



FlashReport

Counterfactual thinking and confidence in blackjack: A test of the counterfactual inflation hypothesis

John V. Petrocelli *, Laura C. Crysel

Department of Psychology, Wake Forest University, P.O. Box 7778, Winston-Salem, NC 27109, United States

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ABSTRACT

This research tests the idea that repeatedly generating counterfactual thoughts in response to recurring events can lead to impairments in memory for actual outcomes (i.e., *counterfactual inflation hypothesis*). Participants ($N = 56$) played 40 games of blackjack and listed their thoughts after each win. They were instructed to list evaluative counterfactuals, reflective counterfactuals, or any thoughts that came to mind following each loss. Because reflective counterfactuals focus only on the alternatives to reality, and not in addition to reality (like evaluative counterfactuals), they were expected to lead to the greatest degree of overestimations of performance and confidence for future blackjack playing. The results confirmed this hypothesis, and also demonstrated that the relationship between thought-listing instructions and confidence for the future was mediated by overestimations of performance. Thus, repeatedly generating reflective counterfactual thoughts appears to lead to a special case of imagination inflation with dysfunctional implications for future confidence and risk-taking.

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Mentally simulating alternatives to reality (i.e., counterfactual thinking) has been the focus of much research in the areas of causal reasoning, social judgments, and affect. An important distinction made in the existing counterfactual literature is that between evaluative and reflective counterfactual thinking (see McMullen, 1997). According to Markman and McMullen (2003), the *evaluative counterfactual thinking* mode involves the consideration of an alternative to reality and evaluating reality in light of that alternative. In the context of a gambling game, one might compare an alternative action and outcome (e.g., "If only had I taken another card, I would have won.") with reality (i.e., not taking another card and losing), and conclude that the decision was a bad one. In contrast, the *reflective counterfactual thinking* mode involves experiencing only the counterfactual alternative simulation, as if it were real (e.g., fantasizing, "I can see it now...").

We propose that the evaluative/reflective distinction is relevant to the accuracy of one's memory. Although researchers (e.g., Epstein & Roese, 2008; Kray & Galinsky, 2003; Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1994) have argued that counterfactual thinking can have functional effects (e.g., self-regulation and planning for the future), we suggest that counterfactual thinking may have dysfunctional implications for memory.

Garry and Polaschek (2000) were perhaps the first researchers to suggest that in addition to affecting the way people judge the past, counterfactuals can affect the accuracy of one's memory. In

fact, it has been shown that imagining childhood experiences that did not occur can increase one's subjective sense that they actually did occur (e.g., Garry, Manning, Loftus, & Sherman, 1996; Hyman & Pentland, 1996; Loftus, 1993). Goff and Roediger (1998) also found *imagination inflation* effects to emerge when people repeatedly imagined basic behaviors (e.g., sharpening a pencil).

We hypothesize that when people repeatedly experience an event (e.g., play multiple games of blackjack) they can confuse simulated alternatives (e.g., "I might have won.") with reality. More formally, the current research tests the *counterfactual inflation hypothesis*, which holds that repeatedly simulating alternatives to reality (i.e., counterfactuals) can lead to confusion in source monitoring processes (see Johnson, Hashtroudi, & Lindsay, 1993) or a misattribution of familiarity (see Jacoby, Kelley, & Dywan, 1989), subsequently distorting memory.

Our reasoning is partly shaped by studies conducted by Petrocelli, Seta, and Seta (2009). They demonstrated that counterfactuals can lead to overestimates of actual performance and inhibited trial-and-error learning. However, they did not examine the effects of evaluative and reflective counterfactuals.

We hypothesized that reflective counterfactuals are especially likely to lead to memory-distortions. This is because reflective counterfactuals focus only on the imagined alternative; with evaluative counterfactuals, alternatives are contrasted with reality. Opting not to "divorce" oneself from reality should attenuate the strength of a counterfactual/memory-distortion link. Further, the procedures of Goff and Roediger (1998) have more commonalities with reflective counterfactuals than with evaluative counterfactuals.

* Corresponding author.

E-mail address: petrocjv@wfu.edu (J.V. Petrocelli).

Thus, reflective counterfactuals should be more likely to create the illusion that simulated alternatives to reality actually occurred.

Overview of experiment

In the current experiment, participants played 40 games of blackjack and listed particular thoughts (i.e., evaluative, reflective, control) following each game. We expected reflective participants to be most likely to confuse losses for wins. However, given research conducted by Gilovich (1983) one might expect no such memory-distortion. In fact, Gilovich showed that sports bettors remembered more details about their losses than they did about their wins (e.g., teams bet on/against, score, key plays). Apparently, greater processing occurred in response to losses as upward counterfactuals (i.e., simulated alternatives better than reality; Markman et al., 1993) helped to explain away losses; wins were taken at face value. Yet, Langer and Roth (1975) demonstrated that when people think skill is involved in guessing the outcomes of coin tosses, they overestimate how many they guess correctly. Also, when people imagine events that did not occur, false memories can be implanted (see Garry & Polaschek, 2000).

Thus, there seem to be two theoretical positions by which counterfactuals and memory intersect to affect judgments, and they appear to make different predictions. On one hand, a focus on losses due to counterfactualizing may lead to better memory for losses and no overestimation of performance (or possibly overestimation of losses). On the other hand, focusing on wins that were nothing more than counterfactualized losses may create source confusion or misattributions of familiarity, leading to an overestimation of performance. The latter position is consistent with the counterfactual inflation hypothesis.

To examine a counterfactual-based memory-distortion for gambling behavior, participants were asked to recall how well they performed and estimated their confidence for playing future games of blackjack after playing 40 games and listing evaluative, reflective or general thoughts after each loss. We hypothesized that inflated confidence would be most strongly associated with reflective counterfactual thinking. However, we expected this relationship to be mediated by the degree to which actual performance was misestimated. That is, we expected the reflective condition to recall performing better than they actually did, and that such misestimation would result in unwarranted confidence for future blackjack playing. Consistent with this thinking, Oettingen (2000) and Oettingen and Mayer (2002) found that fantasizing about one's future competency, without grounding oneself in reality, can lead to overestimations of performance.

Method

Participants and design

A total of 56 undergraduates from Wake Forest University participated in exchange for partial course credit. Only those students who were familiar with the rules and objective of blackjack were recruited. The experiment employed a single-factor design in which post-game thought-listing instructions were manipulated.

Procedure

Participants were given a brief oral introduction to the experiment and escorted to a private cubicle, equipped with a computer, where they remained for the duration of the experiment. All of the instructions and stimuli were presented via Inquisit 3.0 (Software, 2007). Instructions were self-paced; participants advanced the instructions by pressing response keys. The experiment was intro-

duced as a study of what people think about as they play gambling games.

To ensure that participants were knowledgeable of the rules and objective of blackjack, they first completed a four-item quiz. They then responded to the question "Where do you rank your skill at playing blackjack?" using a seven-point scale; *very poor* (1) to *very good* (7). Participants then played 40 games of computerized, standard blackjack against the computer dealer. Participants were not informed of the number of games they were to play, nor were details given about aggregated performance. For each game, the total values of the player's and dealer's cards were tallied. It was made clear who the winner was after each game.

Thought-listing conditions

Participants were randomly assigned to list one of three types of thoughts after each game. The instructions were modeled after the procedures employed by Markman, McMullen, Elizaga, and Mizoguchi (2006), and were presented at the conclusion of each game. Specifically, following losses, the evaluative counterfactual condition was asked to think about how a better outcome might have occurred, as well as what actually occurred, and to type their "if only" in a space provided on the screen. Reflective counterfactual condition participants were asked to do the same, but were asked to think only about how a better outcome might have occurred. Following wins, evaluative and reflective conditions were instructed to list the first thought that came to mind. Control condition participants were instructed to list the first thought that came to mind following wins and losses.

Dependent variables

Finally, participants were asked to recall how well they performed: "What percentage of the games of blackjack that you played did you actually win?" To measure confidence in future blackjack playing, participants were asked to imagine that they were to play 10 more games of blackjack, against the same dealer, and to estimate how many games out of 10 they expected to win.

Results

Before testing our key hypotheses, we first confirmed that the three thought-listing conditions did not differ in their actual performance. The mean number of games won was 17.08 ($SD = 2.86$; 42.7%); no difference was found between the conditions, $F(2, 53) = .76, ns$.

Next, we tested our hypothesis regarding recall of performance using an analysis of covariance, with the skill item as the covariate and perceived percentage of games won as the dependent variable. Consistent with expectations, a main effect emerged for thought-listing condition, $F(2, 52) = 3.15, p = .05$. Pairwise tests indicated that this effect was largely driven by the tendency for participants assigned to the reflective condition to overestimate their actual percentage of wins ($M = 49.26, SD = 17.52$) more than the evaluative condition ($M = 38.88, SD = 10.09$), $t(52) = -2.47, p < .05$. Although the reflective condition differed only marginally from the control condition [$(M = 42.21, SD = 15.64), t(52) = -1.63, p < .11$], the difference was in the direction expected. The evaluative and control conditions did not differ in their recall of their performance, $t(52) = -.89, ns$. The covariate also emerged as significant ($F(1, 52) = 10.98, p < .01$); the greater the perceived skill, the greater their perceived performance.

We speculate that the reflective and control conditions did not significantly differ in recall due to the fact that control participants sometimes generated counterfactuals after experiencing losses. However, it is impossible to confirm whether or not these counterfactuals were reflective in nature. In fact, the thoughts listed by

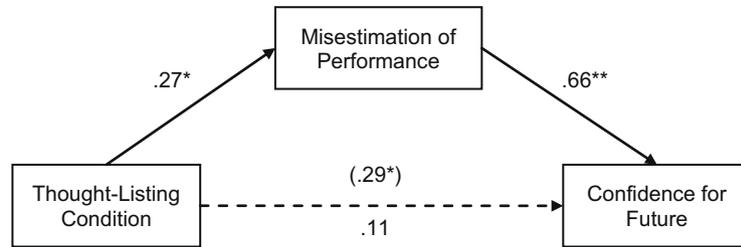


Fig. 1. Mediation analysis regressing confidence for future blackjack onto thought-listing condition and misestimation of performance. *Note:* Values displayed are standardized beta coefficients. The value in parentheses indicates the relationship between thought-listing condition and confidence for future without controlling for misestimation of performance. Thought-listing condition coding: 0 = evaluative; 1 = control; 2 = reflective. Misestimation = perceived percentage of wins – actual percentage of wins. * $p < .05$. ** $p < .001$.

evaluative and reflective condition participants were often similar, but they differed with respect to how they were experienced, as they were reminded of what to focus on after each loss.

To examine our mediational hypothesis, we subtracted actual performance from recalled performance and tested this variable as a mediator of the thought-listing condition/confidence link using the criteria recommended by Baron and Kenny (1986; see Fig. 1). We also coded the thought-listing condition such that a positive coefficient would indicate positive misestimation with the condition we expected to show the greatest overestimation of performance (i.e., reflective). Specifically, we coded the evaluative condition as “0,” the control condition as “1,” and reflective condition as “2” because it best reflected the relationship found between the thought-listing conditions and the proposed mediator.¹ Each step of the mediation analysis also statistically controlled for perceived skill.

The thought-listing condition significantly predicted confidence for future blackjack outcomes and misestimation of performance, such that greater confidence and positive misestimations were associated with reflective counterfactuals. In the full model, misestimation was significantly associated with greater confidence, whereas the effect of thought-listing condition was reduced to non-significance. Further, the reduction of the effect of thought-listing on confidence was statistically significant, $z = 2.01$, $p < .05$.

Discussion

We obtained experimental evidence that the relationship between reflective counterfactual thinking and confidence was in fact mediated by the accuracy of one’s recall for past performance. Thus, repeatedly generating reflective counterfactuals has the potential of leading to a special case of imagination inflation. Participants in this condition recalled winning about 7% more games of blackjack than they actually won; a sizable difference at the casinos if real (rather than imaginary). Similar to Garry and Polaschek (2000), we suggest that such mediation may be driven either by confusing the source of the repeated representations (i.e., internal or external; see Johnson et al., 1993), or mistaking the subjective sense of familiarity of winning (much of which is imagined) for reality (see Jacoby et al., 1989). Determining which process is operating remains for future research.

Although we found evidence for the counterfactual inflation hypothesis, we believe that some caution is warranted. For instance, although the difference in recall was in the direction expected, the reflective and control conditions differed only

marginally. We also suspect that repeatedly counterfactualizing an event that occurs only once may be less likely to cause memory impairment. It is important to note that our participants were never provided aggregated feedback. It seems possible that aggregated feedback (i.e., a single piece of information) is remembered better than feedback for several individual events (i.e., several, seemingly vague or poorly organized, pieces of information). Thus, our data are suggestive of memory-distortions when events occur repeatedly, the desirability of the outcomes varies, and people clearly engage in reflective counterfactual thinking.

According to the functional perspective of counterfactual thinking, counterfactuals shed light on causal inferences. To the extent that an event may reoccur, such causal inferences may shape one’s expectancies. As Markman, Ratcliff, Mizoguchi, McMullen, and Elizaga (2007) argued, counterfactuals associated with affective contrast (i.e., upward-evaluative counterfactuals with negative affect) can result in assimilative effects with regard to expectations for the future (i.e., aligning simulated alternative performances with future performance). However, our data suggest that expectations for the future can also be inflated through a memory-based process when people repeatedly generate reflective counterfactuals.

To the extent that counterfactuals lead to unwarranted perceptions of performance and confidence, and to the extent that these variables increase one’s likelihood of continued gambling (and more losing), counterfactuals would have seemingly dysfunctional implications (see Sherman & McConnell, 1995). On the other hand, counterfactuals may at times promote productivity and success (e.g., Roese, 1994), and overly positive self-evaluations and illusions of well-being that help regulate motivation and self-esteem (Taylor & Brown, 1988). However, in the context of gambling, such illusions may have undesirable consequences.

Connecting counterfactual thinking to memory invites many new questions. For instance, Garry and Polaschek (2000) argued that source monitoring problems are more likely to occur as the time increases between an event and recall. It seems reasonable to expect counterfactual inflation to be augmented over time. However, Carpenter (1973) provided evidence to the contrary by examining how information is represented and extracted from counterfactuals (e.g., “If the doctor had left, Rico would have died.”). Although her participants represented and extracted information from the more complex simulations (i.e., *the doctor left; Rico died*) when given little processing time, they stored the simplified version (i.e., *the doctor stayed; Rico lived*) in long-term memory when given sufficient time. Although participants in Carpenter’s experiments did not repeatedly generate the same counterfactuals for recurring events, the discrepancy between her data and the arguments of Garry and Polaschek warrants further investigation.

Furthermore, it is unclear if there are conditions under which both reflective and evaluative counterfactual thinking lead to memory impairment. It is possible that even evaluative counterfactuals can affect judgments of one’s skill (e.g., picking race horses),

¹ Mediation results and conclusions were virtually the same under three additional coding schemes: when the control, evaluative and reflective conditions were coded as “0”, “1”, and “2”, respectively; when only the evaluative and reflective conditions were analyzed; and when the control and evaluative conditions were coded as “0” and the reflective condition was coded as “1”.

despite one's actual performance (e.g., "My horse lost by a nose and I should have won that bet – I'm better at picking horses than my performance indicates."). In such cases, counterfactual inflation might be mediated by the perceived skill that covaries with counterfactuals.

In conclusion, given that the evaluative condition failed to show the same effects as did the reflective condition, we suggest a simple solution to memory-distortions that may emerge through repeated counterfactualizing. Specifically, people might reduce the likelihood of counterfactual inflation by focusing as much on reality as they do on alternatives.

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