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Domain-based asymmetry in expectations of the future

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Abstract

We examine how prior outcomes can influence expectations about unrelated future events. Consistent with the affect literature, we first predict that prior outcomes will yield more optimistic expectations when the outcomes are positively, rather than negatively, valenced. We then predict that the impact of prior outcomes will depend on not only the valence, but also the domain of prior outcomes. Specifically, we draw from Prospect theory to predict that the impact of prior outcomes on future expectations will be greater in the domain of losses than in the domain of gains. Two lottery-based experiments demonstrate that this effect is robust across different starting and ending wealth states, and a third experiment shows that these differences in expectations also translate into differences in risk preferences.

Keywords: Expectations; Affect; Prospect theory; Risk preferences

As Tversky and Fox (1995) observe, decisions are frequently made without definite knowledge of their consequences. The decisions to invest in a stock, submit a paper to a journal, or take a particular route home from work are all rife with uncertainty. But, decision-makers generally have a subjective probability estimate or an *expectation* regarding the likelihood of success or failure (Wright & Bower, 1992). These expectations may be based on a variety of factors including one's prior experience with similar endeavors. Prior successes or failures in investing will likely yield expectations regarding the success of future investing, and prior experiences with journal submissions will yield expectations regarding success at publishing. But when the past is not a reliable indicator of the future because past and future events are unrelated, how are expectations of the future formed? It is this issue of how expectations about a future outcome might be influenced by *unrelated* prior outcomes that we examine. We demonstrate that randomly generated prior outcomes that ought not to influence perceptions about a future event still do so because of the positive or negative feelings that the prior outcomes evoke.[2]

We draw from the literature on affect (Isen, 1970; Wright & Bower, 1992; Wright & Mischel, 1982) to argue that prior (unrelated) outcomes will yield more optimistic expectations when the outcome valence is positive rather than negative. Further, based on Prospect theory (Kahneman & Tversky, 1979), we make the relatively nuanced claim that this effect of outcome valence is contingent on the *domain* in which the prior outcome occurs (i.e., gains vs. losses). Because of loss aversion, we predict that the affect induced will be stronger when the prior outcomes are in the domain of losses rather than in the domain of gains. This domain-based

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[2] We use the term "expectations" to mean perceived probabilities, that is, an individual's subjective estimate about the likelihood of an outcome.

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asymmetry in affect then translates to a domain-based asymmetry in expectations as well. In two lottery-based experiments employing real money, we observe this effect of changes in expectations being mediated by the affect induced by the prior outcomes. We also find that this effect is robust across different starting and ending wealth states. In a third study, we show how this domain-based asymmetry for expectations influences risky choice. Employing a modified Asian disease problem (Tversky & Kahneman, 1981), we show that risk preferences are more strongly influenced when prior outcomes are in the domain of losses rather than gains.

Extant research on the influence of prior outcomes on perceptions of the future has focused on the biases that occur because of peoples' misconceptions about how chance operates. For instance, the "hot hand" literature (Gilovich, Vallone, & Tversky, 1985) suggests that people expect a streak of outcomes to continue in the future, whereas the "gambler's fallacy" perspective (Tversky & Kahneman, 1971) suggests that people expect a streak to reverse itself, even though the events are independent of each other. We add to this research stream by implicating the role that affect induced by prior outcomes plays in biasing expectations of the future. The mechanism we invoke is subtly different from extant explanations because the affect evoked, and hence the bias about future expectations, depends not only on the valence of prior outcomes, but also on the domain in which it occurs.

We also add to prior research on risky choice according to which peoples' risk preferences are sensitive to the manner in which options are framed. First, as has been demonstrated by Tversky and Kahneman (1981), when faced with two alternative programs that can help combat a rare Asian disease, more people choose the riskier option when the outcomes associated with each of the programs are framed as losses (i.e., numbers of deaths) but more people choose the risk-averse program when the outcomes are framed as gains (i.e., numbers of lives saved). While this earlier research studies the effect of the domain in which the *focal* event occurs, our research studies the effect of the domain (and valence) of *prior* events. Drawing upon the role of affect that drives the predicted domain-based asymmetry for expectations about the future, we show that risk preferences are influenced by the valence of prior outcomes substantially more so when the prior outcomes are in the domain of losses rather than in gains. Second, Thaler and Johnson (1990) found that the effect of prior outcomes on risk preferences may depend on the ability of decision-makers to integrate prior outcomes with the potential payoffs offered by current choices (e.g., prior losses may increase the selection of risky options if there is an opportunity to "break-even"). Because our proposed effects are predicated on the affect evoked by prior outcomes, we show that prior outcomes influence risk preferences even when prior and future events are in different mental accounts and there are no opportunities for the integration of outcomes.

Review of literature

Our review of the literature encompasses two broad areas. We first briefly review research that examines the role that affect associated with prior outcomes may have on judgments of the future. Then, we appeal to the principle of loss aversion to specify how the impact of prior outcomes might vary with the domain (loss or gain) in which the outcomes occur.

The role of affect

Affect refers to the "... specific quality of 'goodness' or 'badness' (i) experienced as a feeling state ... and (ii) demarcating a positive or negative quality of a stimulus" (Slovic, Finucane, Peters, & MacGregor, 2002, p. 329). Recently, Loewenstein, Weber, Hsee, and Welch (2001) have distinguished between two types of emotion: *anticipatory* emotions (e.g., fear), which are immediate and visceral, and *anticipated* emotions (e.g., regret), which are expected to be experienced in the future (pp. 267–268). As Loewenstein et al. (2001) observe, the bulk of the literature views affect as an anticipated emotion. Our approach implicitly invokes an anticipatory perspective on affect. We suggest that expectations are driven by the affect (induced by prior outcomes) that people are experiencing at the time they are judging expectations. Drawing on Schwarz and Clore's (1983) affect-as-information model, one can postulate a direct effect of affect according to which people who have recently experienced a positive (vs. negative) event might be more optimistic about a future event because they misattribute their positive feelings to the future event. Affect might also influence judgments indirectly by creating a "warm glow" (Isen, 1970), which in turn makes mood-consistent information relatively more available, accessible, salient, memorable, and retrievable (Isen, Shalker, Clark, & Karp, 1978; Wright & Mischel, 1982). Therefore, a person who has experienced favorable outcomes that lead to positive affect may, when asked to predict the outcome of a future event, predict a favorable (positive) outcome because the current positive mood makes positive outcomes more available in memory.

In other pertinent empirical work, Johnson and Tversky (1983) studied how people assessed the frequency of various risks and found that inducing positive affect in participants produced an optimism bias (i.e., decrease in judged frequency of risks), whereas inducing negative affect produced a pessimism bias. Wright and Mischel (1982) found that individuals' expectations of success in a pattern-recognition task were influenced by their

immediate feeling state. Similarly, Brown (1984) found that participants in a negative affective state had lower expectations than those in a positive state, when making predictions about success at a concept formation problem. Further, Wright and Bower (1992) demonstrated that inducing affect (through an imagination exercise coupled with hypnosis) had the expected effect on subjective probability assessments of future events that were either personal or non-personal in nature. These results provide strong support for mood congruent effects on optimism and pessimism. Happy people tend to have a much rosier view of the future relative to unhappy people.

The reasoning and evidence that people, after experiencing favorable prior outcomes, will experience positive affect and therefore their expectations of the future should be more positive relative to when they experience unfavorable prior outcomes leads to our foundational prediction:

Hypothesis 1. The expectation of a positive future outcome will be higher when the valence of prior outcomes is positive rather than negative.

This first hypothesis is a relatively straightforward extension of the prior literature on affect (Johnson & Tversky, 1973). However, as we discuss next, the effect of prior outcomes is more complex because the degree of affect (and hence the influence on expectations) depends not only on the valence of the outcome, but also on the domain in which the outcome occurs.

The domain of prior outcomes

Prior outcomes can be characterized not only by whether they are positive or negative, but also by whether they occur in the domain of losses or in the domain of gains. For example, consider the case of applying for a loan. In terms of one's wealth state, a favorable outcome (i.e., getting the loan) is a *gain*, and an unfavorable outcome (i.e., not getting the loan) is an opportunity loss or a *non-gain*. The unfavorable outcome does not change the status quo because it does not change one's existing state of wealth. Now consider the case of preventive medical therapy such as a vaccination. An unfavorable outcome (i.e., contracting the disease) would be an outright *loss*, and a favorable outcome (i.e., not contracting the disease) would be a *non-loss*. In this instance, it is the *favorable* outcome that does not change the status quo.[3]

Applying this distinction to our context, we can envision prior outcomes that fall into four categories: a gain (e.g., Mr. A *won* $100), a non-gain (Mr. A did *not win* $100), a non-loss (Mr. A did *not lose* $100), and a loss (Mr. A *lost* $100) (cells A, B, C, and D in Table 1). Each of these outcomes has affect associated with it—positive for the favorable outcome cells A and C, and negative for the unfavorable outcome cells B and D.[4] Our question revolves around whether the valence of prior outcomes (positive vs. negative) influences expectations differently depending on whether those outcomes occur in the domain of losses or gains.

Prospect theory's value function (Kahneman & Tversky, 1979) is a convenient device to analyze the outcomes in Table 1. Loss aversion, a core tenet of prospect theory, suggests that losses dominate gains (a premise captured by the relatively steep slope of the value function in the domain of losses resulting in outcomes in the domain of losses yielding a stronger effect on value perceptions than outcomes in the domain of gains). In other words, "the aggravation that one experiences in losing a sum of money appears to be greater than the pleasure associated with gaining the same amount" (Kahneman & Tversky, 1979, p. 279).[5] Put differently, the aggravation associated with the outright loss of a sum of money ought to be greater than that associated with the opportunity loss of not being able to gain the same amount. That is, a movement *away* from the origin in the domain of losses yields a relatively large change in value perceptions, while an equivalent movement *towards* the origin in the domain of gains yields a relatively small change in value perceptions (Nagle & Holden, 2002; Thaler, 1980). This view of opportunity costs is consistent with the perspective that "... out-of-pocket costs are viewed as losses and opportunity costs are viewed as foregone gains, (thus) the former will be more heavily weighted"

[3] One reviewer astutely noted the connection between the concept of base-rates and the concept of domains. Base-rates refer to initial probabilities of the domain outcomes. If one player's base-rate of hitting a basketball shot is 90% and another player's is 50%, the former is likely to feel worse in the event of a missed shot. However, in either case, the domain of the outcomes is gains. The two possible outcomes are gain (i.e., addition to the score) and non-gain (i.e., failure to make an addition to the score).

[4] This classification is similar to the classification scheme used in regulatory focus theory (Higgins, 1998) to distinguish between promotion (gains, non-gains) and prevention (losses, non-losses). The domains of gain and loss also bear resemblance to the concepts of benefit and burden used in the literature on resource allocation (Mannix, Neale, & Northcraft, 1995). In the interest of brevity, we do not discuss these other perspectives further.

[5] While value and affect are conceptually distinct constructs, our argument is premised on a positive relationship between the two, as a result of which people feel better about an outcome when the value of the outcome is higher. This thinking is consistent with that of Kahneman and Tversky (1979) who used affectively laden terms such as "aggravation" and "pleasure" to describe the asymmetry in the slope of the value function in the domains of losses versus gains. Moreover, the affective implications of the prospect theory value function have been explored by other research as well. For example, Coughlan and Connolly (2001) studied affective responses to unexpected outcomes and found that losses loom larger than gains. An outcome below expectations generated more (negative) affect than the (positive) affect generated by an outcome that exceeded expectations by the same amount.

Table 1
Classification of prior outcomes

Domain of prior outcomes	Valence of prior outcomes	
	Positive	Negative
Gains	A. Won $\$x$ (gain)	B. Did not win $\$x$ (non-gain)
Losses	C. Did not lose $\$x$ (non-loss)	D. Lost $\$x$ (loss)

(Thaler, 1980, p. 44). Additionally, Northcraft and Neale (1986) note that opportunity costs are relatively abstract and therefore less salient, in comparison to outright losses.

Applying this reasoning to our context, prior outcomes in cells A and B (i.e., gain and non-gain, respectively) belong to the gain portion of the prospect theory value function, whereas prior outcomes in cells C and D (i.e., non-loss and loss, respectively) belong to the loss portion. Since the loss portion of the slope is steeper, for economically equivalent values, the difference in affect between cells C and D should be greater than that in affect between cells A and B. Therefore, we suggest a domain-contingent asymmetry for affect. Moreover, because of the link between affect and expectations (as discussed during our development of Hypothesis 1), we should find a similar domain-contingent asymmetry for expectations about future events. This leads to our second hypothesis, according to which the intensity of the effect predicted in Hypothesis 1 will depend on the domain of prior outcomes.

Hypothesis 2. Prior outcomes will have a stronger effect on expectation about a future outcome when prior outcomes are in the domain of losses, relative to when they are in the domain of gains.

Since all the arguments presented thus far rely on the role of affect associated with prior outcomes, we also offer a prediction that formally considers the mediating role of affect:

Hypothesis 3. The effect of prior outcomes on expectation about a future outcome will be mediated by the affect associated with prior outcomes.

We next turn to a description of two studies designed to assess support for our first three hypotheses. Respondents participated in lotteries in which real money outcomes (payoffs) were varied. Even though lotteries using real money are expensive, we employed this procedure for three reasons. First, this approach was arguably more involving and perceptually consequential to participants. Second, it enabled a simultaneous manipulation of the domain (i.e., gains/losses) keeping the economic impact of prior outcome valence (i.e., negative/positive) constant. Third, this approach was an explicit way of assuring that research participants considered the events to be unrelated; randomly drawn lottery outcomes ought not to influence expectations about a future lottery.

In a subsequent section, we develop and test an additional hypothesis according to which the asymmetry in expectations that we predict ought to be reflected in preferences for risky vs. risk-less choice. The results of this third study are consistent with the results of the first two studies.

Experiment 1

Method

Seventy undergraduates participated in exchange for partial course credit and a chance to win some "real" money. They were randomly assigned to one of the four conditions that followed from our 2 (valence of prior outcomes: negative vs. positive) by 2 (domain of prior outcomes: gains vs. losses) between-subjects factorial design. These four outcomes correspond perfectly to the cells described in Table 1.

The first manipulated factor assured that in one condition, participants experienced a series of two positive prior outcomes (winning the first two lotteries) and in the other condition they experienced a series of two negative prior outcomes (losing the first two lotteries). These manipulations were accomplished through an elaborate mechanism. Participants were told that they would play three lotteries and that their chance of winning a lottery was 50% since there were only two possible outcomes for each lottery. They then received a randomly assigned questionnaire that indicated the letter they were playing for. For one-half of the participants, the winning letter was "A" for the first lottery and "B" for the second lottery. For the other half, the winning letter was "B" for the first lottery and "A" for the second lottery. For each lottery, a randomly selected subject drew a card from an envelope that purportedly had an "A" card and a "B" card, and read the letter aloud so that the rest of the participants knew what it was. A subject would win the lottery if his/her letter matched the one drawn. This procedure was repeated for the second lottery. The outcomes were surreptitiously controlled such that only an "A" could be drawn in the first draw and only a "B" could be drawn in the second draw. Thus, half the participants (the A followed by B participants) won twice, while half the participants (the B followed by A participants) lost twice. Unlike in Chen and Rao (2002), this controlled the sample size in each condition and assured that there were no won–lost and lost–won outcomes that would have attenuated our sample size.

The second manipulated factor assured that these outcomes represented success or failure in the domain

of either gains or losses. The participants in the losses domain started with an initial endowment of $6. They were told that losing a lottery would result in a $2 reduction in their endowment, whereas winning a lottery would result in no reductions. Therefore, in the loss domain condition, success meant avoiding a loss, whereas failure meant incurring a loss. The participants in the gains domain condition received no initial endowment. They were told that winning a lottery would result in a $2 addition to their account, whereas not winning a lottery would result in no additions. Consequently, in the gains domain condition, success meant receiving a gain, whereas failure meant not receiving a gain. It should be noted that even though participants in the losses domain started with $6 and those in the gains domain started with $0, the three lotteries provided all participants the opportunity to reach one of the four end-states ($0, $2, $4, and $6) with equal probabilities (1/8, 3/8, 3/8, and 1/8).

After the outcomes of the first two lotteries were known, participants responded to the dependent variable items related to a third, prospective lottery (chance of winning: 1 = no chance at all; 9 = excellent chance; and confidence about winning: 1 = not at all confident; 9 = very confident). The questionnaire then mentioned that participants had presumably engaged in a thought process while responding to the questions. They were asked to think back about those thoughts and write them down. It is important to note that even though the third lottery was not played, participants provided responses fully expecting that the third lottery would be played.

Participants completed the entire task in approximately 15 min. They were then debriefed and thanked. For their participation, they received partial course credit and $6 each, irrespective of the final amount in their account balance. That is, all of them received as much as, or more than, the amount they had earned through playing the lotteries.[6]

Results

Since the two items (chance and confidence) were highly correlated ($r = .78$, $p < .05$), they were averaged to form the dependent variable "expectations." An ANOVA was run on the composite dependent variable with valence of prior outcome (negative vs. positive) and domain (losses vs. gains) as independent variables. Consistent with Hypothesis 1, there was a main effect for valence of prior outcome. Participants who had won the first two lotteries felt that their likelihood of winning the third was significantly higher than participants who had lost the first two lotteries ($M = 5.53$ vs. 3.94; $F_{(1,66)} = 14.09$; $\eta_p^2 = .18$; $p < .001$). There was no observed main effect of domain. In addition, as predicted in Hypothesis 2, there was a significant valence × domain interaction on expectations of winning the third lottery ($F_{(1,66)} = 5.91$; $\eta_p^2 = .08$; $p < .05$). The pattern of the interaction is displayed in Fig. 1; outcome valence (positive vs. negative) had a stronger effect on expectations when prior outcomes were in the domain of losses ($M = 5.92$ vs. 3.31; Cohen's $d = 1.4$) relative to when they were in the domain of gains ($M = 5.15$ vs. 4.59; Cohen's $d = 0.3$).[7]

To test the mediating role of affect (Hypothesis 3), two independent judges coded participants' thoughts leading to their responses to the two focal questions (i.e., chance of winning and confidence of winning). The judges were given basic information about the study, but were blind to the conditions the participants were in. They were asked to indicate whether, in terms of affect, a participant's response was negative, positive, or neutral. A negative response was defined as one in which the participant had written that his/her responses to the expectation questions were based on some negative feelings (e.g., "I was sad because I didn't win either lottery.") A positive response was defined as one in which the participant had written that his/her responses to the expectation questions were based on some positive feelings (e.g., "I have won the two lotteries in the beginning, so that makes me feel pretty good about winning."). A neutral response was defined as one in which the participant did not indicate any positive or negative feelings as the basis for his/her response (e.g., "My chance is still 50% because there are only two options.").

[6] Subjects were undergraduate Business-school students who completed a mandatory research requirement by participating in this study; they were not required to participate in any more studies during their academic careers. Hence, there likely are no concerns that our procedure contaminated these subjects for future researchers who might employ real money gambles as their stimuli.

[7] The significant 2-way interaction and the stronger effect in the domain of losses versus gains are supportive of our predictions. However, based on the recommendations of an anonymous reviewer, we conducted further contrast analyses. First, in order to determine whether the negative-valence-losses-domain cell was exerting a disproportionately strong effect on the dependent variable, a weight of −3 was given to this cell and a weight of +1 was given to each of the other three cells. We found that the contrast was significant ($F_{(1,66)} = 15.68$; $p < .01$). Next, to determine whether the results are indeed due to an enhancement of prior outcome effects in the domain of losses, a weight of −3 was given to the negative-valence-losses-domain cell, a weight of +3 was given to the positive-valence-loss-domain cell, a weight of −1 was given to the negative-valence-gains-domain cell, and a weight of +1 was given to the positive-valence-gains-domain cell. We found that the contrast was significant ($F_{(1,66)} = 20.22$; $p < .001$). Finally, in order to assess whether the results are driven only by the two negatively valenced cells, a weight of −1 was given to the negatively valenced-losses-domain cell and a weight of +1 was given to the negatively valenced-gains-domain cell, while the other two cells were given a weight of zero. Here again, we found that the contrast was significant ($F_{(1,66)} = 4.61$; $p < .05$).

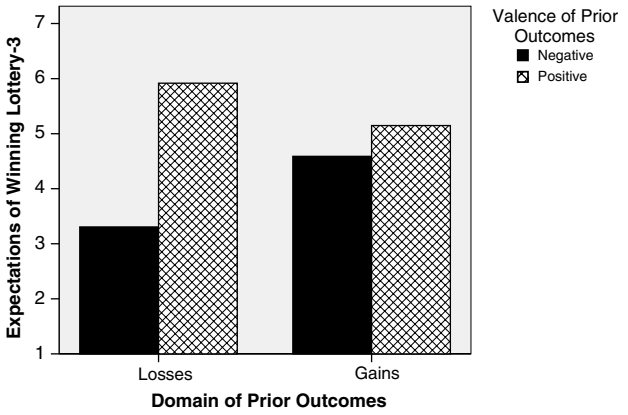

Fig. 1. Results for Experiment 1.

The negative, neutral, and positive responses were coded as −1, 0, and 1, respectively. Since the responses of the two judges were highly correlated ($r = .91$, $p < .001$ and Cronbach's $\alpha = .95$), they were averaged to form the *affect* variable.

To assess whether affect mediated the effect of prior outcomes on expectations, we followed the procedure prescribed by Baron and Kenny (1986). Using regression analyses we observed that the effects of both valence and the valence × domain interaction on the expectation regarding the future event were mediated by affect. When the mediator (affect) was used as the dependent variable, valence was significant ($\beta = .41$; $t_{66} = 4.11$; $p < .001$), as was the valence × domain interaction ($\beta = -.33$; $t_{66} = -3.32$; $p < .01$). When expectation was used as the dependent variable, we again observed a significant effect of valence ($\beta = .40$; $t_{66} = 3.80$; $p < .001$) as well as the valence × domain interaction ($\beta = -.26$; $t_{66} = -2.43$; $p < .05$). In this equation, when affect was introduced as a covariate, we found a significant effect of affect ($\beta = .48$; $t_{65} = 4.14$; $p < .001$), and a lowered significance for both valence ($\beta = .20$; $t_{65} = 1.91$; $p = .06$) and the valence × domain interaction ($\beta = -.09$; $t_{65} = -.94$; $p = .34$). Sobel's (1982) test provided converging statistical evidence that affect mediated the main effect of valence ($z = 2.92$; $p < .01$), as well as the valence × domain interaction ($z = 2.59$; $p < .01$) on expectations of the future.

Discussion

This experiment demonstrates the role of prior outcomes in influencing expectations of the future. By analyzing the verbalized thoughts of participants, we also found evidence for the proposed role of affect as a mediator. One concern that exists, however, is that we used different initial endowments for the losses ($6) and the gains ($0) domains. A rival hypothesis that could have driven the observed effect is that people endowed with $6 (in the losses domain) may readily adjust to their new state of wealth (Chen & Rao, 2002) and therefore the loss of real money may be relatively more painful to them. Therefore, to control for this possible confound, we conducted another experiment in which initial endowments were kept identical in both prior outcome conditions.

Experiment 2

Method

Fifty-four undergraduates participated in this study in exchange for partial course credit and a chance to win some "real" money. Participants in all four conditions started with an initial endowment of $4 and expected to play three lotteries of $1 each. This standardization of the initial endowment in all conditions was the chief design difference between Experiments 1 and 2. All other procedures were similar to that of Experiment 1. Thus, half the subjects were told that winning would result in additions to their account, while losing would have no effect, and the other half were told that winning would maintain their wealth state while losing would result in a deduction. Participants completed the task in approximately 15 min. They were then debriefed and thanked. For their participation, they received partial course credit and $6 each. That is, all of them received as much as, or more than, the amount they had earned through playing the lotteries.[8]

Results

As in Experiment 1, a composite dependent variable (expectation of winning the third lottery) of the two measures (chance and confidence) was computed ($r = .86$, $p < .001$). An ANOVA was run on the composite dependent variable with valence of prior outcome and domain as independent variables. The results were similar to those that were obtained in Experiment 1, providing evidence that the earlier results were robust. As predicted in Hypothesis 1, there was a main effect for prior outcome such that participants who had won the first two lotteries felt that their likelihood of winning the third was higher than participants who had lost the first two lotteries ($M = 5.83$ vs. 4.13; $F_{(1,50)} = 13.47$; $\eta_p^2 = .21$; $p < .01$). In addition, consistent with Hypothesis 2, there was a significant valence × domain interaction ($F_{(1,50)} = 6.09$; $\eta_p^2 = .11$; $p < .05$). The pattern of the interaction is displayed in Fig. 2, and is similar to

[8] As in Experiment 1, subjects participating in this study completed a mandatory research requirement, limiting concerns that our procedure contaminated these subjects for future experiments.

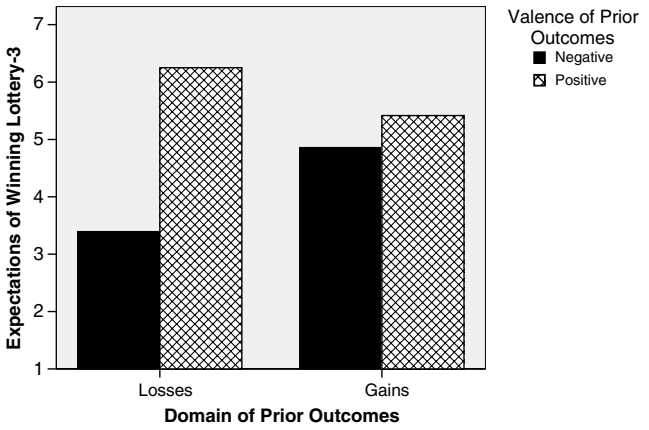

Fig. 2. Results for Experiment 2.

the interaction observed in Experiment 1. Outcome valence (positive vs. negative) had a stronger effect on expectations when prior outcomes were in the domain of losses ($M = 6.25$ vs. 3.39; Cohen's $d = 1.6$) relative to when they were in the domain of gains ($M = 5.42$ vs. 4.86; Cohen's $d = 0.3$).[9]

Again, as in Experiment 1, two independent judges coded participants' thoughts in order to examine the mediating role of affect (Hypothesis 3). Since the responses of the two judges were highly correlated ($r = .84$, $p < .001$ and Cronbach's $\alpha = .91$), they were averaged to form the affect variable. Following the procedure prescribed by Baron and Kenny (1986), we employed regression analyses and found that the effects of valence as well as valence × domain were mediated by affect. When the mediator, affect, was used as the dependent variable, valence was significant ($\beta = .34$; $t_{50} = 2.68$; $p < .05$), as was the valence × domain interaction ($\beta = -.26$; $t_{50} = -2.08$; $p < .05$). When expectation was used as the dependent variable, we again observed a significant effect of valence ($\beta = .44$; $t_{50} = 3.77$; $p < .001$) as well as the valence × domain interaction ($\beta = -.29$; $t_{50} = -2.46$; $p < .05$). In this equation, when affect was introduced as a covariate, we observed a significant effect of affect ($\beta = .60$; $t_{49} = 5.94$; $p < .001$), and a lowered significance for both valence ($\beta = .24$; $t_{49} = 2.46$; $p < .05$), and the valence × domain interaction ($\beta = -.13$; $t_{49} = -1.39$; $p = .16$). Sobel's (1982) test provided converging statistical evidence about affect mediating the main effect of valence ($z = 2.44$; $p < .05$), as well as the valence × domain interaction ($z = 1.96$; $p < .05$).

Discussion

The results of Experiments 1 and 2 are consistent. Whether participants started with different wealth states (Experiment 1) or identical wealth states (Experiment 2), the prior outcomes they experienced impacted expectations about the future via an affective mechanism. Two issues remain. One relates to whether our results are driven by the wealth state just prior to the third lottery, and the other relates to whether domain makes a difference even in the absence of prior outcomes. Further empirical examination confirms that these concerns are unfounded.

We examined the results for Experiments 1 and 2 to ascertain whether they could have been driven not by the theory we propose, but by the wealth state of participants *just prior* to their response to the dependent variable (at the end of two lotteries). In Experiment 1, participants in the loss condition (negative valence, losses domain) were at a wealth state of \$2 at the end of two lotteries, whereas those in the non-gain condition (negative valence, gains domain) were at a *lower* wealth state of \$0. In that Experiment, we found that participants in the loss condition had lower expectations than those in the non-gain condition ($M = 3.31$ vs. 4.59; $F_{(1,66)} = 4.61$; $p < .05$). In Experiment 2, participants in the loss condition were also at a wealth state of \$2, but those in the non-gain condition were at a *higher* wealth state of \$4. Yet, like in Experiment 1, participants in the loss condition had lower expectations than those in the non-gain condition ($M = 3.39$ vs. 4.86; $F_{(1,50)} = 5.15$; $p < .05$). If the terminal wealth state were driving the results, then participants in the \$4 wealth state (Experiment 2) should *not* have behaved in a fashion similar to participants in the \$0 wealth state (Experiment 1). But they did, confirming that it is the prior outcome in combination with the domain associated with the outcome that drives expectations, not one's terminal wealth state.

The second issue relates to whether there is something inherent in the domain (i.e., gain vs. loss) that makes people have different expectations. In Experiments 1 and 2, we implicitly assumed that this was not the case. However, because our experiments did not have a no-prior-outcome (control) condition, we do not know if our assumption was valid. We therefore conducted a post-test with 34 participants in which we used a cover story similar to that of Experiment 2 except that there were no prior outcomes involving real money. Only the domain (i.e., gain vs. loss) was manipulated and participants were asked to indicate their expectations of the chance and confidence of winning. As in Experiments 1 and 2, a composite dependent variable, expectations,

[9] As in Experiment 1, we ran a series of contrast analyses to determine whether the (a) negative-valence-losses-domain cell was exerting a disproportionately strong effect on the dependent variable (it was, ($F_{(1,50)} = 15.91$; $p < .001$)), (b) results are due to an enhancement of prior outcome effects in the domain of losses (they are, ($F_{(1,50)} = 19.88$; $p < .001$)), and (c) results are driven only by the two negatively valenced cells (they are, ($F_{(1,50)} = 5.15$; $p < .05$)). Thus, the results of this analysis for Experiment 2 yield results that are consistent with the analysis for Experiment 1 reported in Footnote 7.

was computed from these two items ($r = .74$, $p < .001$). We observed no effect of domain. Expectations were identical in both the gain and the loss domains ($M = 5.32$ vs. 5.56. $F_{(1,32)} = .25$; $p = .62$). This post-test therefore confirmed that the domain conditions were equivalent. Domain had a moderating influence when prior outcomes were present, but had no effect when prior outcomes were absent.

Overall, the two experiments demonstrate that, due to experienced affect, expectations of the future are influenced by prior outcomes even when these outcomes are randomly generated and therefore not predictive of the future outcome. Further, prior experiences in the domain of losses appear to have a disproportionate effect on expectations of the future, relative to prior experiences in the domain of gains. These effects are observed independent of different initial and terminal wealth states.

If, as we observe, expectations about the future are impacted by the favorability of prior outcomes as well as the domain in which they occur, these expectations ought to influence future behavior. Specifically, if one's expectations about the future are dampened (enhanced), one's willingness to engage in further gambles should also be dampened (enhanced). We next examine how the domain-based asymmetry that yields different expectations might also impact peoples' risk preferences.

Domain-based asymmetry in risky choice settings

The extant robust empirical finding regarding risk preferences is that people are risk averse in the domain of gains and risk seeking in the domain of losses (Kahneman & Tversky, 1979). That is, when options are "framed" in a positive fashion (e.g., lives that will be saved by a medical intervention), people are more likely to choose a risk-free option (an option whose probability of success = 1.0) rather than a risky option (an option whose probability of success < 1.0) even though the two options have the same expected value; when options are framed in a negative fashion (e.g., lives that will be lost despite a medical intervention), people are more likely to choose a risky option rather than a risk-free option (Tversky & Kahneman, 1981). In other words, risk preferences change depending on whether the *focal* event—the option under consideration—belongs to the domain of losses or to the domain of gains. However, our results suggest that the domain in which *prior* events occur influence expectations about the future differentially, and in light of this asymmetric effect, we predict that prior events may influence risk preferences as well.

Specifically, as we have established, prior outcomes can impact expectations of a future positive outcome depending on their valence and the domain in which they occur. When expectations of future success in a risky event are low, the willingness to take risk should also be relatively low. Therefore, manipulating the domain in which prior outcomes occur should yield predictable shifts in preference for risky choice, regardless of the domain in which the focal event occurs. That is, even though a minority may choose the risky option if the focal event is in the domain of gains (Tversky & Kahneman, 1981), the fraction of people choosing the risky option ought to be relatively lower when prior outcomes are unfavorable (rather than favorable), and this effect should occur primarily in the domain of losses (rather than gains). Formally:

Hypothesis 4. Prior outcomes will have a stronger effect on the willingness to choose a risky option when prior outcomes are in the domain of losses, relative to when they are in the domain of gains.

Notice that Thaler and Johnson's (1990) findings regarding the effect of prior outcomes on risk preferences are different from our prediction. They observe that prior losses *enhance* risk seeking if the risky option offers an opportunity to "break even," and that prior gains *enhance* risk-seeking if the possible losses from the risky option are small enough to be offset by the gains accrued from the past (i.e., the "house money effect"). These effects are predicated on a possible integration of prior outcomes with potential payoffs offered by current choices. As Thaler and Johnson (1990, p. 659) note "...a prior outcome is less likely to have an effect if it were expressed in a different currency than the current decision.... A prior outcome that is coded in a different mental account is less likely to influence a choice..." In contrast, the effects we predict are predicated on the affect induced by prior outcomes, and do not require the past and future outcomes to exist in the same mental account. As we discuss next, in Experiment 3 our respondents experienced initial outcomes in one mental account (money) while the focal choice was a variant of the Asian Disease problem that required making choices that would effect outcomes in another mental account (lives saved).

Experiment 3

Method

The stimulus comprised three components.[10] In the first component, respondents read a short (1-page) caselet in which they were asked to adopt the persona of the decision maker, the head of a business unit that makes cosmetics and pharmaceuticals. The decision maker makes an investment in order to ward off a threat

[10] The complete scenarios are available from the authors.

from a competitor. There is a 50% chance that the outcome of the investment will be positive and a 50% chance that it will be negative. For participants in the gains domain, gaining a million dollars was the positive outcome and not gaining anything was the negative outcome. For participants in the losses domain, avoiding the loss of a million dollars was the positive outcome and losing a million dollars was the negative outcome. After they had read the case, subjects turned the page and read that a 50% likelihood of success was akin to a coin toss. So, whether or not their investment decision would pay off would be determined by a coin toss. Half the subjects were in the "Heads" condition and the other half were in the "Tails" condition. The experimenter then tossed a fair coin and, depending on the outcome, respondents noted whether they had won or lost. They then responded to several measures including how much money they had won or lost.

In the second component of the stimulus, the subjects read a scenario regarding a wager on an NCAA basketball tournament pool. An elaborate description about the manner in which the pool was conducted revealed a 50% chance that a specific team would win (i.e., positive outcome) or lose (i.e., negative outcome). In the gains domain, the positive outcome was a net gain of $10, and the negative outcome was not winning anything. In the losses domain, the positive outcome was avoiding the loss of $10, and the negative outcome was losing $10. Again, subjects were informed that the outcome of the basketball game was akin to a coin toss, so a fair coin would be tossed to determine the outcome. Subjects were playing for either a "Heads" or "Tails" outcome, and following the coin toss by the experimenter, they noted whether they had won or lost. They then responded to several measures including how much money they had won or lost.

In the final component of the stimulus, subjects responded to a variant of the Asian Disease problem (Tversky & Kahneman, 1981). They were told that they had to respond to the Centers for Disease Control and Prevention who had requested the pharmaceuticals division of their business unit to provide a drug to combat an outbreak of a rare disease. Scientific estimates suggested that Drug A would save 200 people for sure, while Drug B would save all 600 people with one-third probability but there was a two-third probability that none of them will be saved.[11] Therefore, choosing Drug A was the risk-free option that offered partial success whereas Drug B was the risky option that offered either complete failure or complete success. Subjects then indicated which one of the two drugs they would prefer on a 9 point-scale (1 = prefer Drug A, 9 = prefer Drug B) as well as on a binary choice measure.

[11] Because our goal was limited to comparing a risky option to a riskless option, we chose only one version (gain frame) of the Asian Disease problem. However, we would expect to see similar results in the loss-frame version of the problem.

Subjects

One hundred eight MBA students and staff at a major Business School participated in the study for a chance to win one of five $50 gift certificates to a well-known department store. We were interested in those subjects that either won both coin tosses, or lost both coin tosses. Therefore, subjects who had won once and lost once were excluded from further analysis (a separate analysis indicates that these subjects responded in a relatively neutral manner), leading to an effective sample size of 55 (27 participants in the won twice condition and 28 in the lost twice condition).

Results

Responses to the preference scale were submitted to an ANOVA with valence of prior outcome and domain as independent variables. The pattern of results was similar to the expectations pattern we observed in Experiments 1 and 2. Consistent with Hypothesis 4, we observed a significant valence × domain interaction ($F_{(1,51)} = 4.27$; $\eta_p^2 = .08$; $p < .05$) (Fig. 3). Prior outcome valence (positive vs. negative) had a stronger effect on preferences for the risky versus certain choice when prior outcomes were in the domain of losses ($M = 5.29$ vs. 3.57; Cohen's $d = 1.04$) rather than gains ($M = 4.62$ vs. 4.79; Cohen's $d = 0.09$). In addition, there was a marginally significant main effect of valence of prior outcomes such that participants who had experienced positive prior outcomes preferred the riskier option ($M = 4.95$ vs. 4.18; $F_{(1,51)} = 2.87$; $\eta_p^2 = .05$; $p < .10$). There was no main effect for domain. An examination of the proportion of choices made by subjects in each of the four conditions reveals a (not surprisingly) similar pattern. In the domain of losses, only 14.29% of the subjects who

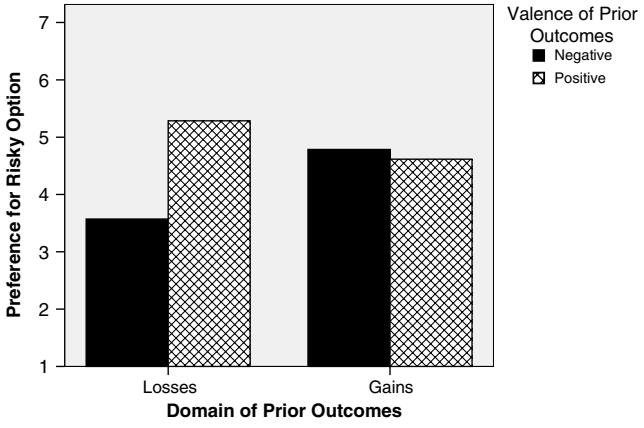

Fig. 3. Results for Experiment 3.

experienced negative prior outcomes chose the risky option, compared to 35.72% of the subjects who experienced positive prior outcomes ($z = 1.31$; one-tailed $p < .05$). In the domain of gains, 43% of subjects experiencing negative prior outcomes selected the risky option, as did 38% of subjects experiencing positive prior outcomes ($z = 0.23$; one-tailed $p > .20$).

Discussion

When participants encountered a choice that was gain-framed (i.e., lives saved) in the Asian disease problem, we observed results that were consistent with those of Tversky and Kahneman (1981). The majority of respondents preferred the risk-less option rather than the risky option. These results were, however, qualified by a domain-based asymmetry that was consistent with our predictions and the results of Experiments 1 and 2. Prior outcomes in the domain of losses (but not gains) had a strong effect on preferences such that the risky option was preferred to a significantly lower degree when the valence of prior outcomes was negative rather than positive.

General discussion

Summary

We develop and test a set of predictions regarding the influence of prior unrelated outcomes on peoples' expectations about the future. We appeal to the literature on the role of affect to predict that prior events will impact expectations about the future due to the affect experienced during the occurrence of the prior events. We then develop the more nuanced argument that prior outcomes influence expectations differentially depending on the domain in which the prior outcomes occur (gains vs. losses); consistent with the principle of loss aversion, the effects are predicted to be stronger in the domain of losses. The results of two real money lotteries are supportive of our hypotheses. In a third study, we examine whether these differential expectations will translate into differences in preferences in risky choice settings. Consistent with our studies on expectations, we find a domain-based asymmetry. Prior outcomes in the domain of losses (but not gains) had a strong effect on preferences such that the risky option was preferred less when the valence of prior outcomes was negative rather than positive.

Theoretical implications

Our research has implications for three areas: (a) expectation formation, (b) decision making, and (c) inter-temporal choice.

Expectation formation

Alice Isen and her colleagues (Isen, 1970; Isen et al., 1978; Isen, Nygren, & Ashby, 1988) as well as others (Johnson & Tversky, 1983; Wright & Bower, 1992; Wright & Mischel, 1982) have conducted extensive research on the role of affect in influencing judgments and decisions. Consistent with this research, we demonstrate that the affect induced by prior outcomes can influence expectations. We then tease apart this effect and show how the result occurs primarily in the domain of losses. That prior events can induce affect is not particularly surprising, but that they can induce differing degrees of affect (and consequently influence expectations and preferences differentially) depending on the domain in which the outcomes occur, is a novel advance.

Our findings contribute to a recent surge of research interest on the role of affect in judgment and decision-making. For instance, the probability weighting function has been found to be more S-shaped for affect-rich versus affect-poor events (Rottenstreich & Hsee, 2001). Similarly, Loewenstein et al. (2001) discuss the influence of anticipated and anticipatory affect on judgment and decision-making. For instance, people might anticipate the affect they would experience following the outcome of a risky choice, and choose the option that they believe will make them feel better (Mellers, Schwartz, Ho, & Ritov, 1997). Similarly, as an anticipatory emotion, people might employ their current affect as a heuristic to make judgments (Finucane, Alhakami, Slovic, & Johnson, 2000). Our findings are situated more in the anticipatory tradition. We suggest that the anticipatory affect evoked by prior outcomes varies with the domain of prior outcomes and influences expectations about the future to a greater degree in the domain of losses than in the domain of gains.

Decision making

Based on Kahneman and Tversky's (1979) prospect theory, the straightforward prediction is that people should be risk seeking when operating in the domain of losses and risk averse when operating in the domain of gains. This and related research has, however, not considered the domain of prior events. We show that although risk-aversion is indeed dominant when the focal event is in the domain of gains, this tendency varies with the domain (and valence) of prior outcomes.

Our results also extend research by Thaler and Johnson (1990) who observed that positive prior outcomes might lead to a "house-money" effect in which people become risk-seeking and that negative prior outcomes might lead to a "break-even" effect that also leads to risk-seeking. This presumably happens because people feel they can integrate future outcomes with prior gains and losses (e.g., compensate earlier losses with the new outcome). By using different mental accounts (money and lives), we demonstrate that prior outcomes can influence

decision-making even when no opportunity for integration exists. Our results suggest that the decision to choose a risky option depends not only on whether the outcome can be integrated with earlier gains or losses, but also on expectations about whether the risky option will pan out. If expectations indeed change based on prior outcomes (as we demonstrate), so should risk preferences. Preference for a risky option is going to be lower (relative to a risk-free option) if one becomes more pessimistic about the outcome. We demonstrate that preference for a risky option reduces when prior outcomes are negative rather than positive in the domain of losses.

Inter-temporal choice

The inter-temporal choice literature examines how people form preferences for future events. One stream of research suggests that people like to defer favorable events so that they may savor the event that is expected to occur in the future (cf. Prelec & Loewenstein, 1993). Another stream suggests that happy endings are preferred even when the event may not be expected to occur (Chen & Rao, 2002); initial outcomes may shift the psychological reference point, making happy events relatively more enjoyable if they occur later, rather than earlier, in a series. Our research is consistent with this latter perspective. Recently experienced unfavorable events may lower expectations and depress the reference point. Consequently, when a favorable outcome occurs in the future, it may be even more enjoyable than if it had not been preceded by an unfavorable event. However, because people have limited resources for dealing with emotionally impactful events (Linville & Fischer, 1991), the impact of these prior unfavorable events might vary with the intensity of the affect evoked.

Practical implications

Our research is of relevance to practitioners interested in influencing consumers' expected value of future outcomes and, thus, their assessment of risk. Managers desirous of leveraging differing expectations of product performance so as to reduce price sensitivity and enhance purchase behavior will benefit from understanding how those expectations are formed and updated. For instance, a consumer who has just won a series of gambles might, through the positive affect that has been induced, experience an optimism bias when evaluating the likelihood of breakdown of a consumer durable whose purchase she is contemplating. This might reduce her willingness to pay for an extended warranty. Additionally, the frame in which the prior outcomes occurred would likely impact expectations of failure. The experience of a loss (vs. a non-loss) is likely to have a greater impact on generating negative expectations about performance, relative to the experience of a non-gain (vs. a gain).

To researchers and practitioners in public policy, it is well known that prior events can influence future outcomes. For instance, previous childbirth experiences and lifetime alcohol problems affect the perceptions of pregnant women regarding the risk associated with drinking during pregnancy (Testa & Reifman, 1996). The current research suggests that this impact of prior events could occur even when prior and future events are unrelated, and more so in the domain of losses rather than gains. Public policy officials may be interested in influencing the subjective expectations and resulting risk taking behavior of at-risk populations that engage in excessive gambling, drinking and driving, unsafe sex, sharing potentially contaminated needles, and the like. In general, these populations' risk perceptions are affected by a variety of factors including the number of occasions on which they or their friends engage in risky behavior with favorable or unfavorable consequences. Since the unfavorable outcomes (such as death or disease) are rarer than favorable outcomes (the status quo), most members of at-risk populations likely underestimate the probability of unfavorable outcomes. Therefore, the challenge for public policy officials is to generate a pessimism bias among this population by making prior unfavorable outcomes more salient.

The findings of the current research also present some avenues for future research. A field study within an organization could help understand the impact of prior events on managerial decision-making. For instance, investing behavior might depend on the outcome (positive vs. negative) as well as the domain (losses vs. gains) of prior unrelated investments. Similarly, one could try to understand whether the willingness to pay for a product can change based on the outcome of prior unrelated events. If expectations about a product's performance increase because prior unrelated events are positive, a consumer might be willing to pay more for the product. A related question of interest is whether enhanced pessimism (due to negative prior outcomes) leads to a willingness to pay to reduce risk, increasing the willingness to purchase and pay for extended warranties.

In general, the study of risk and decision-making is a rich area for further research. Issues such as the risk of contracting SARS (Severe Acute Respiratory Syndrome) or being the victim of a terrorist attack have a huge impact on public behavior, despite the relatively small objective probabilities associated with these events. Our research suggests that the perceived chance of contracting SARS might be influenced by an unrelated event such as a prior terrorist attack.

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