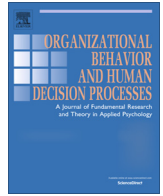




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Perceiving outcomes as determined by external forces: The role of *event construal* in attenuating the outcome bias

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ABSTRACT

People view the same decision as better when it is followed by a positive outcome than by a negative outcome, a phenomenon called the *outcome bias*. Based on the idea that a key cause of the outcome bias is people's failure to appreciate that outcomes are in part determined by external forces, three studies tested a novel method to reduce the outcome bias. Experiment 1 showed that people who construed a person's interactions with the environment as events rather than as actions or choices were less susceptible to the outcome bias in a medical decision making task. Experiments 2 and 3 demonstrated that people who recalled past events rather than actions or choices exhibited lower outcome bias in a risky decision making task and in an ethical judgment task. These findings indicate that an event construal helps people appreciate the role of external factors in causing outcomes.

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1. Introduction

Imagine that before leaving your home this morning to walk to your office, you had checked the weather report and learned that the probability of rain today was only 10%. You decided that the probability was not high enough to warrant carrying your umbrella. However, when you were walking back home in the evening, there was a heavy downpour and you were thoroughly drenched. Would you be livid at yourself, concluding that you made a bad decision to not carry your umbrella to work that morning? Could it be that reading an article claiming that Barack Obama got reelected because of the American people's decision to elect him versus because of a variety of economic, demographic, and cultural factors influence the extent to which you would blame yourself for not carrying an umbrella?

According to normative theories of decision making, a decision should be based on the possible outcomes for each course of action, the probabilities associated with each of those outcomes, and the decision maker's utility function. The outcome following the decision, if caused by factors outside the individual's control, does not convey any information about the quality of the decision (Brown, Kahr, & Peterson, 1974; Edwards, 1984). However, people's evaluations of decisions are significantly influenced by outcomes caused by external factors—individuals view the same decision as worse if

it followed by a negative outcome than if it is followed by a positive outcome, a phenomenon called the *outcome bias* (Baron & Hershey, 1988). This bias is pervasive in diverse fields, including medicine (Gupta, Schriger, & Tabas, 2011), law (Hastie, Schkade, & Payne, 1999), and accounting (Kennedy, 1993). The outcome bias is related to the *hindsight bias*, which refers to the finding that people shift their *ex ante* estimated probabilities of outcomes once they learn about the realized outcome (Fischhoff & Beyth, 1975; see Hawkins & Hastie, 1990; Rozin & Royzman, 2001, for reviews). The outcome bias is distinct from the hindsight bias in that the outcome bias occurs even when the probabilities of the different outcomes are precisely specified and known in advance.

Researchers have attempted to design interventions to attenuate the outcome bias. Some of the prominent interventions that have been investigated are giving people information about the existence of the outcome bias (e.g., Clarkson, Emby, & Watt, 2002), and asking people to generate arguments for why an alternate outcome could have been realized (e.g., Anderson, Jennings, Lowe, & Reckers, 1997; Kennedy, 1995; Lowe & Reckers, 1994). This work has found that whereas merely informing people about the existence of the outcome bias is not effective at attenuating the bias, asking people to generate arguments for alternative outcomes is effective to some extent (Grenier, Peecher, & Piercy, 2009). However, these studies suffer from strong demand effects. For example, when asked to recall arguments for why alternate outcomes could have been realized, participants are likely to infer that the experimenter wants them to moderate their view of their

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decision. Notably, these interventions have been designed by applied researchers in the field of accounting; we are not aware of basic research in judgment and decision making designed to reduce the outcome bias (but see [Agrawal & Maheswaran, 2005](#), on motives that influence this bias).

[Baron and Hershey \(1988\)](#) discussed a number of possible causes of the outcome bias, including overgeneralization of the heuristic that “good decisions lead to good outcomes, bad decisions to bad outcomes;” a shift in attention to arguments for or against the decision depending on whether the outcome was positive or negative, respectively (as tested by [Grenier et al. \(2009\)](#)); and the idea that certain individuals possess clairvoyance that helps them select decisions that are destined to lead to positive outcomes whereas others do not. We propose an additional cause of the outcome bias—people’s tendency to under-emphasize the role of external factors outside the individual’s control in causing outcomes. If this is indeed the case, then a potential intervention for reducing the outcome bias would be to help people appreciate that external factors beyond their control also influence the outcome. We tested a novel method to reduce the outcome bias by altering people’s construal or frame of mind.

In this research, we target people’s construal of interactions between individuals and the environment, which we use as a blanket term encompassing other individuals, objects, and natural forces outside the individual. Between the person and the environment, the person usually appears more psychologically salient and somatosensorially dynamic; when people interact with other people or objects, they typically perceive themselves as moving and everything else as reacting to their movements ([Gibson, 1975](#)). Because of this individual-focus bias, which is particularly prevalent in English-speaking North American cultures ([Fausey, Long, Inamori, & Boroditsky, 2010](#); [Markus & Kitayama, 2003](#); [Morris & Peng, 1994](#); [Nisbett, Peng, Choi, & Norenzayan, 2001](#)), people often view interactions between a person and the environment as being driven by the individual’s agency, leading to a sense that the person is responsible for any resulting outcomes. For example, people automatically interpret potentially accidental occurrences (e.g., “He set the house on fire”) as being intentional, spontaneously describe prototypically accidental occurrences as having been done intentionally, and tend to remember intentional occurrences more than unintentional ones ([Rosset, 2008](#)).

Based on the above idea, recent research has identified two construals through which people perceive their interactions with the environment. One construal is *action construal*, the idea that person–environment interactions consist of a series of actions, whereas another construal is *choice construal*, the idea that person–environment interactions consist of a series of active choices and decisions. These construals have been shown to influence how people judge actors. For example, participants induced to think of person–environment interactions as choices rather than as mere actions were more likely to blame victims of negative outcomes ([Savani, Stephens, & Markus, 2011](#)). Although these two construals differentially influence certain types of judgments, both action construal and choice construal focus on the individual as driving person–environment interactions.

Of course, people do not always view the individual as driving person–environment interactions, and under certain circumstances, might view resulting outcomes as largely determined by factors outside the individual’s control, which we refer to as *event construal*. In situations in which the environment is more visually and somatosensorially dynamic, such as when a hurricane moves and swirls, factors in the environment might be seen as causes responsible for the outcome. People might view external factors as causal agents even in more mundane circumstances. For example, imagine that a person’s cell phone rings and the person picks up the phone. The individual can construe this interaction with

the environment as “I picked up the phone” (action construal), “I decided to pick up the phone” (choice construal), or “The phone rang, so I picked it up” (event construal). Whereas action construal and choice construal focus on the individual as driving person–environment interactions, event construal focuses relatively more on external factors outside the individual’s control as also driving person–environment interactions.

Our key argument is that if the outcome bias occurs in part because people do not fully appreciate that the outcome is influenced by external factors outside the individual’s control, one solution for reducing the outcome bias would be to induce a general event construal mindset in which people are more likely to view person–environment interactions as being driven by external factors outside the individual’s control.

Although the idea of event construal is related to *locus of control* ([Lefcourt, 1982](#); [Rotter, 1966](#)), it departs from locus of control in two important respects. First, past research manipulating locus of control has typically targeted people’s actual control over their outcomes ([Pittman & Pittman, 1979, 1980](#); [Weiner, Nierenberg, & Goldstein, 1976](#); [Whitson & Galinsky, 2008](#); [Zhou, He, Yang, Lao, & Baumeister, 2012](#)). In contrast, in the current research, our manipulations of event construal target how people construe interactions between a person and the environment; these manipulations do not involve any changes in actual control. For example, construing picking up the phone as “the phone rang, so I picked it up” does not change the person’s actual degree of control over the phone in any respect. Second, research on locus of control has largely focused on negative consequences of an external locus for psychological well-being ([Abramson, Seligman, & Teasdale, 1978](#); [Maier & Seligman, 1976](#)), whereas we investigate the positive effects of event construal on decision making.

We conducted three studies to test our hypothesis. Experiment 1 tested whether people who construe a person’s interactions with the environment as events rather than as actions or choices are less likely to exhibit the outcome bias when evaluating hypothetical medical decisions that yielded positive or negative outcomes due to external factors. Experiment 2 tested whether participants who recalled past events rather than past actions or choices are less likely to show the outcome bias when evaluating risky decisions that yielded positive or negative outcomes due to external factors. Experiment 3 tested whether, in comparison to those assigned to either choice construal, action construal, or neutral conditions, participants in the event construal condition will be less likely to exhibit the outcome bias when deciding whether to punish individuals whose ethically-laden decisions yielded positive or negative outcomes due to external factors. We used two different experimental manipulations, and three different comparison conditions—action construal, choice construal, and neutral—to assess the robustness of the effect.

2. Experiment 1

Experiment 1 manipulated action construal, choice construal, and event construal by asking participants to differentially construe a stream of person–environment interactions displayed in a video. We then measured the extent to which participants exhibit the outcome bias by asking them to evaluate a series of decisions made by physicians or patients, designed such that the same decision was first followed by a positive outcome and then by a negative outcome. We hypothesized that there would be a similar extent of outcome bias in the action construal and choice construal conditions, but less outcome bias in the event construal condition.

2.1. Method

2.1.1. Participants

A survey seeking 300 U.S.-resident respondents was posted on Amazon's Mechanical Turk (www.mturk.com); 318 participants (176 women, 141 men, 1 of unreported gender; mean age 41.20 years) took the survey. Ten responses that came from duplicate IP addresses (bypassing a duplicate IP address restriction built into the survey program) were excluded given that the same individual could potentially have contributed multiple responses. Participants were randomly assigned to one of three conditions: action construal, choice construal, or event construal, manipulated between-participants. The valence of the outcome was varied within-participants.

As this was the first study to investigate the effect of event construal on the outcome bias, we did not have any prior research to form the basis of a power analysis. Therefore, we decided to a target sample size of 100 participants per cell.

2.1.2. Manipulation

We manipulated participants' construal by asking them to watch a 5-min video of a person engaging in mundane activities in an apartment (e.g., opening envelopes that were lying on the table, responding to a phone call, and reading a magazine; adapted from Savani & Rattan, 2012). Participants in the *action construal* condition were instructed to click the mouse whenever the actor touched an object; those in the *choice construal* condition were instructed to click the mouse whenever the actor made a choice; and those in the *event construal* condition were instructed to click the mouse whenever something happened to the actor. Once the video was over, participants were asked to rate the difficulty of the video task on a 7-point scale ranging from *very easy* to *very difficult*.

2.1.3. Dependent measure

Thereafter, we presented participants with 12 items from Baron and Hershey's (1988, Experiment 1, p. 572) measure of outcome bias (see Appendix).¹ The 12 items were divided into six pairs. In each pair, the outcome was described as being positive in one item but negative in the other item (see the Appendix for the full list of items). For example, in one pair of items, a physician decided to go ahead with a heart surgery that had a 92% chance of success and an 8% chance of failure. In one item from this pair, participants were told that the surgery succeeded, and in the other item from their pair, they were told that the surgery failed. Participants were asked to judge the quality of the decision on a 7-point scale ranging from $-3 =$ "Incorrect and inexcusable" to $+3 =$ "Clearly correct, and the opposite decision would be inexcusable" (see Baron & Hershey, 1988, p. 571). If participants evaluated the same decision more favorably when it was followed by a positive outcome than when it was followed by a negative outcome, then they would be exhibiting the outcome bias.

2.1.4. Additional measures

Given that the experimental manipulation could have influenced participants' engagement with the dependent measure, we assessed how involved participants were in the decision evaluation task using an abbreviated version of Zaichkowsky's (1985, p. 350) involvement scale. Specifically, participants were asked to rate the medical decision making task on 10 bipolar adjectives, such as *important–unimportant*, *irrelevant–relevant*, and *boring–interesting*. As half of the items were reverse scored, 34 participants who gave

the same response to all 10 items were dropped from all analyses because their responses indicated that they did not read the questions before responding.

At the end of the survey, participants were asked "Did you encounter any technical problems while viewing the video?" and were asked to select either "Yes" or "No." Twenty participants who indicated that they encountered technical problems were excluded from the analyses.

2.2. Results

2.2.1. Preliminary analyses

We first tested whether the difficulty of the video task and participants' involvement with the outcome bias task differed by condition. Given that we did not have any *a priori* hypotheses about recall difficulty and involvement, we analyzed the data using one-way ANOVAs. We found that the difficulty of the recall task did not differ by condition, $F(2,251) = 1.01$, $p = .36$, and neither did participants' involvement with the medical decision making task, $F(2,251) = 0.15$, $p = .86$.

To test whether participants completed the manipulation task as intended, we compared the number of clicks that they made by condition. We expected fewer clicks in the choice condition than in the action condition, given that choices would qualify as actions but not all actions would qualify as choices. Further, given that the video depicted a solitary individual going about everyday activities in an enclosed space, we expected fewer events than either actions or choices. An ANOVA confirmed that the number of relevant incidents that participants identified in the video (as indicated by the number of clicks they made) differed by condition, $F(2,251) = 79.23$, $p < .001$, with the most number of clicks in the action condition, $M_{\text{action}} = 58.06$, $SE = 2.35$, fewer in the choice condition, $M_{\text{choice}} = 30.16$, $SE = 2.36$, and fewest in the event condition, $M_{\text{event}} = 16.08$, $SE = 2.48$. Tests of marginal effects indicated that all cells were significantly different from each other, $ps < .001$.

2.2.2. Main analyses

Given that we had specific *a priori* hypotheses about how the dependent measure would vary by condition, we tested the hypotheses using planned contrasts (Abelson, 1995; Abelson & Prentice, 1997; Rosenthal & Rosnow, 1985; Rosnow & Rosenthal, 1995). We ran a repeated measures ANOVA with mean rating of the positive outcome items and mean rating of the negative outcome items as the dependent measure, and two contrast variables as predictors. Contrast 1 tested whether the action construal and choice construal conditions differed from each other (action construal = -1 , choice construal = $+1$, event construal = 0), whereas Contrast 2 tested whether the event construal condition differed from the average of the other two conditions (action construal = -1 , choice construal = -1 , event construal = $+2$).

The main effect of Contrast 1 was nonsignificant, $p = .72$, indicating that participants in the action condition and choice condition did not differ in their mean evaluations of the decisions (averaged across positive outcomes and negative outcomes). We found a main effect of Contrast 2, $F(1,251) = 5.96$, $p = .015$, indicating that overall, participants in the event condition evaluated the decisions more favorably than those in the action condition and choice condition (averaged across positive outcomes and negative outcomes).

We found a main effect of outcome valence, indicating that participants evaluated the same decisions more favorably when they were followed by a positive outcome rather than a negative outcome, $F(1,251) = 249.79$, $p < .001$, indicating presence of the outcome bias. As predicted, the Contrast 1 \times outcome valence interaction was nonsignificant, $F(1,251) = 2.75$, $p = .10$, indicating that outcome valence influenced participants' evaluations of the

¹ We only included items 1–8 and 12–15 from Baron and Hershey's (1988) Table 1. Items 9–11 were not included in the study because they did not show a clear outcome bias in Baron and Hershey's study.

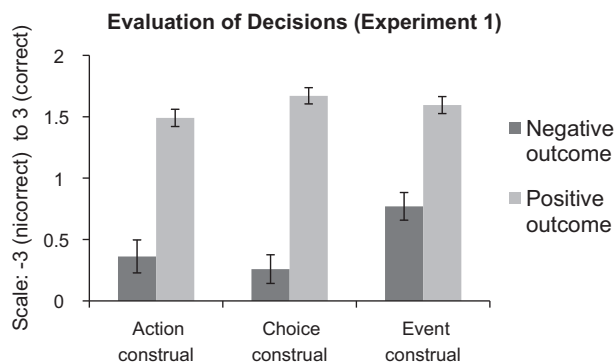


Fig. 1. Mean evaluation of identical medical decisions followed by either positive outcomes or negative outcomes, by condition. Error bars indicate the standard error of the mean.

decisions to a similar extent in the action condition and the choice condition. However, the Contrast $2 \times$ outcome valence interaction was significant, $F(1, 251) = 8.46$, $p = .004$, indicating that outcome valence influenced participants' evaluations of the decisions to a lesser extent in the event construal condition than in the other two conditions (see Fig. 1).

2.3. Discussion

Experiment 1 showed that inducing participants to construe the same stream of person–environment interactions in terms of events rather than actions or choices reduced the outcome bias in a subsequent, unrelated medical decision making task. Specifically, although across conditions, participants evaluated the same decision more favorably when it was followed by a positive outcome than by a negative outcome, participants' evaluations in the event construal condition were less influenced by the valence of the outcome compared to the evaluations of participants in the action and choice conditions. Construing person–environment interactions as events (i.e., as “things that happened”) appears to have helped participants appreciate that the outcome in the medical decision making task was also “something that happened” because of factors outside the physician's or patient's control. Thus, the construal of outcomes as caused by human agency or by external factors seems to be one of the factors contributing to the outcome bias.

3. Experiment 2

Experiment 2 was designed to conceptually replicate the findings of Experiment 1 using a different manipulation and a different dependent measure. Instead of manipulating participants' construal of another person's interactions with the environment in a video, we altered their construal of their own past interactions. Specifically, we asked participants to recall actions, choices, or events from the previous day. Further, given that in Experiment 1, participants identified more relevant person–environment interactions in the action and choice conditions than in the event condition (as indicated by the differential number of clicks), in this study, we asked all participants to recall the same number of relevant responses.

One potential concern with the outcome bias measure used in Experiment 1 is that it is not obvious that the same decision was followed by different outcomes only because of factors outside the decision maker's control. To address this concern, in the current study, we used a task in which the outcome was unambiguously determined by factors outside the individual's control, and

thus there can be no rational justification for showing an outcome bias. Specifically, participants had to decide whether to play a series of six identical lotteries that would be determined by the roll of a die, and subsequently received positive outcomes in half the trials and negative outcomes in the other half. As in Experiment 1, we hypothesized that there would be a similar extent of outcome bias in the action construal and choice construal conditions but less outcome bias in the event construal condition.

3.1. Method

3.1.1. Participants

A survey seeking 240 U.S.-resident respondents was posted on Amazon's Mechanical Turk; 240 participants (142 women, 98 men; mean age 33.45 years) took the survey. We decided on a target sample size of 80 participants per cell at the outset. Two responses that came from duplicate IP addresses (bypassing a duplicate IP address restriction in the survey program) were excluded given that they could potentially have come from the same individual. Participants were randomly assigned to one of three conditions: action construal, choice construal, or event construal, varied between-participants. The valence of the outcome was varied within-participants.

3.1.2. Manipulation

We adapted Savani and Rattan's (2012, Experiment 1) manipulation in this study. Participants in the action construal condition were asked to list three things that they did the previous morning (8 am–12 pm), afternoon (12 pm–4 pm), evening (4 pm–8 pm), and night (8 pm–12 am). Those in the choice construal condition were asked to list three choices that they made in the same periods, whereas those in the event construal condition were asked to list three things that happened to them in the same periods. After listing their responses, participants were asked to rate the difficulty of the recall task on a 7-point scale ranging from *very difficult* to *very easy*. Six participants were excluded because they gave nonsensical responses that did not follow the instructions (e.g., “2,” “ok,” “good”).

3.1.3. Dependent measure

Thereafter, all participants were asked whether they wanted to receive \$10 for sure or to play a lottery. The lottery would be played by the computer by means of rolling a fair die. If the computer rolled an odd number, participants would receive \$0, and if the computer rolled an even number, participants would receive \$30. Participants were informed that they would learn the outcome of the lottery even if they decided not to play it. There were six such lottery trials. Participants were informed that “One participant would be randomly selected and receive 10% of their total earnings from the lottery task in the form of a bonus payment on MTurk. Therefore, please make your choices as if you were playing with real money.” The lotteries were designed to provide participants with a positive outcome (or a negative counterfactual) on half the trials, and a negative outcome (or a positive counterfactual) on the other half of the trials.

In the three positive outcome trials, if participants decided to play the lottery, they were informed that the computer rolled an even number, so they won \$30 (they would have received only \$10 had they not played the lottery); if they decided to not play the lottery, they were informed that the computer rolled an odd number, so they would have received nothing had they played the lottery (instead of the \$10 that they currently received). Therefore, participants were led to believe that whatever decision they made was the “correct decision.”

Conversely, in the three negative outcome trials, if participants decided to play the lottery, they were informed that the computer

rolled an odd number, so they won nothing (they would have received \$10 had they *not* played the lottery); if they decided to not play the lottery, they were informed that the computer rolled an even number, so they would have received \$30 had they played the lottery (instead of the \$10 that they currently received). Therefore, participants were led to believe that whatever decision they made was the “wrong decision.”

On each trial, if participants played the lottery, they were asked, “Do you think your decision to play the lottery was a good decision or a bad decision?” If they did not play the lottery, they were asked, “Do you think your decision to *not* play the lottery was a good decision or a bad decision?” Participants indicated their response on a 9-point scale ranging from “It was a very bad decision” to “It was neutral – neither good nor bad” to “It was a very good decision.”

3.1.4. Additional measures

As in Experiment 1, we administered a 10-item involvement scale with half the items reverse-scored, and five participants who gave the same response to all 10 items were dropped from the analyses.

At the end of the survey, participants were asked “Were you at any time distracted by other things while completing the survey? (Don’t worry, you will receive your full payment whether or not you were distracted!)” and asked to select either “Yes” or “No.” Sixteen participants who indicated that they were distracted were excluded from the analyses.

3.2. Results

3.2.1. Preliminary analyses

We found that the difficulty of the recall task marginally differed by condition, $F(2,208) = 2.96, p = .06$, with the choice condition being the most difficult, $M_{\text{choice}} = 5.03, SE = .18$, the event condition being moderately difficult, $M_{\text{event}} = 5.24, SE = .19$, and action condition the most easy, $M_{\text{action}} = 5.62, SE = .18$. Tests of marginal effects indicated that the difficulty level of the choice condition and the action condition were not statistically different from the event condition, $ps > .13$, but the choice condition was more difficult than the action condition, $p < .02$. As the difficulty level of the key experimental condition—event construal—was in between the two control conditions—action and choice—difficulty of the task is unlikely to be a confounding variable. Nevertheless, we controlled for difficulty of the task in the main analyses.

On average, participants played the lottery in 2.4 out of the 6 trials. The number of lotteries that participants decided to play did not differ by condition, $F(2,208) = 0.73, p = .48$. Further, participants’ involvement with the lottery task did not differ by condition $F(2,208) = 1.71, p = .18$.

Next, we attempted to test two possibilities about the extent of causal thinking across the three conditions. Our preferred position is that participants in the event construal condition think of causes to a similar extent as those in the other two conditions, but that they focus more on external causes outside the individual rather than on internal causes within the individual. An alternative possibility is that participants in the event construal condition view outcomes as being random, and thus are less likely to think in causal terms compared to action construal and choice construal. To assess the extent to which participants were thinking causally, we used the Linguistic Inquiry and Word Count (LIWC) software (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007), which computed the percentage of causal words (e.g., because, effect, hence) in each participants’ textual responses to the manipulation. Given that the modal percent of relevant words was zero, we analyzed the data using a Tobit regression censored at zero. As the Tobit regression cannot estimate omnibus effects, we included two dummy coded variables indicating the action construal condition

and the choice construal conditions, respectively, as predictors (with the event construal condition as the dropped baseline). Compared to the event construal condition, the proportion of causal words in the action construal condition were no different, $B = -1.26, SE = .83, t(208) = 1.53, p = .13$, nor were the proportion of words in the choice construal condition, $B = .68, SE = .80, t(208) = .86, p = .39$.

Finally, we tested whether the valence of participants’ responses differed across conditions. We again used the LIWC software to assess the percentage of participants’ words that conveyed positive emotions and those that conveyed negative emotions, and submitted the scores to separate Tobit regressions. There were no significant differences for positive emotions, $p's > .20$, but compared to the event construal condition, participants’ responses were significantly less negative in the action construal condition, $B = -5.44, SE = 1.37, t(208) = 3.97, p < .001$, and marginally less negative in the choice construal condition, $B = -1.68, SE = .94, t(208) = 1.80, p = .074$. Therefore, we controlled for both positivity and negativity of participants’ responses in the following analyses.

3.2.2. Main analyses

Given that participants were informed that the outcome of each lottery would be determined by a die rolled by the computer, from a normative decision making perspective, participants’ evaluations of their decisions should not differ based on whether their decisions were followed by a positive outcome or a negative outcome. Therefore, the difference in evaluations between the positive outcome and negative outcome trials would reflect the outcome bias.

We ran a repeated measures ANOVA with mean evaluations of decisions with positive outcomes and decisions with negative outcomes as the within-participant dependent variable. The independent variables were two contrasts, Contrast 1 testing whether the action construal and choice construal conditions differed from each other, and Contrast 2 testing whether the event construal condition differed from the average of the other two. As covariates, we included difficulty of the recall task used in the manipulation, and the proportion of positive emotion words and proportion of negative emotion words in participants’ responses.

The main effects of the two contrasts were non-significant, $p's > .81$, indicating that there was no significant difference in people’s mean evaluations of their decisions (averaged across positive and negative outcomes) across conditions. A significant main effect of outcome valence indicated that overall, participants evaluated decisions more favorably when they were followed by positive outcomes than when followed by negative outcomes, $F(1,205) = 10.08, p = .002$, indicating presence of the outcome bias. As predicted, the Contrast 1 \times outcome valence interaction was nonsignificant, $F(1,205) = .19, p = .66$, indicating that the extent to which the valence of the outcome influenced participants’ evaluations of the decision was similar in the action construal and choice construal conditions. More importantly, the Contrast 2 \times outcome valence interaction was significant, $F(1,205) = 4.40, p = .037$, indicating that the valence of the outcome influenced participants’ evaluations of the decision to a lesser extent in the event construal condition than in the other two conditions (see Fig. 2).

The difficulty of the recall task, $p = .90$, the proportion of positive emotion words, $p = .09$, and the proportion of negative emotion words in participants’ responses to the experimental manipulation, $p = .52$, did not significantly interact with outcome valence.

3.3. Discussion

The findings supported our hypothesis that event construal reduces the outcome bias using a different experimental manipulation and a different dependent measure than in Experiment 1.

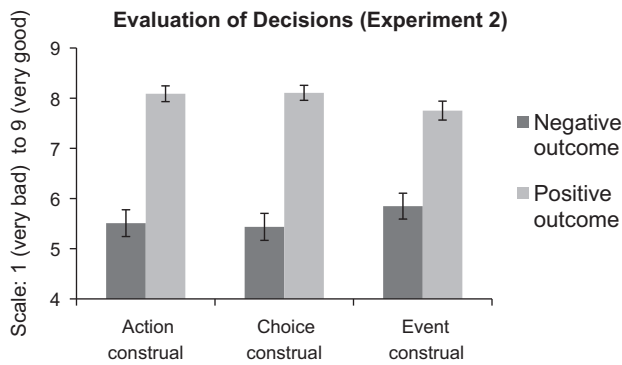


Fig. 2. Mean evaluation of lottery decisions followed by either positive outcomes or negative outcomes, by condition. Error bars indicate the standard error of the mean.

We conceptually replicated the effect with respect to participants' evaluations of their own actual decisions rather than their evaluations of others' hypothetical decisions. Compared to participants who recalled their actions or choices from the previous day, participants who recalled things that happened to them the previous day were less influenced by whether their decision about playing a lottery was followed by a positive outcome or a negative outcome. Thinking of events appears to have helped participants appreciate to a greater extent that the outcome of the lottery was determined by an external factor outside their control—the die rolled by a computer program—and thus tempered the extent to which the outcome influenced their evaluations of their decisions.

Although participants' responses tended to be more laden with negative affect in the event construal condition than in the action construal or choice construal conditions, the negativity of participants' responses did not influence the extent of their outcome bias and thus was not a confound. Once again, the findings showed that the construal of outcomes as caused by human agency or by external factors seems to be one of the factors contributing to the outcome bias, and inducing people to think of their interactions with the environment as driven to some extent by external factors helps reduce the outcome bias.

4. Experiment 3

The goal of Experiment 3 was to extend the findings of Experiments 1 and 2 in a number of ways. With reference to the experimental manipulation, first, whereas Experiments 1 and 2 assumed that action construal or choice construal is people's default construal as they go about their daily lives, Experiment 3 included a truly neutral condition without any experimental intervention to explicitly test this assumption. Second, the previous experiments did not include any manipulation checks, so it is not clear whether participants in the event construal condition actually construed person–environment interactions as driven more by external factors compared to action construal and choice construal, as we have been assuming. Therefore, we included a manipulation check asking participants to rate the extent to which they were focused on themselves versus external factors in the environment as the causal factor. Third, it might be possible that event construal reduces the outcome bias not because people focus on external factors as causal agents to a greater extent but because they view the outcome as more unpredictable in general compared to those in the action and choice conditions. To test this idea, we measured how predictable participants thought the outcome was in this study.

With reference to the dependent measure, first, whereas Experiments 1 and 2 examined participants' evaluations of

decisions—how good or bad a decision was—Experiment 3 examined a behavioral intention—whether a decision maker should be punished for the decision they took. Second, Experiment 3 tested whether event construal reduces the outcome bias in the ethical domain, one with particular practical relevance for the field of law (Gino, Moore, & Bazerman, 2009; Gino, Shu, & Bazerman, 2010). Finally, whereas Experiments 1 and 2 investigated the outcome bias at the within-individual level (participants saw both positive and negative outcomes following the same decision), Experiment 3 used a between-subjects design in which participants were exposed to either positive or negative outcomes, not both.

4.1. Method

4.1.1. Participants

Surveys seeking 800 U.S.-resident respondents were posted on Amazon's Mechanical Turk; 810 participants (483 women, 326 men, 1 unreported gender; mean age 36.34 years) took the survey. Ten responses that came from duplicate IP addresses (bypassing a duplicate IP address restriction in the survey program) were excluded because they could potentially have come from the same individual. We decided on a target sample size of 100 participants per cell at the outset. Participants were randomly assigned to one cell of a 4 (Construal conditions: action construal, choice construal, event construal, or neutral) \times 2 (Outcome condition: positive or negative) between-participants design. Thus, both the construal condition and the valence of the outcome were manipulated between-participants.

4.1.2. Manipulation

The action, choice, and event construal conditions were the same as in Experiment 2. Participants in the action construal condition were asked to list three things that they did the previous morning (8 am–12 pm), afternoon (12 pm–4 pm), evening (4 pm–8 pm), and night (8 pm–12 am). Those in the choice construal condition were asked to list three choices that they made in the same periods, whereas participants in event construal condition were asked to list three things that happened to them in the same periods. No participants provided obviously bogus responses in this task. Participants in the neutral condition did not have to do a recall task.

In the action, choice, and event conditions, participants were asked to rate the difficulty of the recall task on a 7-point scale ranging from *very difficult* to *very easy*. They were then administered the manipulation check item, "While you were answering the questions on the previous pages, to what extent were you focused on you yourself as driving what you do versus on the environment as driving what you do?" The 7-point response scale ranged from *I was completely focused on how the environment was driving what I do* to *I was completely focused on how I myself was driving what I do*. Participants in the neutral condition were not asked these questions.

4.1.3. Instruction check

Rather than identifying distracted participants by their self-report, we included a behavioral measure of distraction in this study that was not included in the previous studies. Following measures suggested by Maniaci and Rogge (2014), after the manipulation, participants were presented with a filler scale containing 6 actual items along with two instruction check items. The first instruction check item asked them to select "Strongly disagree" on the response scale, whereas the second asked them to skip the item. Thirty-five participants who failed either instruction check were dropped from the analyses.

4.1.4. Dependent measure

Thereafter, participants were presented with three scenarios in which a decision maker in a position of authority made an ethically questionable decision (adapted from Gino et al. (2009, Study 2, p. 40)).

In the first scenario, the manager of a sewage treatment plant had to decide whether to build a backup storage system in case there was heavy rain while the plant was shut down for remodeling and upgrading. The chance of a heavy rain was stated as being 10%. The manager decided not to build the backup storage. Participants in the positive outcome condition read that there was no rain while the plant was shut down and everything went as planned. Participants in the negative outcome condition read that there was heavy rain that led sewage to leak into the river, which caused people to get sick, killed fish and animals, and polluted the river.

In the second scenario, the commissioner of a government agency had to decide whether to build tents (providing less protection) or shacks (providing more protection) for people who were made homeless by a hurricane. Temperatures dropped below the freezing point about once every four winters. The commissioner decided not to build the shacks. Participants in the positive outcome condition read that the temperature stayed above the freezing point during the winter, so there were no casualties. Participants in the negative outcome condition read that the temperature dropped below the freezing point during the winter, killing 50 children.

In the third scenario, the mayor of a wealthy town located upstream on a river had to decide whether to invest in water conservation measures. Downstream communities faced water shortage once every 10 years. The mayor decided not to invest in the measures. Participants in the positive outcome condition read that there was sufficient rainfall. Participants in the negative outcome condition read that there was insufficient rainfall and 46 downstream farmers suffered for lack of water.

For each scenario, participants were asked to rate how unethical the decision was and the extent to which the decision maker should be punished for his or her action on 7-point scales ranging from *not at all to extremely* (adapted from Gino et al. (2009)). Participants were also asked how predictable the outcome was on a 7-point scale ranging from *very unpredictable to very predictable*.

4.1.5. Additional measures

After the dependent measure, as in Experiments 1 and 2, we administered a 10-item bipolar involvement scale with half the items reverse-scored, and five participants who gave the same response to all 10 items were dropped from the analyses.

4.2. Results

4.2.1. Preliminary analyses

Analyzing data from the three conditions that received the manipulation, we found that the difficulty of the recall task differed by condition, $F(2, 535) = 9.26, p = .001$. The choice condition was the most difficult, $M_{\text{choice}} = 5.09, SE = .11$, the event condition was moderately difficult, $M_{\text{event}} = 5.34, SE = .12$, and the action condition was the least difficult, $M_{\text{action}} = 5.76, SE = .11$. Tests of marginal effects indicated that the choice condition and the event condition were significantly more difficult than the action condition, p 's < .02, but the choice condition and event condition did not differ from each other, $p = .12$. Given that the difficulty measure was not administered in the neutral condition, we could not control for difficulty of the task in the main analyses. However, as the difficulty level of the key experimental condition—event construal—was in between the two control conditions—action

and choice—difficulty of the task is unlikely to have been a confounding variable.

Analyzing the manipulation check data from the three conditions that received the manipulation, an ANOVA confirmed that whether participants viewed themselves or external factors as driving their actions significantly differed by condition, $F(2, 534) = 6.63, p = .001$.² Participants in the event construal condition, $M_{\text{event}} = 4.73, SE = .13$, were more likely to focus on external factors than those in the action condition, $p < .001, M_{\text{action}} = 5.33, SE = .12$, or the choice condition, $p = .004, M_{\text{choice}} = 5.23, SE = .12$. The action condition and choice condition did not differ from each other, $p = .58$.

Analyzing data from all four conditions, an ANOVA confirmed that participants' involvement with the ethical decision making task did not significantly differ by condition, $F(3, 756) = 1.00, p = .39$.

We averaged participants' ratings of how predictable the outcome was across the three scenarios, $\alpha = .65$. An ANOVA indicated that the predictability of the outcome did not significantly differ across the four priming conditions, $F(3, 756) = 2.01, p = .11$.

4.2.2. Main analyses

Participants' judgments of ethicality and punishment were highly intercorrelated across the three scenarios, and thus were averaged, $\alpha = .89$. We refer to this variable as the behavioral judgment measure. We ran a regression with the behavioral judgment measure as the dependent measure, outcome condition (positive outcome = +.5 and negative outcome = -.5) as a predictor, along with three contrasts. Contrast 1 tested whether the action and choice conditions were different from each other (+1, -1, 0, 0). Contrast 2 tested whether the mean of the action and choice conditions was different from the neutral condition (-1, -1, +2, 0). Finally, Contrast 3 tested whether the mean of the action, choice, and neutral conditions was different from the event condition (-1, -1, -1, +3). We also included interactions between these contrast variables and the outcome valence condition.

The main effect of Contrast 1 was non-significant, $B = -.043, SE = .068, t(752) = .64, p = .52$, indicating that the mean judgment of ethicality/punishment (averaged across positive and negative outcomes) did not differ across the action and choice conditions. The main effect of Contrast 2 was non-significant, $B = -.048, SE = .037, t(752) = 1.29, p = .20$, indicating no difference between the neutral condition and the action and choice conditions combined. Notably, the main effect of Contrast 3 was significant, $B = .086, SE = .029, t(752) = 2.95, p = .003$, indicating that compared to the neutral, action, and choice conditions, participants in the event construal condition viewed the decisions as more unethical and deserving of punishment regardless of the outcome valence.

A main effect of the outcome valence indicated that overall, participants judged the decision maker as more unethical and deserving more punishment in the negative outcome condition than in the positive outcome condition, $B = -1.82, SE = .096, t(752) = 18.96, p < .001$, indicating presence of the outcome bias. The Contrast 1 \times outcome valence interaction was nonsignificant, $B = .024, SE = .14, t(752) = 0.18, p = .86$, indicating that there was a similar extent of outcome bias in the action construal and choice construal conditions. The Contrast 2 \times outcome valence interaction was also nonsignificant, $B = -.050, SE = .074, t(752) = 0.68, p = .50$, indicating that there was a similar extent of outcome bias in the neutral condition as in the action and choice conditions combined. Finally, the Contrast 3 \times outcome valence interaction was significant, $B = .13, SE = .058, t(752) = 2.19, p = .029$, indicating that there was a smaller outcome bias in the event construal condition than

² One participant did not answer the manipulation check item.

Table 1

Means and standard deviations (in parentheses) of evaluations of ethically questionable decisions followed by either positive outcomes or negative outcomes, by condition.

Condition	Negative outcomes	Positive outcomes
Neutral	4.97 (1.23)	2.92 (1.26)
Action	5.09 (1.22)	3.17 (1.37)
Choice	4.98 (1.28)	3.11 (1.37)
Event	5.10 (1.31)	3.67 (1.49)

Note: Scale 1 (more ethical) to 7 (more unethical).

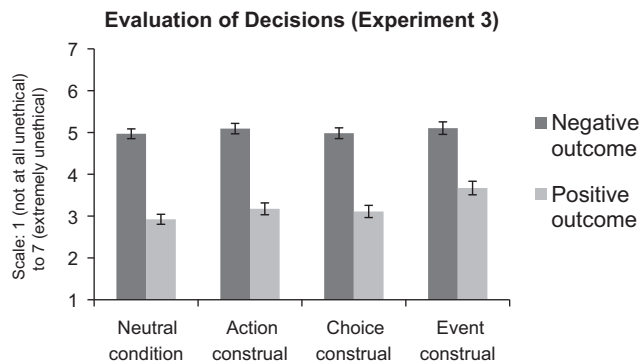


Fig. 3. Mean evaluation of ethically questionable decisions followed by either positive outcomes or negative outcomes, by condition. Error bars indicate the standard error of the mean.

in the neutral, action, and choice conditions combined (see Table 1 and Fig. 3).

The same response pattern held when analyzing the two dependent measures (unethicalness of the behavior and the extent to which the decision maker should be punished) separately—the key Contrast 3 × outcome valence interaction was significant for each, $ps < .04$.

4.3. Discussion

Experiment 3 conceptually replicated the findings of Experiments 1 and 2 in the domain of ethical decision making. Participants viewed a decision maker who made ethically questionable decisions as more unethical and deserving more punishment when a negative outcome followed the decision than when a positive outcome followed the same decision, but this effect was smaller among participants in the event construal as compared to participants in either action, choice, or neutral construal conditions. Notably, in addition to reducing the outcome bias, the event construal condition led participants to view ethically questionable decisions as overall more unethical and deserving more punishment. Event construal thus appears to have helped people take a step back and appreciate the overall ethically questionable nature of the decision by itself.

This study helped clarify a number of potential issues. First, the level of outcome bias was similar in the action construal condition, the choice construal condition, and a neutral condition in which there was no experimental intervention before the outcome bias measure was administered, indicating that the action and choice conditions used in Experiments 1 and 2 indeed served as appropriate control conditions. Second, whereas the textual analysis of participants' responses to the manipulation in Experiment 2 indicated that participants in action, choice, and event conditions thought about causes to a similar degree, Experiment 3 showed that they thought about different types of causes—those in the event construal condition were more likely to focus on external causes

outside the individual compared to those in the action and choice conditions. Third, Experiment 3 also showed that it is not the case that event construal made participants view the outcome as more or less predictable compared to the other conditions. This null finding is not surprising given that the probability of the outcome was explicitly stated in each scenario, so the degree of unpredictability is unlikely to have been influenced by the manipulation.

5. General discussion

Across three experiments, we showed that inducing participants to construe person–environment interactions as events (rather than as actions or choices) significantly reduced the outcome bias, a persistent judgment error that occurs when people judge a decision as good or bad based on the outcome following the decision (Baron & Hershey, 1988). Experiment 1 showed that participants who watched a video and indicated when something happened to the actor (compared to when the actor touched an object or when the actor made a choice) were less influenced by whether a medical decision was followed by a positive outcome or a negative outcome when evaluating the quality of the decision. Experiment 2 demonstrated that participants who recalled things that happened to them during the previous day (compared to those who recalled things they did or the choices they made) were less influenced by whether a risky decision was followed by a positive outcome or a negative outcome when evaluating the quality of the decision. Experiment 3 found that participants who recalled events from the previous day (rather than recalling actions, recalling choices, or not recalling anything) were less influenced by whether an ethically laden decision was followed by a positive outcome or a negative outcome when evaluating the ethicality of the decision and the extent to which the decision maker should be punished. Experiment 3 further found that event construal led to harsher judgments of the ethically questionable decisions compared to action construal and choice construal, irrespective of the outcome.

5.1. Limitations and future directions

5.1.1. Relationship with locus of control

Whereas the present studies found that event construal had a positive consequence—reducing the outcome bias—the related literature on locus of control has demonstrated that an external locus of control, which is similar to event construal, has a number of negative consequences, such as learned helplessness (Abramson et al., 1978). Event construal might not have similar consequences as an external locus because event construal does not require that people view themselves as without control, just that they perceive mundane person–environment interactions as determined in part by external factors. Future research might simultaneously manipulate event construal and locus of control to identify cases in which the two have similar consequences versus in which they have different consequences.

5.1.2. Strength of the manipulation

Although event construal reduced the outcome bias in each of the three studies, it did not eliminate the outcome bias in any study. One reason this might be the case is that although event construal increased participants' tendency to view external factors outside the person as causal agents compared to the control conditions, it did not lead them to view external factors as the primary cause. Indeed, the manipulation check included in Experiment 3 showed that even in the event construal condition, participants viewed themselves as having more causal power than external factors. In other words, although our manipulations were strong enough to reduce participants' emphasis on personal causation,

they were not strong enough to eliminate this tendency. Future research can explore whether stronger manipulations that lead people to attribute full causality to external factors (such as lack of action–outcome contingency; Whitson & Galinsky, 2008) can eliminate the outcome bias.

Additionally, the tendency to under-appreciate the extent to which external factors outside the decision maker's control are responsible for the outcome is probably only one of multiple causes of the outcome bias. Therefore, it is not surprising that attacking this tendency reduced but did not completely eliminate the bias. Future research can investigate other causes of the outcome bias apart from the failure to consider external causal factors, and whether supplementing the event construal manipulation with other manipulations designed to target additional causes might lead to further reductions in the outcome bias.

Although event construal did not completely eliminate the outcome bias, the reduction observed is important both theoretically and practically. Theoretically, the finding that inducing people to think of events—things that happened to them or to others—reduces the outcome bias suggests a potential source of the bias that has not been considered in previous research (e.g., Baron & Hershey, 1988)—the tendency to under-emphasize external factors outside the individual's control that influence the outcome. Knowledge of an important cause of the outcome bias might spur research in related domains, such as the hindsight bias (Hawkins & Hastie, 1990), overconfidence (Moore & Healy, 2008), and counterfactual thinking (Roese, 1997), as similar processes might be at play in these areas. Practically, given that the outcome bias is a pervasive bias influencing consequential decisions in business (Mauboussin & Callahan, 2013), law (Kamin & Rachlinski, 1995), and medicine (Arkes, Wortmann, Saville, & Harkness, 1981), even a small reduction in the outcome bias can have significant practical benefits. For example, studies of the outcome bias by institutional investors, who have been found to annul previous investment decisions based on short-term outcomes of their investments, have estimated foregone value at \$170 billion, or approximately 1.3% of the fund inflows (Stewart, Neumann, Knittel, & Heisler, 2009; see also Frazzini & Lamont, 2008). Therefore, even some reduction in the outcome bias among institutional investors can lead to substantially higher earnings.

5.1.3. Asymmetric influence on positive versus negative outcomes

Although outcome bias is defined as the *difference* in evaluation of a decision followed by a positive outcome versus the same decision followed a negative outcome, a cursory examination of the figures reveals that event construal appears to have more of an impact on evaluations of decisions followed by negative outcomes than of decisions followed by positive outcomes (compared to the control conditions) in Experiment 1 and vice versa in Experiment 3. A key distinction between the two experiments that can perhaps explain this asymmetry is the match between the outcome and the valence of the decision making context. For example, in Experiment 1, participants' evaluations of the medical decisions were positive on average, but in Experiment 3, participants' evaluations of the unethical decisions were negative on average. It is possible that when people view a decision favorably at baseline, they are more surprised by negative outcomes, and thus evaluations of negative outcomes drive the outcome bias. In contrast, when people view a decision unfavorably at baseline, they are more surprised by positive outcomes, and thus evaluations of positive outcomes drive the outcome bias. Future research can investigate this possibility by simultaneously manipulating the favorability of the decision making context along with the valence of the outcome.

5.1.4. Generalizability of the dependent measures

The dependent variables used in the present studies were attitudinal in nature, asking participants to evaluate the quality of decisions on rating scales. Future research can investigate whether event construal reduces the outcome bias even when outcome bias is measured behaviorally rather than attitudinally, such as by measuring how much rewards or fines participants are willing to give to agents following decisions that were followed by either positive outcomes or negative outcomes. Such a step would be necessary for determining whether the extent to which event construal reduces the outcome bias is significant enough to be of practical relevance in real world settings (such as accounting, finance, and law).

Although outcome bias focuses on the special case in which the outcome is determined by factors outside the individual's control, in other cases, the outcome can be a direct cause of the decision. For example, an employee might sabotage a coworker by offering them a chocolate with peanut traces right before an important presentation, knowing fully well that the coworker is allergic to peanuts. Might an event construal lead the sickened person to forgive the wrongdoer, thinking “it just happened” instead of “my coworker deliberately tried to make me sick”? Future research can investigate whether event construal reduces the extent to which people hold individuals accountable for their decisions and forgive people for intentionally harmful decisions.

Future research can examine additional consequences of event construal compared to action, choice, or other construals. For example, previous research has found that when people are in a choice construal, they are more tolerant of wealth inequality in society (Savani & Rattan, 2012) and less sympathetic toward disadvantaged individuals (Savani et al., 2011). Might an event construal reverse these effects, making people more concerned about wealth inequality and to have more sympathy for disadvantaged others? If individuals view outcomes as determined by external factors, then they might realize that many individuals end up in bad circumstances because of societal or structural factors rather than because of bad decisions, and become more likely to support programs that help disadvantaged individuals.

5.1.5. Negative consequences of event construal

There are certainly cases in which event construal is likely to be deleterious. For example, given that people are unaware of the number of food-related decisions that they make in everyday life (Wansink & Sobal, 2007), individuals who view their food and drink consumption as externally determined events are likely to end up overeating or end up eating nutritionally suboptimal foods. Indeed, a chronic event construal mindset in this domain (e.g., the idea that “I'll eat whatever is available”) might be one of the causes of the existing obesity epidemic (Jeffery & French, 1998). Instead, an alternate choice construal, in which people are aware of all the food and drink related decisions they make throughout the day, might lead to more optimal consumption.

5.1.6. Generalizability of the participant population

One limitation of our studies is that they were conducted with participants from the United States and were run entirely in English. Past research indicates that there are cultural and linguistic differences in people's construal of person–environment interactions in intentional versus nonintentional terms. For example, compared to Americans, Indians were less likely to view the same actions as intentional choices (Savani, Markus, Naidu, Kumar, & Berliã, 2010). When thinking about causes of events, Asians tend to recruit and consider a broader range of personal and situational explanations than Westerners (Choi, Dalal, Kim-Prieto, & Park, 2003; Miller, 1984; Morris & Peng, 1994). Compared to English speakers, Japanese speakers attended less to individual actors

implicated in accidental events (Fausey et al., 2010). These findings suggest that if an important source of the outcome bias is people's failure to appreciate the role of external factors in determining the outcome, then *ceteris paribus*, the outcome bias might be smaller in Asian cultures than in Western cultures. Future research might examine this intriguing possibility.

5.1.7. Designing applied interventions

Given that most research on the outcome bias since Baron and Hershey (1988) has been in the applied fields of medicine (e.g., Gupta et al., 2011), law (Hastie et al., 1999), and accounting (Kennedy, 1993), our research suggests interventions for reducing the bias in these settings. For example, before physicians view the results of an important test, asking them to recall past medical events is likely to reduce their chances of falling prey to the outcome bias. Perhaps a small intervention such as a prominent message to this effect on the envelope enclosing the results of a medical test, or at the beginning of the e-mail providing the test results, might be effective. Future research can test the effectiveness of more subtle manipulations implemented over a longer period of time in applied settings.

5.2. Conclusion

The current research suggests that the key to adaptive decision making is to be flexible enough to switch between construing one's interactions with the environment as actions and choices driven by the individual versus as events driven by external factors. Action and choice construals would be helpful in cases in which there is a close link between the quality of the decision and the quality of the outcome (e.g., quality and quantity of food consumed and subsequent health outcomes) but an event construal may be more adaptive in circumstances in which people's actions are unintentional (e.g., breaking an expensive vase by mistake) or in which the outcomes that people encountered are primarily driven by external factors (e.g., getting stuck in traffic because of a recent road accident).

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Appendix A

Items used in the dependent variable of Experiment 1, adapted from Baron and Hershey (1988, pp. 571–572).

A.1. Stem for items 1–4

A 55-year-old man had a heart condition. He had to stop working because of chest pain. He enjoyed his work and did not want to stop. His pain also interfered with other things, such as travel and recreation. A type of bypass operation would relieve his pain and increase his life expectancy from age 65 to age 70. However, 8% of the people who have this operation die from the operation itself.

A.2. Stem for items 5–8

A 55-year-old man had a liver condition. He had to stop working because of liver pain. He enjoyed his work and did not want to

stop. His pain also interfered with other things, such as travel and recreation.

A type of bypass operation would relieve his pain and increase his life expectancy from age 65 to age 70. However, 8% of the people who have this operation die from the operation itself.

Item 1/5: His physician decided to go ahead with the operation. The operation succeeded. Evaluate the physician's decision to go ahead with the operation.

Item 2/6: His physician decided to go ahead with the operation. The operation failed and the man died. Evaluate the physician's decision to go ahead with the operation.

Item 3/7: The man decided to go ahead with the operation. The operation succeeded. Evaluate the man's decision to go ahead with the operation.

Item 4/8: The man decided to go ahead with the operation. The operation failed and the man died. Evaluate the man's decision to go ahead with the operation.

A.3. Stem for items 9–12

A patient's presenting symptoms and history suggest a diagnosis of globoma, and if it is not globoma, it will be popitis. The two diseases were considered equally likely.

Test 1 indicated globoma correctly in 92% of patients with globoma, and indicated popitis correctly in 80% of patients with popitis. Test 2 indicated globoma correctly in 86% of patients with globoma, and indicated popitis correctly in 98% of patients with popitis.

If globoma was treated (by surgery), the treatment was always successful. But if popitis was treated, the treatment was successful only one-third of the time.

Item 9: The physician chose Test 1 and the test indicated globoma. The physician decided to go ahead with the operation. The operation succeeded. Evaluate the physician's decision to perform Test 1.

Item 10: The physician chose Test 1 and the test indicated globoma. The physician decided to go ahead with the operation. The operation failed. Evaluate the physician's decision to perform Test 1.

Item 11: The physician chose Test 1 and the test indicated popitis. The physician decided to go ahead with the operation. The operation succeeded. Evaluate the physician's decision to perform Test 1.

Item 12: The physician chose Test 1 and the test indicated popitis. The physician decided to go ahead with the operation. The operation failed. Evaluate the physician's decision to perform Test 1.

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