Event detail and confidence in gambling: The role of counterfactual thought reactions

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ABSTRACT

Differences in people's reactions to the same events described with full vs. sketchy information are examined. It is hypothesized that differences in counterfactual thought reactions to varying levels of event detail shape confidence in, and willingness to gamble on similar, future events. In three experiments, participants were presented with different types and levels of event detail about their performances on a trivia test, on several games of blackjack, or on gambling on a professional horse race. Upward counterfactual thoughts were observed more frequently in response to losing events containing high levels of detail and specificity. Importantly, counterfactual thought frequency also mediated the relationships between event detail and the level of confidence in and willingness to gamble on similar, future events. Evidence also indicates that this relationship is based on the hindsight bias that results from counterfactual thinking. Results are discussed in terms of cognitive processes and decision making research.

The way that people react to events and outcomes depends in large part on the amount and type of information that is available about the events. Our investigation is focused on how the amount and detail of the information that one receives about a decision, in this case a losing decision, affect the emotional and behavioral reactions to that decision. In particular, we examine the effects that these reactions to the event have on future decisions and on the confidence that people have in making successful decisions in the future for similar events.

Our predictions regarding the effects of the amount and detail of information about events that involve decisions with undesirable outcomes are grounded in theoretical and empirical work surrounding counterfactual thinking (Epstude & Roese, 2008; Kahneman & Miller, 1986; Kahneman & Tversky, 1982; Roese & Olson, 1995). We propose that the amount and detail of information about the event determines the number of counterfactual thoughts that are generated. Further, we propose that the frequency of counterfactual thoughts mediates between the amount and detail of information that one receives about the losing event and subsequent behaviors and levels of confidence when similar decisions must be made in the future. Thus, we shall first provide a background of relevant, previous ideas and results concerning the generation of counterfactual thoughts.

Counterfactual thinking

Norm theory (Kahneman & Miller, 1986) holds that reactions to an event are very much influenced by perceived normality. When the various aspects of the event are not normal or expected and the outcomes are undesirable, people mentally simulate alternatives to reality (Kahneman & Tversky, 1982). That is, they mentally undo specific features of an event. These counterfactual alternatives are then used as comparison standards against which the actual outcome is compared. Comparison standards are extremely important in determining affective, judgmental, and behavioral reactions to events and outcomes. In judging one's own performance, one might use one's past performance, one's ideal performance, or the performance of others as a standard of comparison. Affective, cognitive, and behavioral reactions depend on the standard one uses. One might also use a counterfactual world (i.e., what might have been) as a comparison standard. The comparison to a counterfactual world, and which counterfactual world is chosen for comparison, can have important effects on feelings of regret, judgments of causality, and subsequent behaviors (Epstude & Roese, 2008; Roese & Olson, 1995).

Research over the past 20 years has identified factors that determine the frequency and influence of counterfactuals. For instance, people are more likely to generate counterfactuals when the actual events involve abnormal features (Wells & Gavanski, 1989), the outcome is a near miss (Kahneman & Varey, 1990), and the decision involves actions rather than inactions (Kahneman & Miller,

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1986). In this paper, we focus on another important factor in determining the generation of counterfactuals. The greater the amount and detail of information that one has about an event, the more likely he/she is to generate counterfactual alternatives. Clearly, in order to mutate aspects of reality, one must know about some factors that can in fact be mutated. If one knows only the outcome of a game, for example, it is difficult to think about alternative scenarios whereby the outcome of the game might have been different. The more detailed information that one has, the easier it is to find factors that, if altered, could have turned a loss into a win.

This prediction is derived from Kahneman and Miller's (1986) treatment of counterfactual generation. According to Kahneman and Miller, it is the presence of specific mutable antecedent conditions that allows the generation of counterfactual alternatives, especially when these conditions are unexpected and when the outcome is undesirable. In this case, counterfactual alternatives will be used as comparison standards against which the actual facts are evaluated. In the absence of specific features that are easily mutated, people will construct standards of judgment from pre-existing expectations rather than from counterfactual alternatives to reality. The likelihood of engaging in counterfactual thinking requires that mental models are developed by chaining together specific pieces of information to form inferences (Byrne, 1997, 2005; Feeney & Handley, 2006).

The idea that event detail is predictive of counterfactual generation is also consistent with the theorizing of Sherman, Beike, and Ryalls (1999), who noted that people react to a general event very differently from the way they respond to any specific event of the same type. For instance, people are more willing to expend resources to assist specific, identified victims of unfortunate events than they are for the same number of unidentified or "statistical" victims (Jenni & Lowenstein, 1997). The greater compassion and compensation offered to specific victims has been termed the "identifiable victim effect" by Small and Loewenstein (2003). In proposing a possible mechanism to account for the different reactions to general vs. specific events, Sherman et al. (1999) argued that the propensity to engage in counterfactual thinking is greater when processing specific events than it is when judging general events (see also Sanna, Schwarz, & Stocker, 2002). They reasoned that specific events draw people's attention toward mutable features more so than do general events. Because the mutable features of specific events are more salient and easier to counterfactualize, alternatives to reality are more likely to emerge in response to specific events than to the vague and unspecified features of general events.

Sherman et al.'s (1999) discussion of norm theory and reactions to general and specific events also sheds some light on the hypothesis that counterfactual thinking mediates the influence that the type of event (i.e., general vs. specific) has on affective, evaluative, and behavioral responses. This hypothesis is grounded in the notion that reactions to an event are very much affected by the comparison case adopted when processing that event. If specific, but not general, events increase one's attention toward mutable features, and people tend to counterfactualize such features, then the two types of events are likely to possess very different standards of comparison. Take the case of a coach of a professional basketball team. He would probably be more than willing to accept an average of nine turnovers committed by his team per game, and even perceive the attainment of such a goal as exceptionally good. However, even if the general goal is met, in the case of each and every specific turnover, his response may be characterized by a range of negative affects.

According to Sherman et al. (1999), judgments of events and outcomes described in general terms are shaped largely by comparisons to pre-event expectations. In the case of the basketball coach's feelings about his team's global average of nine turnovers per game, he may see no viable alternatives to which to compare this general rate than the team's expected average (shaped by the team's previous rate, his ideal, or another team's rate). However, any specific turnover is likely to elicit a number of counterfactual alternatives, resulting in a much different comparison case, and a much different set of responses. For example, specific event information, such as the referee's interference on the play may prompt the coach to generate upward counterfactuals as a function of his focus on the possibility that the turnover would not have occurred had the referee not been in the way. This will lead to strong emotions. However, when thinking about turnovers in general, this specific information is not likely to be accessible or available, and thus a different reaction (one involving less extreme affect) is likely to emerge. Essentially, different standards of comparison for general and specific events are likely to result in different affective, evaluative, and behavioral reactions. These propositions were tested empirically in the current research.

The effects of counterfactual thinking

The first part of our derivation is that the greater the event detail, the more counterfactuals one will generate in response to that event. We now focus further on the specific effects that such a difference in counterfactual generation should have. It is important at this point to specify the kinds of situations and outcomes with which we shall be concerned. Our focus is on losing rather than winning events. In addition, we focus on events where skill and learning play only a minor role. That is, these are situations such as gambling (where the outcomes are based primarily on luck) or tasks where learning from feedback would be extremely difficult and unlikely. Our focus is on undesirable outcomes because they are most likely to lead to counterfactual generations. In examining reactions to bets on football games, Gilovich (1983) reported that far more counterfactuals were generated in response to losing as opposed to winning bets. These counterfactuals are most likely to be upward counterfactuals, which mutate losses into wins (Markman, Gavanski, Sherman, & McMullen, 1993).

What are the likely effects of increased counterfactual generation in response to a losing decision? Two effects have been well-documented. First, generating upward counterfactuals makes one feel worse about the bad outcome (Markman et al., 1993) – "It could have and should have never happened." Second, these upward counterfactuals lead one to be better prepared for future similar decisions (Markman et al., 1993; Roese, 1994) – "I see how the loss could have been avoided, and I won't make that same mistake again." The idea that upward counterfactual thinking leads to improved performance in the future has recently been formalized by Epstude and Roese (2008) in their functional theory of counterfactual thinking. According to this theory, counterfactual thinking is viewed as a useful and beneficial component of behavior regulation. The upward counterfactual thoughts that are activated by a failed goal specify what might have been done differently to achieve the goal. These thoughts will improve subsequent behavior either by engaging a content-specific pathway that provides a regulatory sequence that replaces a failed behavior with one that is more likely to succeed (Smallman & Roese, 2009) or by engaging a content-neutral pathway that improves performance by engaging enhanced attentional, cognitive, or motivational processes. In either case, the counterfactuals that are generated generally help to improve future performance. Similarly, Kray and Galinsky (2003) have shown that the activation of a counterfactual mind-set can improve performance, and Morris and Moore (2000) have demonstrated a positive relationship between counterfactual generation and learning.

We do not disagree with this functional approach that proposes a general improvement in subsequent performance when counterfactuals are generated in response to a poor or losing decision. Very often these counterfactuals point to effective means for doing better (e.g., "If I had not gone out drinking before the exam, I would have passed"). However, as noted, we are concerned with losing situations where one cannot easily learn what the better behaviors might be. These are gambling-type situations in which the outcomes are determined primarily by luck or difficult tasks in which learning from a failed choice is highly unlikely. In such situations, are people still likely to generate counterfactuals that would have changed the losing outcome into a winning outcome? Are they likely to view these counterfactuals as indicative of behaviors that will indeed improve future performance if adopted? Are they likely to have greater confidence in the likelihood of future success because these counterfactuals seem to point the way to future success or because they see ways in which they could have or should have made a winning decision? Are they then willing to bet more money on their likelihood of success in the future? We believe that the answer to all these questions is yes.

It is important to note that the functional theory of counterfactual thinking does not necessarily conflict with our predictions or conclusions. As Epstude and Roese (2008) stated: "…counterfactuals are instead seen as mostly beneficial, yet with important dysfunctional exceptions that may emerge under particular conditions." (p. 170). We focus on some of these particular conditions in our studies and note that these are not unusual or unique conditions. We believe that they emerge on a regular basis in most gambling situations from casinos to race tracks. We believe that the effects specified by the functional view of counterfactual thinking will also occur following losing decisions in gambling situations. That is, losing gamblers will develop a belief in a causal chain that specifies how performance can be improved and an increased confidence for future success. However, in this case, the confidence and the causal chain that are developed are not warranted and will not improve subsequent performance. Because most work in the area of the functions of counterfactual thinking have focused on situations where counterfactuals will help to improve future performance, it is important to investigate situations where the same cognitive and emotional effects of counterfactual thought will have negative effects on future performance.

Thus, we propose that counterfactual generation is likely to have important effects on losing gamblers. Their counterfactuals will leave them feeling more like winners. "If not for the bad decisions of others or the freak plays, my bet would have won."; or "If I had only made the choice that I 'knew' was the right choice, I would have won." Thus, these types of counterfactuals will lead losing gamblers to feel like very good decision-makers. They will feel competent and confident about future similar gambles. In such cases, gamblers will not learn from their losses. Even though their mutations would have led to success in the present case, these are not indicative of a general strategy or principle that can be used effectively in the future. They will feel more like winners, but they will not have gained any knowledge that will make them more likely to win in the future. Thus, they will continue to make the same kinds of losing decisions with far more confidence than is warranted (see also: Dillon & Tinsley, 2008; Wohl & Enzle, 2003).

We propose that these kinds of counterfactuals and their effects are likely to occur primarily when one possesses details about the facts and factors that might have been different. When one knows only vague, general information about the event or knows only the outcome of the event, it is difficult to generate the kinds of counterfactuals that will lead to confidence in one's abilities and in future success. This, then, is our major prediction: To the extent that one has information and details about an event where one's choice has led to a loss, one will generate upward counterfactuals. More

importantly, in situations such as gambling, these upward counterfactual generations will cause one to feel like a better decision-maker, will give one greater confidence in future gambling choices,[1] will give one a false sense of optimism, and will increase betting in future gambling situations.

Thus, the gambler who watches a basketball game in which her/his team loses will generate more counterfactual thoughts, will be more confident about a bet on the next game, and will bet more money on this future game than a gambler who knows only the outcome of her/his losing bet. Such a prediction is consistent with, and is grounded in, important research that was conducted by Gilovich (1983). Gilovich found that gamblers who bet on a losing team in a basketball game, in which a fluke event was a key aspect of the loss, focused heavily on the fluke event. This focus allowed the losers to feel that they had made a good decision and led them to want to bet more money on the same team if a rematch took place. However, Gilovich (1983) did not directly examine the key mediating role of counterfactual generation. In addition, our proposal does not require the existence of any fluke event. Given enough detail, losing gamblers will always find ways in which their loss could have been a win. In fact, because gamblers are highly motivated to see themselves as good decision-makers, our predictions are consistent with other findings of motivated bias in decision making (Kunda, 1990; Molden & Higgins, 2008). Paradoxically, then, gamblers who lose, rather than learn that they are not very successful at betting, may in fact be just as confident about future success as gamblers who win – provided that they have the information upon which to create counterfactual worlds.

Overview of experiments

Three experiments were designed to examine whether counterfactual thoughts emerge more frequently in response to events that contain more information and more detail. In addition, these experiments examine whether such counterfactual generation serves as a mechanism by which event detail shapes an individual's decisions and confidence regarding a similar, future event. Experiment 1 examined judgments of one's own subjective confidence for a future trivia test and willingness to bet on this future performance, after exposing participants to different levels of event detail regarding their performance on an initial trivia test. Experiment 2 examined counterfactual thoughts in reaction to blackjack outcomes and assessed betting confidence for a future game, after providing participants with different levels of detail about their actual initial performance. Experiment 3 involved participants' reactions to their losing betting decisions in a video-recorded (rigged) horse race. The degree of information and detail about the race was varied. In addition to examining counterfactual generation and its subsequent effects on future confidence and betting behavior, Experiment 3 also investigated the role of hindsight bias in these effects. Hindsight bias refers to the finding that, once an outcome is known, people overestimate how foreseeable such an outcome was in foresight (Fischhoff, 1975; Hawkins & Hastie, 1990). Roese and Maniar (1997) found that counterfactual thinking and hindsight bias can go "hand in hand." Counterfactual

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[1] In a study of counterfactual mind-sets, Kray and Galinsky (2003) found that participants given such a mind-set made better decisions but did not show greater confidence in these decisions. There are, however, important differences between that study and the present studies. Most important, participants in the Kray and Galinsky experiment did not generate counterfactuals about an initial choice that turned out badly. There was nothing that they could "learn" that might improve or seem to improve a subsequent performance. In addition, the better decisions that were made by their participants with a counterfactual mind-set went against the decision that was made by the vast majority of control participants. So, if anything, participants with a counterfactual mind-set might show decreased confidence in their counter-normative decision.

thoughts indicate that, if something different had occurred, one would have (and should have) won (see also Nestler & von Collani, 2008). Therefore, given the conditions that did in fact exist, the outcome may appear far more inevitable, and this perceived inevitability is reflected in hindsight bias. Experiment 3 examined the roles of both counterfactual generation and hindsight bias in explaining the relation between event detail and subsequent feelings of confidence and optimism following a losing decision.

The following hypotheses were tested in each of the experiments. First, it was hypothesized that counterfactual thoughts would be associated with high levels of event detail. Second, the link between event detail and reactions to the event (as well as expectations regarding similar, future events) will be mediated by the relative frequency of upward counterfactual responses. Finally, we hypothesized that the effects of event detail in each experiment would be spontaneous. That is, the effect of the level of information on the dependent variables was expected to occur regardless of whether participants were specifically asked to list their thoughts.

Experiment 1: Detail of trivia test feedback

The purpose of Experiment 1 was to test whether the level of event detail for mistaken decisions leads to different cognitive responses that play a role in people's confidence in their own skills and in their willingness to gamble on this task. We propose that, by explaining away unfavorable outcomes and utilizing alternatives to reality as standards of comparison for estimating their abilities, poorly performing individuals will have a falsely, optimistic sense of their abilities that is actually counter-indicated by their poor performance.

When receiving detailed feedback performance on a task that involves multiple alternatives, such as a multiple-choice trivia test, people may find it quite easy to counterfactualize those items for which they receive feedback that they were wrong. "I knew I should have selected C." or "I was going to pick that alternative – I should have gone with my gut feeling." are common reactions in such cases. Students often make such comments following feedback multiple-choice exams. People can easily imagine themselves selecting the correct alternative, especially if they actually had considered it before giving their final answer. For people who receive feedback that is not detailed about their test performance (i.e., only their overall test score), such counterfactual alternatives for each item will not be readily available. They are unaware of which of their answers were incorrect or correct. If highly detailed feedback, as opposed to more global feedback, leads one to counterfactualize reality and use a more optimistic standard of comparison, then receiving detailed information should lead to expectations of better future performance, as well as estimates of greater confidence, than does global information. Interestingly, then, those who get detailed information about specific items on a test will expect to do better on a future similar test than will those who do not. This effect on future expectations will be mediated by the counterfactual thoughts generated in response to the detailed information.

Participants were asked to complete a multiple-choice trivia test. Before they began responding, they reported their pre-test expectations. Participants received either detailed or global false feedback regarding their performance. All participants were led to believe that they responded correctly to 35% of the total trivia items regardless of their actual performance. Half of the sample was asked to complete a thought-listing task (after each item or after the completion of all trivia items, depending on the level of detail condition); the other half was not. This was done to determine whether counterfactual thoughts are generated spontane-

ously in this type of situation. If the same effects are observed with or without specific instructions to generate counterfactuals, we can assume that participants spontaneously generate counterfactual alternatives to reality. Markman et al. (1993) and Sanna and Turley (1996) have presented evidence for spontaneous counterfactual generation with methodologies that differed from ours. Participants were then asked to respond to questions regarding how well they would expect to perform on a similar, future trivia test. Most importantly, we examined whether counterfactual thinking acts as a mediator between the type of event feedback received and judgments about future events. However, because counterfactuals should be more impactful for judgments among those who are exposed to high levels of event detail, we also tested the possibility that counterfactuals act as a moderator with regard to the type of event feedback received and judgments about future events.

Method

Participants

A total of 132 undergraduate students, enrolled in psychology courses at Indiana University, participated in the experiment for partial fulfillment of course credit. Each experimental session included a maximum of four participants.

Materials

A goal of the current experiment was to control the level of detail of performance feedback given to each participant as well as the level of performance success. Multiple-choice trivia items (20) were designed such that each item's alternative answers were perceived as feasibly correct (boosting the perceived validity of any false feedback). A pilot test ($N = 33$) identified twenty such trivia items. Examples of trivia items included "Of the following fruits, which contains the most calories? A. Orange, B. Pear, C. Plum;" "Which of the following amounts of U.S. coins possesses the greatest total weight? A. 16 Quarters, B. 20 Nickels, C. 44 Dimes." Those items that showed a relatively even distribution of alternatives selected as the correct answer and that reached a correct response rate between 15% and 60% were selected from a larger set. The average overall performance rate on a second set of 28 participants was 35.4% correct ($M = 7.07$, $SD = 2.91$).

Procedure

All experimental materials were presented using MediaLab v2004 Research Software (Jarvis, 2004). The instructions of the experiment were self-paced. The experiment was introduced as a study of "what people think about as they respond to trivia questions." Participants were informed that they would be asked to respond to 20 trivia questions. To increase overall motivation and involvement in the task, participants were also informed that the names of the top ten high scorers would be entered into a drawing for a $30 prize. It was explained that the better they performed on the trivia test, the better their chances would be of winning the drawing.

Before participants began the trivia test, they were presented with sample items to inform them about the nature of the questions. These sample items appeared again during the test (items 8, 12, and 13). Importantly, participants were not given the correct answers to these items when presented as sample items, nor were they permitted to respond to them at this time. Participants were then asked how many items out of 20 they expected to answer correctly as well as how confident they were that they would perform at this expected rate using a 7-point scale anchored at *not at all confident* (1) and *extremely confident* (7). Participants were then presented with the items of the multiple-choice trivia test one at

a time. Participants were randomly assigned to one of two performance feedback conditions (low or high feedback detail).

Low feedback detail condition. After completing the entire trivia test, participants assigned to the low feedback detail condition were informed that they correctly answered 7 out of the 20 items (35%), regardless of their actual performance. These participants were reminded of the 20 trivia items (one per screen) with the answers they selected in parentheses (not the correct answers). Half the participants were also asked to complete a thought-listing task (typing one thought per screen) for each of the 20 items. Specifically, these participants were asked to list thoughts that went through their mind during the trivia test, after answering trivia items, and after the feedback that they got 7 out of 20 items correct. The other half of the low feedback detail participants were not asked to complete a thought-listing task. However, for these latter participants, a delay with a countdown was displayed at the bottom of the screen.

High feedback detail condition. Participants in the high feedback detail condition were also presented with performance feedback. However, they received feedback after responding to each item. The correct answer was revealed in cases where they were informed that they were incorrect. Some of this feedback was false, such that all participants were led to believe that they answered 7 of the 20 items correctly. That is, regardless of their responses, participants were informed that their response was incorrect for 13 items and correct for 7 items. False feedback was given only when necessary such that each participant's performance conformed to 35% correct.[2] Immediately after receiving feedback for each item, half the participants were asked to complete a thought-listing task. The other half of the participants were not (a countdown was displayed at the bottom of the screen).

Dependent variables. Following the listing of thoughts (or a delay), participants were asked to report how well they would expect to perform on a similar trivia test, consisting of 20 new items, by indicating how many items out of 20 they would expect to answer correctly. Participants were also asked to indicate their subjective confidence in their ability to perform at this level using a 7-point scale anchored at *not at all confident* (1) and *extremely confident* (7). Finally, participants were asked the following question: "Hypothetically, if you had $100, how much of it would you bet on the chance that you would correctly answer more than 7 items on a similar, 20-item trivia test?" Participants were then asked about any suspicions they may have had about the validity of the feedback they received. Very little suspicion was reported.

Results and discussion

Regardless of the feedback condition, participants held relatively equal (initial) expectations about their performance on the trivia test (see the top half of Table 1). Participants also did not differ in their actual performance on the trivia test nor in their suspicion of the validity of the feedback. The average number of items actually correct was 6.57 (SD = 1.98; 32.85% correct). Suspicion of the validity of the feedback was below the mid-point, and actual performance did not correlate significantly with suspicion of the

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Table 1
Means and standard deviations of pre-test expectations and dependent variables by feedback detail condition, and two-way ANOVA/ANCOVA results for the main effect of feedback detail condition (Experiment 1).

Variable	Feedback detail condition				
	Low[a]		High[b]		
	M	SD	M	SD	$F(1, 130)$
Pre-test expectations					
Expected number correct	12.61	2.60	13.39	2.51	3.13
Subjective confidence	4.58	.84	4.70	.96	.59
Actual performance	6.34	2.01	6.80	1.95	1.74
Suspicion of feedback	3.23	1.62	3.59	1.91	1.39
Dependent variables					
Expected number correct on NT	8.31	1.91	9.22	2.11	6.04[*]
Subjective confidence for NT	3.98	.94	4.52	1.23	7.52[**]
Hypothetical bet on new test	37.64	28.94	51.92	28.27	7.35[**]

Note: NT = new test. Actual performance was included as a covariate in the test of differences between the feedback detail conditions among the dependent variables; ANCOVA df = (1, 129).
[a] n = 66.
[b] n = 66.
[*] p < .05.
[**] p < .01.

validity of the feedback, $r(130)$ = .15, *ns*. Thus, the manipulation of performance feedback was successful.

Intercoder agreement of thought-listings

Each thought-listing response was coded by two coders, blind to the hypotheses and conditions, as a counterfactual response (upward or downward) or a non-counterfactual response. A response was coded as a counterfactual when it clearly expressed the consideration of an alternative antecedent and either directly described or implied an alternative outcome. The overall agreement between the two coders was high, Cohen's kappa = .79. A third coder was used to resolve disagreements. Examples of counterfactuals included: "I usually guess C when I don't know – I knew I should have guessed C." and "I got mixed up; shouldn't have been thinking cheetah, could've got that one."

Counterfactual thoughts

Participants in the thought-listing condition listed more upward counterfactuals (M = 2.57, SD = 2.33) than they did downward counterfactuals (M = .08, SD = .27), $t(65)$ = 8.82, p < .001. As expected, high feedback detail participants generated a greater number of upward counterfactual thoughts in response to the event (M = 4.06, SD = 2.04) than did low feedback detail participants (M = 1.09, SD = 1.51), $F(1, 64)$ = 45.07, p < .001.

Confidence regarding a new trivia test

Three separate 2 (feedback detail: high vs. low) × 2 (thought-listing: yes vs. no) analyses of covariance (ANCOVA) tests were conducted for the three measures of confidence pertaining to a new, similar trivia test. Because the amount of false feedback that participants received increased as their actual performance deviated from 35%, actual performance rate was used as a covariate in the analyses. This covariate was not statistically significant in any of the ANCOVAs. Thus, actual performance was not included in any of the subsequent analyses. As expected, high feedback detail participants reported greater expectations of improving their performance on a similar trivia test and greater subjective confidence in doing so, and they placed larger bets than did low feedback detail participants (see the bottom half of Table 1). Also, as expected, there was no main effect of thought-listing condition and no interaction between feedback detail and thought-listing condition for any of the dependent variables. Thus, counterfactual

generation following high feedback detail appeared to be spontaneous, as the same effects occurred even when participants were not asked to list thoughts.

Mediation analyses

Three separate tests of mediation were computed using the criteria recommended by Baron and Kenny (1986). However, only the expected number correct on a new trivia test supported the notion that counterfactuals acted as a mediator between the type of event feedback and judgments about future events. Similar to our earlier findings for the entire sample, a significant relationship was found between feedback detail and expected number correct on a new trivia test for those participants who listed their thoughts, $\beta = .22$, $t(64) = 2.60$, $p < .05$. When both feedback type and upward counterfactual frequency were entered into the regression model simultaneously, feedback detail was no longer a significant predictor ($\beta = .01$), whereas upward counterfactual frequency was, $\beta = .56$, $t(63) = 3.90$, $p < .001$. A modified Sobel test showed that the reduction in the effect of feedback detail on subjective confidence for a new trivia test was significant ($z = 3.08$, $p < .001$). Thus, we obtained some support for our hypothesis regarding counterfactual thinking as a mediator.

Moderation analyses

We also tested whether or not there was any evidence that counterfactual thought frequency or pre-event expectations acted as moderators of the relationships between the type of event feedback and the dependent measures using the hierarchical multiple regression model procedures recommended by Cohen and Cohen (1983). For tests examining counterfactuals as a moderator, we focused on the two dependent variables in which we failed to find evidence of mediation.

Regarding subjective confidence for a new trivia test, the main effect for upward counterfactual frequency (see mediation analysis above) was qualified by an interaction between feedback detail and upward counterfactual frequency, ($\beta = .42$, $t(62) = 2.04$, $p < .05$; see the top panel of Fig. 1). Simple slope analyses were examined using the procedures recommended by Aiken and West (1991) – plotting predicted regression means at one standard deviation above and below the mean of counterfactual frequency. These analyses showed that subjective confidence for a new trivia test increased with upward counterfactual frequency but only for the detailed feedback condition ($\beta = .47$, $t(62) = 3.24$, $p < .01$); no relationship was found among participants who did not receive detailed feedback ($\beta = -.13$, $t(62) = -.34$, *ns*).

An interaction between feedback type and upward counterfactual frequency also emerged for the hypothetical bet on a new trivia test, ($\beta = .46$, $t(62) = 1.98$, $p = .05$; see the bottom panel of Fig. 1). The hypothetical bet increased with upward counterfactual frequency only for the high feedback detail condition ($\beta = .89$, $t(62) = 5.39$, $p < .001$); no relationship was found for those who received non-detailed feedback ($\beta = .23$, $t(62) = .57$, *ns*). These two instances of moderation are in line with our theoretical reasoning because they indicate that counterfactuals have greater importance for judgments when people are exposed to high levels of event detail.

In models that examined pre-test expectancy and pre-test confidence as moderators, main effects were observed for feedback detail in each of the three tests that included pre-test expectancy (average $\beta = .22$, $p < .05$), and in each of the three tests that included pre-test confidence (average $\beta = .19$, $p < .05$). In addition, pre-test expectancy emerged as a significant predictor of all three of the dependent variables (average $\beta = .30$, $p < .01$). Further, pre-test confidence significantly predicted subjective confidence on a new trivia test and hypothetical bet for a new trivia test (average $\beta = .32$, $p < .01$). However, pre-test expectancy and pre-test confi-
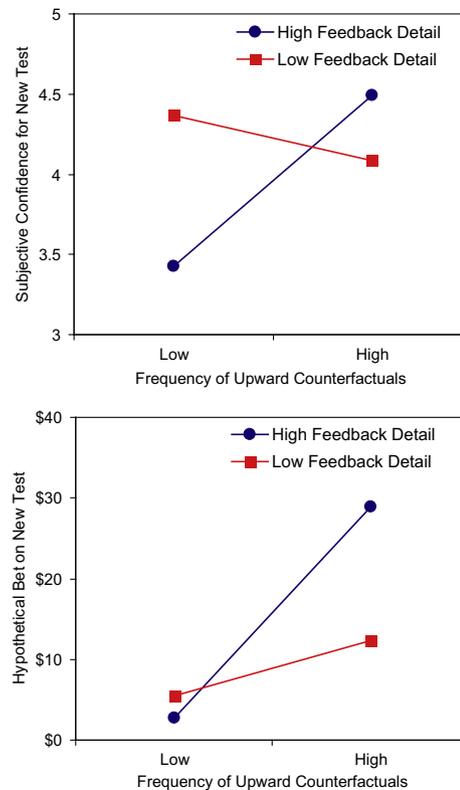

Fig. 1. Predicted regression equation means of subjective confidence and hypothetical bet by upward counterfactual frequency and feedback detail condition (Experiment 1).

dence both failed to moderate the relationships between feedback detail and all three dependent variables.

The overall pattern of results of the tests of moderation are consistent with the notion that counterfactual thinking plays a greater role in reactions to events associated with high event detail than does one's pre-event expectations. There was no evidence that pre-event expectations play a greater role in reactions to events with low feedback detail than events with high feedback detail.

Our predictions about the effects of high vs. low levels of event detail about test performance were strongly supported. High feedback detail participants were more likely to feel greater confidence due to the nature of the feedback they received. These participants were well aware of the items they answered "incorrectly" and aware of the "correct" answers. Thus, they possessed information that allowed them to generate counterfactual activity for particular items. On the other hand, low feedback detail participants were uncertain about which items they responded to correctly or incorrectly. Thus, a counterfactual perspective would be less potent with regard to confidence because they lacked detailed information that would support any claims as to what they could have or should have done differently.

Experiment 2: Detail of blackjack game information

Experiment 2 examined how people react to true feedback that is either high or low in detail, and how such reactions affect their decisions to bet on the outcomes of similar, future events in the context of a gambling game. This experiment relates very much to the work of Gilovich (1983), described earlier. The results of his experiments are consistent with the idea that gamblers will continue to gamble partially due to the upward counterfactuals that they generate following losses. His results emerged when a

"freak" occurrence took place. We propose that people will counterfactualize a lost gamble whenever they are exposed to the detailed features of the event, even when the event does not involve anything that might be regarded as exceptional or highly abnormal. This notion is consistent with others' (Gavanski & Wells, 1989; Hofstadter, 1979) arguments that people will generate counterfactuals, even in response to normal events.

In Experiment 2, we examined judgments of confidence after exposing participants to low or high levels of event detail about their actual performance on a gambling task. Confidence was operationalized as the number of tickets (for a chance to win an electronic drawing) that participants were willing to place as bets. Participants were asked to play 10 games of blackjack, were told to win as many games as they could, and were told that they would have a chance to win a $30 drawing. Before playing these games, participants reported their pre-event expectations. During the games, a detailed vs. non-detailed feedback manipulation was implemented. As in Experiment 1, half the participants also listed their thoughts while playing blackjack. After the 10 games were completed, participants were informed that they would play a final "bonus" game of blackjack. Before the bonus game was played, participants placed a bet on the outcome. We tested hypotheses similar to those of Experiment 1.

Method

Participants

One-hundred and twenty undergraduate students, enrolled in psychology courses at Indiana University, participated in Experiment 2 for partial fulfillment of course credit. Each experimental session involved a single participant. Only participants with knowledge of blackjack were recruited. The data from 20 participants, who admitted that they were not entirely familiar with the game of blackjack, were excluded from all analyses, resulting in a final sample of 100 participants.

Procedure

The experiment was introduced as a study of "what people think about as they gamble." Participants were asked to play 10 games of standard blackjack (without splits or double downs). To ensure that participants understood the basic rules, a brief introduction was provided with examples. It was highlighted that most gambling games involve luck, but that blackjack is one of the few gambling games that involves some luck as well as some skill. Participants were informed that they would play only against the dealer (the experimental assistant) and that they were to get as close to 21 as they could without "busting." It was explained that ties between the dealer and a participant were counted as a win for the dealer. To increase overall motivation and involvement in the task, participants were told that they would have a chance to win an electronic $30 drawing in another part of the experiment. It was made clear that their chances of winning the $30 drawing depended on how well they performed in playing blackjack.

Before the first game was dealt, participants were asked to indicate the number of games out of 10 that they expected to win. In addition, participants were asked to rate how confident they felt that they would win at least the number of games they predicted on a 7-point scale anchored at *not at all confident* (1) and *extremely confident* (7).

Low detail condition. For participants in the low detail condition, a slightly modified version of blackjack was employed. At the conclusion of each game (when the dealer was finished), participants were instructed to turn over their face-down card. However, the dealer did not turn over his face-down card. In addition, any additional cards dealt to the dealer were dealt face-down and were not revealed to participants. These participants were informed only whether or not they won the game. The dealer recorded the winner of each game and the number of games won by each participant. Directly following each instance of feedback, half the participants were instructed to list the first thought that went through their minds during the game or after learning about the outcome (the other half were not asked to do so).

High detail condition. The procedures for participants in the high detail condition were the same as those in the low detail condition with one exception. When the player decided to stop taking cards during a game, the dealer turned over his own face-down card and continued to take cards face-up when required (at or below 16). The dealer did not turn over his face-down card in games when the player busted (went beyond 21). Half of these participants were asked to list the first thought that went through their minds (the other half were not asked to do so).

Bonus game. Before the bonus game, all participants (regardless of their number of wins) were given a small sheet of paper, reading "100 Tickets;" and it was indicated that their number of tickets was based on how well they had performed in the 10 games. They were informed that their tickets would be entered into an electronic drawing for $30. It was explained further that the more tickets they had, the better their chances would be of winning the drawing. For a chance to increase their number of tickets, all participants were permitted to place a bet on winning the bonus game (any amount between 10% and 100% of their available tickets). Participants were also asked to indicate their perceived chances of winning the bonus game on a 7-point scale anchored at *not at all likely* (1) and *extremely likely* (7).

Results and discussion

Regardless of the event detail condition, participants did not differ in their initial expectations about the number of games they expected to win or how subjectively confident they were at winning this number of games. Participants also did not differ in the number of games they actually won (see the top half of Table 2).

Intercoder agreement of thought-listings

Each thought-listing response was coded by two separate coders using the same criteria as in Experiment 1. The overall agreement between the two coders was high, Cohen's kappa = .82. A third coder was used to resolve disagreements. Examples of counterfactuals included: "I stopped but should have used the ace as a one and hit." and "I would have won had I not taken so many risks."

Counterfactual thoughts

Participants in the thought-listing condition listed more upward counterfactuals ($M = 2.10$, $SD = 1.31$) than they did downward counterfactuals ($M = .20$, $SD = .45$), $t(49) = 10.62$, $p < .001$. These totals were out of 10 possible thoughts listed. The frequency of counterfactuals listed by participants should be considered in light of the average win percentage (approximately 40%). Winning games were unlikely to elicit counterfactual thoughts.

As expected, participants assigned to the high detail condition generated a significantly greater number of upward counterfactuals ($M = 2.92$, $SD = 1.18$) than did low detail participants ($M = 1.28$, $SD = .84$), $F(1, 48) = 31.72$, $p < .001$. The level of detail conditions did not differ in their frequency of downward counterfactuals, $F(1, 48) = .39$, *ns*.

Table 2
Means and Standard Deviations of Pre-Event Expectations and the Dependent Variable by Event Detail Condition, and Two-Way ANOVA/ANCOVA Results for the Main Effect of Outcome Detail Condition (Experiment 2).

Variable	Event detail condition				
	Low[a]		High[b]		
	M	SD	M	SD	F(1, 98)
Pre-event expectations					
Expected number of wins	5.40	1.18	5.58	1.01	.67
Subjective confidence	4.88	.85	5.04	.78	.96
Number of wins	4.08	1.51	4.16	1.57	.07
Tickets bet on winning BG	53.38	33.84	68.20	31.04	5.10[*]
Likelihood of winning BG	3.94	1.09	4.40	.99	4.98[*]

Note: BG = bonus game. Number of wins was included as a covariate in the tests of differences between the event detail conditions among the dependent variables; ANCOVA df = (1, 97).
[a] n = 50.
[b] n = 50.
[*] p < .05.

Confidence in winning the bonus game

A 2 (event detail: high vs. low) × 2 (thought-listing: yes vs. no) ANCOVA was conducted for the dependent variable, including number of wins as the covariate. Surprisingly, this covariate failed to reach statistical significance, $F(1, 97) = .26$, ns ($r = .07$, ns). Importantly, as expected, high event detail participants bet a greater number of their tickets on the bonus game and perceived a greater chance of winning than did participants in the low event detail condition (see the bottom of Table 2). There was no main effect of thought-listing condition and no interaction between feedback and thought-listing condition. These null effects further support the notion that the effects of event detail on counterfactual thinking, and of counterfactuals on judgments, are spontaneous.

As in Experiment 1, counterfactual thought frequency was tested as a mediator of the relationship between level of detail and tickets bet on the bonus game ($\beta = .23$, $t(48) = 2.28$, $p < .05$) and perceived likelihood of winning the bonus game ($\beta = .22$, $t(48) = 2.20$, $p < .05$). As indicated earlier, upward counterfactual frequency was significantly associated with the high event detail condition, $\beta = .63$, $t(48) = 5.63$, $p < .001$. When both level of detail and upward counterfactual frequency were entered into the regression model simultaneously, level of detail was no longer a significant predictor of tickets bet on the bonus game, $\beta = -.07$, $t(47) = 5.63$, ns, yet, upward counterfactual frequency was, $\beta = .43$, $t(47) = 2.46$, $p < .02$. A modified Sobel test showed that the reduction in the effect of event detail on tickets bet on winning the bonus game was significant, $z = 2.25$, $p < .05$. A similar pattern was found when testing counterfactual thought frequency as a mediator of the relationship between event detail and perceived likelihood of winning the bonus game. However, the Sobel test showed that the reduction in the effect of level of detail on perceived likelihood of winning the bonus game was not significant ($z = .46$, ns).

It is possible that counterfactual thoughts generated in response to highly detailed losing events are seen as feasible, reasonable, and probable. For high detailed feedback participants, an upward counterfactual in response to a lost game might function perceptually as a win when evaluating one's skill at playing blackjack. Thus, we tested the sum of the number of games of blackjack won and the number of upward counterfactual responses (made after losing games) as a moderator of the relationship between event detail and perceived likelihood of winning the bonus game. It was expected that perceived likelihood would increase with this summed variable, especially for high event detail participants. An interaction between event detail and the summed variable was supported statistically, $\beta = .57$, $t(46) = 2.14$, $p < .05$ (see Fig. 2). As predicted,
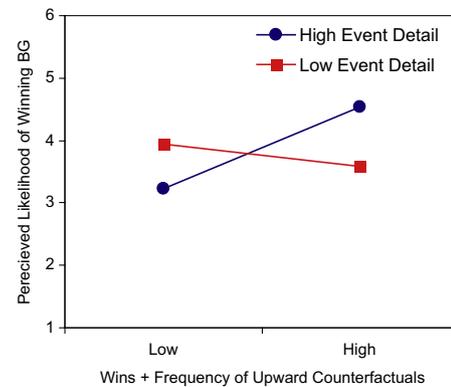
Fig. 2. Predicted regression equation means of perceived likelihood of winning the bonus game (BG) by wins + upward counterfactual frequency and event detail condition (Experiment 2).

perceived likelihood of winning the bonus game increased significantly with the sum of the number of games of blackjack won and upward counterfactuals, but only for the high event detail condition, $\beta = .53$, $t(46) = 3.38$, $p < .01$. In addition, when the summed variable was high, high event detail participants reported a greater perceived likelihood of winning the bonus game than did low event detail participants, $\beta = .38$, $t(46) = 2.01$, $p < .05$. No other simple slopes were statistically significant. These results are consistent with the ideas of Garry and Polaschek (2000) and Petrocelli and Crysel (in press), who argued that people can misremember a counterfactualized outcome as a truth.

Pre-event expectancy and pre-event confidence were also tested as moderators of the relationship between feedback type and tickets bet on winning the bonus game. No evidence was found for either of these potential moderators. Surprisingly, pre-event expectancy and pre-event confidence also failed to have a main effect on the dependent variables.

Importantly, the current experiment dealt with actual events that participants experienced. The current experiment also did not involve abnormal events. Everything that occurred in the games of blackjack was well within what can be expected in standard blackjack. The results provide evidence that people mentally simulate alternatives to reality even when nothing out of the ordinary occurs. Our analyses suggest that gamblers who obtain detailed information (i.e., watch all of the details of the gambling event) are more likely to persist in gambling and bet more money than gamblers who are simply informed about the results, as counterfactualized losses lead to greater confidence for future gambles.

Experiment 3: Detail of horse racing information

In Experiments 1 and 2, we investigated the role of counterfactual generation in causing losing decision-makers to maintain confidence and have high expectations for future success. Rather than taking their negative outcomes at face value and concluding that they are not very good decision-makers, participants who had a good deal of detailed information about the event that had a negative outcome generated counterfactual thoughts about how the bad outcome could have been a good outcome. These participants concluded that they would be successful at a future, similar task. In Experiment 3, in addition to examining the role of counterfactual thinking in this process, we investigated an additional cognitive factor, hindsight bias. In the situations that we are studying, it is likely that the counterfactual thoughts that are generated alter participants' estimates of the prior probabilities of possible outcomes in a way that reflects hindsight bias. Such hindsight bias may well play a role in the confidence that our participants then have in

their future success. If they "knew" what was going to happen in the first event, they will know what to expect the next time.

Contrary to earlier theorizing, Roese and Olson (1996) hypothesized and demonstrated that counterfactual thinking can increase (not decrease) the likelihood of developing hindsight bias (also see Roese & Maniar, 1997). Roese and his colleagues suggest that people conclude that, given the actual antecedent conditions, the outcome was inevitable. However, various mutations of these actual antecedent conditions would have led to different outcomes. Thus, even though counterfactual thoughts suggest that other outcomes were possible, there is also inevitability to the actual outcome given the conditions that prevailed. In this way, counterfactual generation will lead to hindsight bias. Roese and Olson (1996) further suggest that counterfactual thoughts help one to develop a causal attribution for the outcome. When it is easy to generate counterfactual attributions that help explain how undesirable outcomes come about, people tend to become certain about the outcome's a priori predictability. This subjective sense of inevitability permits people to feel certain that they were aware of the causal antecedents of the outcome. In our paradigm, perceiving the outcome as inevitable and believing that one understands the cause-effect links may help to build one's confidence for the future. Thus, we hypothesized that the strength of one's hindsight bias mediates the relationship between counterfactual thinking and confidence for a similar, future event.

We tested this process account in Experiment 3 using a horse racing paradigm. We manipulated the degree of event detail by exposing participants to either a complete video of a race or to only the outcome (i.e., high vs. low detail respectively). Of particular interest was whether the increased likelihood of counterfactualizing that results from higher levels of event detail enhances the likelihood that one will perceive the outcome as inevitable (i.e., hindsight bias).

Participants were provided with information about an upcoming professional horse race that involved only four horses. Participants were asked to study program information and to place a bet on one of the four horses to win the race. In order to enhance motivation for the task, participants were given an opportunity to win actual money and were informed that their chances of winning depended on how well they performed. We employed a memory-based indicator of hindsight bias (see Pohl, 2007), such that participants initially indicated how likely each horse was to win the race. Participants then either watched the entire race (i.e., high event detail) or learned only about the finishing position of each horse (i.e., low event detail). The horses' numbers were manipulated such that all participants' horses finished second (i.e., placed). Afterwards, all participants were asked to recall how likely they initially thought each horse was to win the race. It was then explained that they would be asked to place a bet on a horse to win a new bonus race.

Consistent with our earlier experiments, we hypothesized that counterfactual thinking would be most prevalent under high event detail. Watching the entire race should allow viewers to see mutations of conditions that would have led to alternative outcomes. Such counterfactual thinking should lead to more confidence in and more money bet for the bonus race. We also expected the relationship between event detail and betting confidence to be mediated by counterfactual thinking (consistent with our earlier findings). In addition, because more frequent counterfactual thinking should lead to hindsight bias, we expected the event detail-betting confidence link to be mediated by hindsight bias as well. If our theorizing is correct, we should also find evidence that the strength of one's hindsight bias mediates the relationship between counterfactual thought frequency and betting confidence. In other words, the easier it is for people to undo an undesirable outcome, the more they will feel that they understand the causal structure of the event, and the more confident they will be about experiencing success in a similar, future situation.

Method

Participants

A total of 56 undergraduate students, enrolled in psychology courses at Wake Forest University, participated in Experiment 3 for partial fulfillment of course credit. Only participants with basic knowledge of the sport of horse racing were recruited to participate.

Procedure

The method of presenting experimental materials and instructions was similar to the procedures described in Experiment 1. The experiment was introduced as a study of "what people think about as they gamble." All participants were presented with race program information for an upcoming horse race that involved only four horses. This information included past performance totals (e.g., number of races, frequency of wins, places, and shows) as well as each horse's fastest time for the distance to be run in the race. They then bet on one horse to win the race. The horse numbers were not displayed in the program. This helped to ensure that each participant's horse finished second. In fact, regardless of the horse selected, all participants were informed that their horse's number was "#7" (the horse that finished second). Participants were informed that for participating in the experiment they had an opportunity to win actual money ($100) through a drawing. It was explained that their chances of winning depended on how they performed in the horse racing task and that their goal was to win as much money in the race as possible.

In order for us to be able to assess hindsight bias, participants were asked to indicate how likely each horse was to win the race using a 9-point scale anchored at *not at all likely* (1) and *extremely likely* (9). Participants were then randomly assigned to one of the two event detail conditions. Low event detail condition participants were shown only the finish position of each horse and the payout amounts; they did not watch the race. High event detail condition participants were given the same information, but they also watched the entire race.

After learning about the outcome, participants completed a thought-listing task similar to that used in Experiment 2; a maximum of four thoughts could be listed. They were then reminded that, earlier, they had estimated each horse's chances of winning and were asked to recall exactly what their estimates were, being as accurate as possible (using the same 9-point scale). It was then explained that they would be asked to place a bet on a horse to win a new bonus race.

Finally, participants were reminded about the $100 drawing for participating in the experiment. It was explained that they currently had 100 tickets to enter into the drawing. Instructions were similar to those used in Experiment 2. For the purposes of betting, we informed participants that each ticket represented one dollar. It was further explained that, if they bet 50 tickets, this would be like betting $50. If they placed a winning bet, they would be awarded tickets equaling the number of dollars they would have won had they bet with real money; and if they placed a losing bet, the number of tickets (dollars) they bet would be deducted from their total. The total number of tickets that they ended up with would be entered into the drawing.

Results and discussion

Intercoder agreement of thought-listings

Each thought-listing response was coded by two separate coders using the same procedures as those used in the earlier experi-

ments. The overall agreement between the two coders was high, Cohen's kappa = .70. A third coder was used to resolve disagreements. Examples of counterfactuals included: "I second guessed myself; knew I should have went with better odds." and "I thought Lemon Drop had a good chance – almost won; could have saved energy but used it too much in the earlier stages."

Counterfactual thoughts

Participants listed more upward counterfactuals (M = .95, SD = .79) than they did downward counterfactuals (M = .00, SD = .00), $t(55)$ = 9.19, $p < .001$. As expected, participants assigned to the high event detail condition generated a significantly greater number of upward counterfactuals (M = 1.18, SD = .72) than did low event detail participants (M = .71, SD = .81), $F(1, 54)$ = 5.12, $p < .05$ (β = .29, $t(54)$ = 2.26, $p < .05$).

Hindsight bias

Overall hindsight bias was calculated by summing the differences between expected and recalled likelihood estimates of a win that participants reported for each horse.[3] Specifically, we summed the difference for the winning horse (recalled likelihood − expected likelihood) with the differences for the three losing horses (expected likelihood − recalled likelihood). Thus, increases in probability estimates for the horse that actually won the race and decreases in probability estimates for the horse on which they bet (#7) and the two other losing horses reflected hindsight bias. The sample mean was .38 (SD = 1.07). Testing this mean against zero in a one-sample t-test indicated that a significant hindsight bias emerged, $t(55)$ = 2.62, $p < .02$. Furthermore, hindsight bias was greater in the high event detail condition (M = .68, SD = 1.12) than in the low event detail condition (M = .07, SD = .94), $F(1, 54)$ = 4.81, $p < .05$ (β = .28, $t(54)$ = 2.19, $p < .05$). That is, participants in the high event detail condition recalled making greater likelihood estimates for what actually occurred after they learned about the actual outcome than did participants in the low event detail condition. Also as expected, the strength of hindsight bias correlated positively with counterfactual thought frequency, β = .28, $t(54)$ = 2.12, $p < .05$. As counterfactuals increased, the strength of one's perceptions that they knew the outcome in advance increased.

Bonus race bet

As expected, more tickets were bet on the bonus race in the high event detail condition, β = .30, $t(54)$ = 2.32, $p < .05$. Consistent with our earlier findings, when statistically controlling for the frequency of upward counterfactuals, the effect of event detail was reduced to non-significance, β = .10, $t(53)$ = 1.55, ns. A modified Sobel test showed that the reduction in the effect of event detail from the reduced to the full model was statistically significant, z = 1.99, $p < .05$. On the other hand, upward counterfactual thought frequency remained a significant predictor of tickets bet on the bonus race, β = .34, $t(53)$ = 2.65, $p < .02$. Thus, counterfactual thinking mediated the relationship between event detail and risky betting.

We conducted an additional test of mediation that included hindsight bias as a predictor of the bonus race bet. As reported above, hindsight bias was significantly correlated with both the event details level and with counterfactual thought frequency. When all three predictors were included in the model, only the strength of the hindsight bias was a significant predictor, β = .53, $t(52)$ = 4.41, $p < .001$; event detail and counterfactual thought fre-

quency were no longer significant predictors (β = .06, $t(52)$ = .57, ns and β = .14, $t(52)$ = 1.26, ns respectively). Sobel tests confirmed that the effects of event detail and counterfactual thought frequency were significantly reduced when the strength of one's hindsight bias was included in the model (z = 2.46, $p < .02$ and z = 1.96, p = .05, respectively). Thus, our hypotheses that hindsight bias would mediate the relationship between event detail and betting confidence, as well as that between counterfactual thought frequency and betting confidence, were confirmed.

General discussion

Across the three experiments, the results provide strong support for the role of counterfactual thinking in boosting people's confidence and in increasing the amount of money that they are willing to bet on subsequent opportunities. In particular, when a high level of detail is provided about events that involve bad outcomes, people are likely to generate upward counterfactuals that lead to this confidence and to increased gambling. Because the upward counterfactuals indicate ways in which the losing outcome could have (and should have) been avoided, losing gamblers are able to discount their losses and to feel more like winners who actually have good judgment and decision-making abilities. With only low levels of detail about the events, on the other hand, counterfactual alternatives are not easily generated, and people seem to use a combination of pre-event expectations and information gained from their recent performance to assess their level of confidence for future success. They are not so confident about their future success and bet less on their subsequent gambles.

The results of our experiments can best be understood in terms of Kahneman and Miller's (1986) norm theory treatment of counterfactual generation and Sherman et al.'s (1999) account of the reasons for different reactions to general vs. specific events. According to both approaches, it is the presence of specific mutable antecedent conditions that allows the generation of counterfactual alternatives, especially when the outcome involves failure or loss. In the absence of easily mutable specific features, people are more likely to construct judgments of future success on the basis of pre-existing expectations. Recent work on mental models (Byrne, 1997, 2005; Feeney & Handley, 2006) also suggests that counterfactual mental simulation helps to build mental models of events that consist of chains that are developed by linking together specific pieces of information from the event conditions in order to form inferences. In other words, specific events draw attention to mutable features. Because these mutable features of specific events are more salient and are easy to counterfactualize, alternatives to reality are more likely to be developed than they are in the case of the vague and unspecified features of general outcomes and events.

One might ask whether the amount of detailed information about a losing outcome provokes counterfactual thinking or supports counterfactual generation.[4] According to the provocation view, the presence of mutable specific information activates counterfactual thinking. Without such specific information, people will simply not consider alternative possibilities. The results of Experiments 2 and 3, and the significant meditational effects of counterfactual thinking in Experiment 1, would seem to support this view. According to the idea that the amount of specific detail supports counterfactual generation, people will always generate counterfactuals after a bad outcome (e.g., "If only I had won.", "If only the other team had not scored a run that inning."), but only people who find evidence to support such counterfactual thinking in terms of specific mutable events are then able to actually generate viable and feasible alternatives to reality. The significant moderation results from

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[3] Because the estimates were made on 9-point scales from "not at all likely" to "extremely likely," these were not strict probability judgments that added to 1.0. Thus, no judgment was constrained by the other judgments. Hindsight bias could be reflected in the recalled likelihood for any of the horses. Analyses that included only the horse that won the race or the winning horse plus the horse that was bet on showed the same results as analyses including all 4 horses.

[4] We thank an anonymous reviewer for pointing out this important distinction.

Experiment 1, where subjective confidence for the new trivia test and amount bet increased with upward counterfactual frequency but only for the detailed feedback condition, seems consistent with the idea that the amount of detailed information supports counterfactual generation. We suspect that both views have some truth value. A bad outcome without any event detail is less likely to provoke counterfactual thinking in the first place. However, even outcomes without very much detail will induce wishes of undoing the outcome and thoughts about how life would be better if only the outcome had not occurred. But such incipient counterfactual thoughts cannot be fleshed out without sufficient event detail and will not have powerful effects on judgments.

Our major findings are consistent with, and can be understood in terms of, theory and research in several other areas of cognitive and social psychology. First the unwarranted confidence that follows from having detailed information about a losing situation can be thought of as an example of motivated bias (Kunda, 1990; Lord, Ross, & Lepper, 1979; Molden & Higgins, 2008). That is, people are generally motivated to believe that they are good decision-makers and bias their perceptions to arrive at such a belief. In addition, gamblers are highly motivated to believe that they will perform better in the future and that they will recoup their losses. Biased perceptions that bring about such overly optimistic beliefs and judgments are rendered more likely when losing events are presented in ways that allow counterfactual worlds to be generated in which better outcomes could have been achieved. Losers will then feel more like winners. A high level of detail about the event is one way in which these counterfactuals become more probable. Consistent with this, Kunda (1990) proposed that people will engage in motivated reasoning when such reasoning is supported, or is supportable, on the basis of specific information that is available to them.

Second, Sherman and McConnell (1995), in discussing the potential dysfunctional effects of counterfactual thinking, suggested that such thinking can lead to illusions of control (Langer, 1975). We argue that, in a predominantly chance situation, counterfactual generation is a major contributor to illusions of control. The counterfactuals that our participants generated led them to believe that they understood the causal factors for success in trivia questions, blackjack, and horse race gambling. They felt that they knew the way to increase their likelihood of future success. For example, the detailed information that is provided about the different horses in a race makes it appear as though there is a logical and correct answer to the best choice and that once one thinks about it, one is now better able to make such a choice. Thus, instead of the losing experience decreasing confidence, the illusion of control that is brought about by counterfactual thinking led our participants to have a subjective probability of success that was likely to be greater than the objective probability of success. We suggest that the more frequently a gambler entertains thoughts of what could have been, or what should have been, the stronger the illusion of control will become.

Third, in addition to the effects of counterfactual generation on the illusion of control, the counterfactuals that were provoked, and/or supported by event detail, also led to hindsight bias. Roese and Maniar (1997) found that counterfactual thinking and hindsight bias go "hand in hand." That is, counterfactuals indicate that, given the antecedent events that existed, the outcome was inevitable. Thus, people will feel that they should have known, and did know, what was going to happen. However, these feelings of hindsight bias also carry with them the belief that, had the antecedent conditions been different, then the outcome surely would have changed as well. Thus, one gains confidence that a losing past outcome (that was inevitable under the existing circumstances) can be changed into a winning outcome in the future. Our findings in Experiment 3 show the important mediating role of hindsight bias in linking counterfactual generation to subsequent feelings of confidence and to a willingness to gamble more in the future.

Our results indicate that the counterfactual alternatives that are generated in response to losing events with a high level of detail will not cause people to learn from their losses or to increase their actual likelihood of success in the future. Such results might seem to be in opposition to recent work that suggests that upward counterfactuals lead to improved performance in the future. For example, Epstude and Roese's (2008) functional theory of counterfactual thinking proposes that counterfactual thinking is a beneficial component of behavior regulation. The upward counterfactuals that are activated by a failed goal specify what could have been done differently to achieve the goal. Such beneficial effects of counterfactual generation are supported by recent empirical work (Kray & Galinsky, 2003; Morris & Moore, 2000). As stated earlier, we do not disagree with predictions by the functional approach of improvement in subsequent performance due to counterfactual thinking. These upward counterfactuals can and often do suggest better and more effective ways of doing things. However, our losing situations involved tasks where one could not easily learn what these better ways of doing things might have been. The outcomes were determined to a large extent by luck or guessing, or the tasks were so difficult (e.g., good blackjack playing or answering hard trivia items) that actual learning would take a very long time. Despite this, our participants did generate counterfactuals that would have changed a specific loss into a win, and viewed their counterfactuals as indicative of behaviors that would increase future performance if adopted. They did increase their feelings of control and confidence, and they were willing to bet more money on this belief. In other words, our losing gamblers developed a belief in a causal chain that specified how performance could be improved. However, the confidence and the feelings of control and understanding were not warranted. The changes that participants entertained would not actually increase performance levels.

As an example, consider one of our blackjack players in Experiment 2 who decided to take another card when he/she had 14 against the dealer's 10. This player received a 9 and thus busted. The player then saw that the dealer had started with 13, and he/she would have won if the decision had been made not to take a hit at 14. This strategy will not make the player a better player in the future or make him/her more likely to win. In fact, although the counterfactual behavior would have been successful in this specific situation, it is generally a very bad strategy.

Epstude and Roese (2008) suggested that the beneficial effects of upward counterfactual generation can occur by two different pathways. A content-specific path provides a regulatory sequence that replaces a failed behavior with a specific alternative that is more likely to succeed (Smallman & Roese, 2009). A content-neutral path can improve performance by enhancing attentional, cognitive, or motivational processes. For example, counterfactual generation can lead to broad self-inferences of efficacy, mastery, and confidence (Roese, 1999). We believe that, just as the beneficial effects of counterfactual generation can operate by these two pathways, so too can the detrimental effects of counterfactual generation that we observe. Our participants generated very specific alternative behaviors that they felt would enhance future performance. They also indicated a content-neutral path in that they felt more in control and had more confidence in their abilities.

In short, our results suggest that when gamblers have access to specific details of the gambling event they will be more confident about future gambling, will be more likely to gamble in the future, and will bet more money than will gamblers who learn only the outcomes of their gambles.

In fact, those who operate gaming establishments understand very well the importance of having gamblers generate close counterfactuals, cases in which a losing reality was within easy grasp of

a winning outcome. Gamblers are supplied with exactly the kinds of detailed information that make the generation of upward counterfactuals likely. Losers watching a photo finish of a horse race will see in replay and in an enlarged picture just how close they were to winning. In the game of keno, not only do the lights on the winning numbers glow, but the lights also extend a bit to all surrounding numbers, a practice that makes the close counterfactuals very accessible. In roulette, the casinos ensure that there are many ways to "almost win." The numbers that are close to each other on the wheel are different from the numbers that are close to each other on the betting carpet. Of course, the numbering system puts still a different set of numbers close to each other. Thus, in roulette, the number 7, based on all the above possibilities, is actually close to the following numbers – 4, 5, 6, 8, 10, 11, and 20. If one had bet on any one of these numbers where 7 was the actual winner, he/she almost won. Therefore, through their own motivational tendencies and with a little help from the gaming establishments, gamblers who lose can see how close to winning they really were and thus maintain, and even increase, their habitual gambling behaviors. Even in losing, they feel like winners and make their next bet with renewed optimism and confidence. We conclude that these effects are far more likely to occur when event detail is high.

Acknowledgments

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