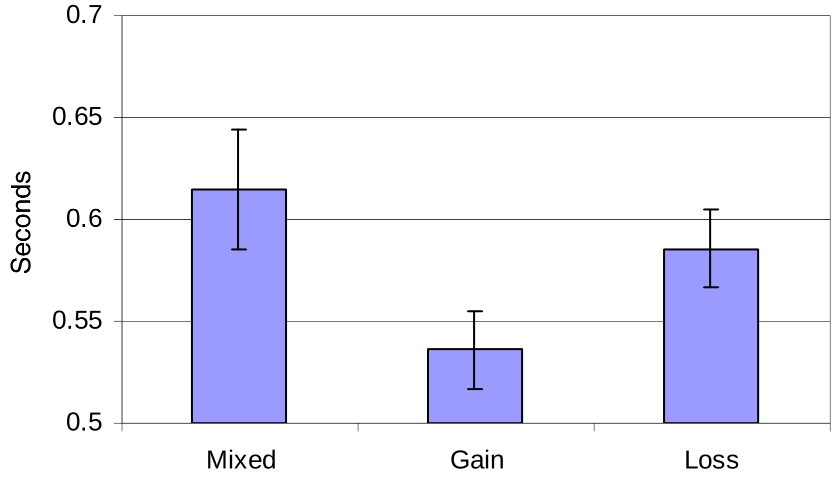

Figure 2. Scatter plots and regression lines of the risky choices made in Session 1 and 2 of Study 2: Comparison of the Mixed (loss gain), Gain, and Loss tasks.