Can Exposure to Post-outcome Information "Debias" the Hindsight Bias?

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Abstract

The present study investigated the effects of post-outcome information on retrospective judgments. Participants completed a within-subjects scenario-based hindsight paradigm. After being exposed to outcome information participants were dismiss, exposed to outcome congruent post-outcome information, or exposed to outcome incongruent post-outcome information. Results revealed the largest hindsight bias in the incongruent post-outcome group. These results are discussed in terms of their fit with competing cognitive reconstruction models of retrospective judgment making and hindsight bias.

Keywords: Hindsight Bias; Judgment Formation; Surprise; Expectation; Representational Change.

The Hindsight Bias Effect

Imagine that it is November 7, 2000 around lunchtime. Today is Election Day in the U.S., however none of the polls have closed anywhere in the nation. Someone you are having lunch with asks, "What do you think each presidential candidate's chances of winning are?" What would you have said?

Sanna and Schwarz (2003) had undergraduates predict the percentage of votes that each of the presidential candidates would receive. On average, participants predicted that the Gore/Lieberman ticket would win the popular vote by a margin of 4.45%. After a hotly contested election, several recounts, and a Supreme Court decision, the final official popular vote count had Gore/Lieberman ahead of Bush/Cheney by only 0.35% percent. After the media had announced the official results of the election, Sanna and Schwarz asked the same participants to attempt to remember what vote-predictions they had made before they knew the actual outcome of the election. On this retrospective judgment, participants' average margin between the two tickets was reduced to 0.58%. This was significantly lower than the original margin they had predicted in foresight. In other words, participants' post-outcome retrospective answers were closer to the actual election results than their pre-outcome predictive answers thereby overestimating the accuracy of their initial beliefs as if they "knew-it-all along."

This hindsight bias or the "knew-it-all along" effect is one of the most frequently cited judgment biases in the literature and has been shown to be robust across a wide variety of domains and task environments such as: medical diagnoses (Arkes, Faust, Guilmette, & Hart, 1988), legal judgments (Kamin & Rachlinski, 1995), jurors' decisions (Casper, Benedict, & Perry, 1989), victim degradation in rape scenarios (Carli, 1999), stock purchases (Louie, 1999), sporting event results (Roese & Maniar, 1997), and answers on almanac trivia questions (Hell et al., 1988). Understanding the cognitive mechanisms that lead to this effect is important for several reasons. The robustness and ubiquity of the hindsight bias phenomenon suggests that it can offer a window into how humans store and retrieve information and use information to make judgments (Hawkins & Hastie, 1990; Hoffrage & Pohl, 2003). Furthermore, the fact that it has been observed in many "real life" situations, such as jurors' decisions and medical diagnoses, has profound practical implications (Christensen-Szalanski & Willham, 1991). Therefore, the goal of providing and testing a theoretical explanation for the hindsight bias phenomenon is important for both scientific and practical reasons.

Theoretical Explanations of the Hindsight Bias

"Creeping determinism" accounts (Fischhoff, 1975; Carli, 1999; Wasserman, Lempert, & Hastie. 1991) propose that outcome information is automatically integrated in one's memory representation and that this updated representation is used to make the retrospective judgment. This account would expect memory updating anytime one is exposed to post-prediction information that activates memory elements supporting a particular outcome. Therefore, this theory proposes that anytime individuals are exposed to post-prediction information that supports a potential outcome, their retrospective judgments will be more in favor of that outcome.

Metacognitive cue based accounts (Ofir & Mazursky, 1990;1997) propose that when making a retrospective judgment people first judge whether or not they found an outcome surprising and then use this metacognitive information to estimate their predictive state of mind. According to this view, expected or unsurprising outcomes give people an "I would have known that!" feeling. This theory proposes that this metacognitive reaction causes people to be overconfident about their predictive accuracy, which leads to inflated retrospective judgments. It is then this over-estimation that causes the hindsight bias effect. Furthermore, this view proposes that unexpected or surprising outcomes give people an "I would have never known that!" feeling. This metacognitive reaction leads people to be under-confident in their predictive accuracy. This serves to deflate retrospective judgments, thereby reducing or perhaps reversing the hindsight bias effect.

Finally, the surprise cued sense-making account (Pezzo, 2003) proposes that hindsight bias happens when people successfully "make sense" of outcome information. Successful "sense-making" leaves people with an updated representation of the situation that favors the given outcome. On retrospective judgments, people use this updated

representation to reconstruct their predictive judgment, which leads to hindsight bias. Only unexpected or surprising outcomes should not intuitively "make sense." Therefore, according to this theory, hindsight bias should only occur after exposure to surprising or unexpected outcome information. Expected or unsurprising outcomes should initially "make sense" and therefore not activate any sense-making processes. Therefore, according to this theory, hindsight bias should not occur after exposure to expected outcome information.

"Debiasing" with Post-outcome Information

One of the first things psychological researchers tend to do after the discovery of a robust judgment or reasoning bias is attempt to devise treatments that will counteract or eliminate the bias. This pursuit is well justified for both pragmatic and theoretical reasons. Pragmatically hindsight bias can be found in many situations in which the consequence can be quite detrimental, such as juror decision-making and medical diagnosis. Therefore, any treatment that can reduce or eliminate this bias is useful in and of itself. Furthermore, finding the boundary conditions in which an effect occurs can also be useful in guiding theory development and testing psychological models of a phenomenon.

One of the earliest proposed interventions to "de-bias" individuals' retrospective-judgments was to ask subjects to search for reasons why the given outcome *may not have* occurred (Slovic & Fishhoff, 1977). The assumption was that accessing information that supports other possible outcomes would help individuals regain their pre-outcome perspective. Indeed several investigations have asked individuals exposed to outcome information to search for reasons as to why the true outcome may not have occurred before making their retrospective judgments. The general finding is that this manipulation can attenuate the hindsight bias effect (e.g., Arkes et al., 1988; Koriat, Lichtenstein, & Fischhoff, 1980; Slovic & Fischhoff, 1977).

The results from these reason-generation studies have been interpreted as support for the "creeping determinism" explanation of the hindsight bias. According to this view, thinking of reasons why an outcome may not have occurred will increase the accessibility of information supporting the alternative outcome, thereby counteracting the effects of the outcome information.

However, the metacognitve cue or "I would have known that!" explanation of hindsight bias predicts this same pattern, albeit for different reasons. Under this explanation, thinking of reasons why the given outcome *may not have occurred* may decrease a person's metacognitive feeling of certainty, thereby counter acting the bias. However, it has been pointed out that attempting to recall information from memory actually activates two distinct types of information for an individual: (1) the items, elements, or reasons that are activated as a result of the memory search or the accessible content and (2) the metacognitive assessment of the ease or difficulty to which this information was found or the accessibility experiences (Sanna, Schwarz, & Stocker, 2002; Schwarz et al., 1991).

It has been hypothesized that these two different sources of information can have different effects on one's subjective feeling of outcome certainty. If the *accessible content* provided by the memory search activates memory elements that support the alternative outcome, this lead to an "I never would have known that" feeling. However, if the *accessibility experiences* provided by the search give an individual the subjective feeling that it was difficult to think of information that would support alternative outcomes, this may in fact reinforce a persons feeling of certainty about the "true" outcome. Therefore, the "I would have known that" account of hindsight bias would be able to explain any result of any study using a reason-generation paradigm to provide the post-outcome information.

The only theory that these results would seem to rule out is the "sense-making" explanation of hindsight bias. This theory proposes that when outcomes are "surprising" people attempt to make sense of the outcome and that it is this sense-making process that leads to hindsight bias. According to this view, attempting to think outcome incongruent information may make the outcome seem more surprising. This explanation proposes that surprise is the cue that activates the sense-making processes that lead to hindsight bias. Therefore, studies that show that thinking of outcome incongruent information attenuates the bias are not well explained by this theory.

However, Sanna et al. (2002) found generation paradigm evidence that supports the pattern suggested by this sense-making theory. They found that asking participants to list two reasons why the alternative outcome could have happened had no significant effect on the magnitude of the hindsight bias. However, asking participants to list ten thoughts on why the alternative outcome could have happened significantly *increased* the magnitude of the hindsight bias. However, because the generation paradigms only ask participants to think of incongruent information, this design did not test the other prediction of the "sense-making" account. Namely that congruent post-outcome information should make an outcome seem more expected, thereby removing the cue for "sense-making" and attenuating the hindsight bias.

In summary, the effects of post-outcome information on the hindsight bias effect are interesting for both practical and theoretical reasons. Practically providing post-outcome information is one of the simplest potential treatments for the hindsight bias effect. Theoretically, the different theories make opposing predictions about what effects congruent and incongruent post-outcome information should have on the hindsight bias effect. Therefore, systematic observation into the effects of post-outcome information will help us rule out at least one explanation for the effect. Unfortunately, incomplete designs that test only incongruent information and reliance on a reason-generation paradigm have lead to inconsistent and uninterruptible results.

Experiment

The goal of the present study was to test the effects of post-outcome information on hindsight bias in a way that allowed for the manipulation of outcome congruency, and did not rely on a generation paradigm. The present study used a within-subjects scenario based hindsight bias design. In this design participants first read a narrative story that set up a situation but did not reveal the outcome to the situation. This pre-outcome story was designed to present an equal amount of information supporting each of the two possible outcomes. Next participants were asked to make a predictive judgment as to the likelihood of the two possible outcomes. After making their predictions, participants were exposed to one of the two possible outcomes. The outcome only group only received the outcome information. The two other groups were exposed to post outcome information that was either congruent or incongruent with the given outcome. A week later the participants returned to the lab and made a retrospective judgment where they were asked to remember their original ratings. Hindsight bias is then assessed as a change between predictive and retrospective judgments in favor of the given outcome.

By providing the participants with the post-outcome information, we are able to test for the effects of *accessible content* without confounding it with effects of *accessibility experiences.* Furthermore, this paradigm allows us to manipulate outcome and post-outcome information independently, thereby offering a complete test of the opposing theories of hindsight bias.

Predictions

"Creeping Determinism" theory predicts that: 1) Retrospective judgments will favor the given outcome. 2) Congruent post-outcome information will further activated outcome supporting memory elements thereby exacerbating the hindsight effect. 3) Incongruent post-outcome information will activate memory elements that support the alternative outcome thereby attenuating the hindsight bias.

The metacognitive cue explanation of hindsight bias, predicts that: 1) Retrospective judgments will favor the given outcome. 2) Congruent post-outcome information will make individuals feel even more confident in their initial accuracy, thereby increasing the effect. 3) Incongruent post-outcome information will make individuals less confident in their predictive accuracy and this should lead to retrospective ratings that are more in favor the alternative outcome, which will reduce or reverse the hindsight bias effect (see Ofir & Mazursky, 1990; 1997).

The surprise cued sense-making theory predicts that: 1) Retrospective judgments will favor the given outcome. 2) Congruent post-outcome information will make activation of "sense-making" processes less likely, thereby attenuating the overall hindsight bias effect. 3) Incongruent post-outcome information will make activation of "sense-making" processes more likely, thereby increasing the overall hindsight effect (see Table 1 for a summary of these predictions).

Table 1: Predictions about the effects of post-outcome information and its congruency with outcome on the hindsight bias effect (HSB = Hindsight Bias).

	Post-outcome information condition		
Theory	Incongruent	None	Congruent
Creeping Determinism	less HSB	Usual HSB	more HSB
Metacognitive Reaction	no or reverse HSB	Usual HSB	more HSB
Surprise Cued Sense-making	more HSB	Usual HSB	less HSB

Method

Participants

One-hundred thirty-three introductory psychology students from the University of Illinois at Chicago participated in this study for course credit (Incongruent = 46, No Post-outcome = 43, Congruent =44).

Materials

Pre-outcome information: Two texts were created so that they met the following criteria: 1) the domain or subject matter of the text had to be a subject that would be familiar enough for most undergraduates to intelligently comprehend the situation and recognize what evidence should afford different outcomes, 2) the events had to be fictional so that participants could not enter the experiment already knowing the true outcome, 3) the agents had to be fictional or historically obscure so that individuals would not come to the study with an initial preference for positive or negative outcomes for any of the characters, 4) the situations described in the scenarios had to afford two mutually exclusive outcomes, 5) the stories' structures had to afford rearrangement of the order in which the agents were presented (to control for order effects) without any loss of story coherence, 6) the text had to have an equal amount of information that supported or opposed either of the two potential outcomes, 7) the pre-outcome scenarios had to end with the upcoming event without alluding to the outcome of the event. One text developed to meet these criteria described an upcoming professional tennis match between two fictitious players. A second text was developed that used the same structure but described an ancient battle between two opposing armies.

Outcome information: Two outcome information texts were designed for each of the two stories. These texts were designed to meet the following criteria: 1) the text clearly and unambiguously informed the participant of the "true" outcome of the text, 2) the text did not present any further information that was not given in the pre-outcome text, 3) the text did not allude to what factors or events played a role in the outcome. One text was created to describe each of the two possible outcomes to the different scenarios.

Post-outcome information: The two possible post-outcome texts for the tennis story set up a discussion between opposing player's fans in the tennis text. Likewise, the post-outcome texts for the battle scenario set up an academic disagreement among historians. The post-outcome information only presented the arguments for one side of the discussion. Therefore, the passages only reinforced information that supported one of the two possible outcomes. No new information was presented in the post-outcome texts. The statements all referred back to information presented in the pre-outcome text. These materials allowed for the post-outcome information to reactivate information that favored a certain outcome without providing information or facts that were not available for the predictive judgment.

Design and Procedure

This study consisted of two sessions that took place one week apart. All stimuli were presented and measures were collected via an Eprime application run on personal computers. Participants were run in groups of 1 to 20. In the first session participants were assigned one of the two text conditions. The information in these texts was block randomized into eight different sequences to control for order effects.

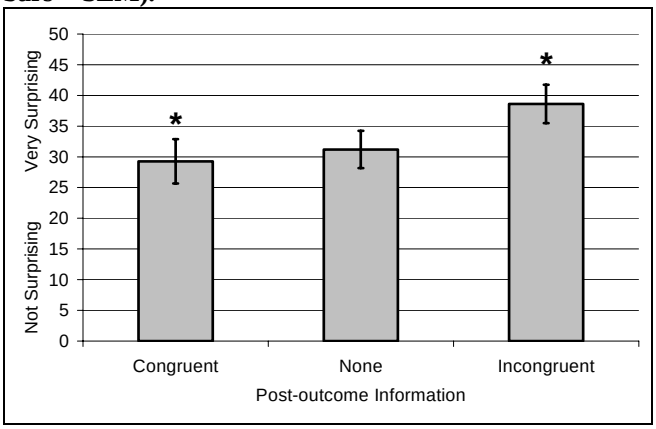
In session one, participants first read the pre-outcome information one sentence at a time. Next they made a series of ratings including their predictive judgment. For example, participants in the tennis text condition read a passage which described an upcoming match between professional tennis stars Mark Krause and Nathan Mitchell. After reading the text, they were presented which a judgment-prompt stating, "Either Mark Krause won the match OR Nathan Mitchell won the match. Use the scale below to indicate your opinion of how likely the two outcomes are based on the story." Below this question was a continuum that was flanked on either side by "Krause Wins" and "Mitchell Wins." Participants indicated their response by moving the marker on the scale between the two possible outcomes. Locations closer to an outcome's anchor indicated judgments that that outcome was more likely. The continuum allowed for 78 possible marker locations. After making their ratings participants were randomly assigned to an outcome condition (e.g. Krause wins or Mitchell wins) and one of three post-outcome conditions (None, Mitchell Justification, or Krause Justification). Pairing possible outcomes with post-outcome stimuli led to the three post-outcome congruency conditions (congruent, no post-outcome, and incongruent). After reading the outcome and post-outcome information, participants made a rating indicating how "surprising" they found the outcome using a continuum anchored on "Not Surprising" and "Very Surprising". Finally participants were ask not to discuss the experiment with other students and dismissed.

Participants returned a week later for the second session. At this time, participants were asked to attempt to remember their exact ratings from the previous week's questions. The questions were presented in exactly the same way as the previous weeks section only at the top of the screen participants were reminded to try to remember their original opinion. This rating was used as the measure of participants' retrospective judgments which were compared to their initial judgments to assess hindsight bias.

Results

Surprise Ratings: To investigate the effect of post-outcome information on outcome surprise ratings a 2 (text: tennis or battle) X 3 (post-outcome information: congruent, none, incongruent) between subjects ANOVA was conducted on participants' surprise ratings. Results revealed a main effect of condition F (2, 127) = 6.26, $p < .01$, $\eta 2$= 0.09 (see Figure 1). The congruent post-outcome information led to the smallest mean surprise rating while the incongruent post-outcome lead to the largest ($p < .05$, Scheffe's test). The average no post-outcome condition surprise rating fell only slightly higher than the congruent condition, and was not significantly different than either of the other groups.

Figure 1: Surprise Ratings as a Function of Post-Outcome Condition. (* = sig. different groups, error bars = SEM).



Hindsight Bias: Initial analyses revealed no effects of text, therefore this variable was collapsed across in order have greater power to investigate the effects of the congruency manipulation on hindsight bias. A 2 (judgment: predictive or retrospection) X 3 (post-outcome information: congruent, none, incongruent) mixed design ANOVA was conducted on predictive and retrospective outcome likelihood judgments. These ratings were centered on the middle value of the rating continuum and recoded so that higher positive scores represent judgments in favor of the given outcome while lower negative score represent judgments in favor of the alternative outcome (possible range –38.5 to 38.5). Results revealed a main effect of judgment such that participant's retrospective judgments were more in favor of the given outcome (M = 5.33, SD = 21.86) than their predictive judgments (M = -0.86, SD = 18.36), F (1, 133) = 10.06, $p < .01$, $\eta 2$= 0.07. Therefore,

when collapsing across post-outcome conditions, this study replicated the standard hindsight bias effect.

However, this simply shows that individuals in this study showed the traditional hindsight bias effect. All theories predicted hindsight bias in general. Where the theories differ is in their predictions about the nature of the judgment X post-outcome interaction. However, no judgment X post-outcome interaction was detected by the current analysis. However, given the normal size of the hindsight bias, the failure to detect moderation is not surprising. In a meta-analysis of 122 published studies investigating the hindsight bias, Christensen-Szalanski & Willham, (1991) found that the average hindsight bias effect on scenario based designs is rather small (d = 0.34), but very reliable across studies. The size of the hindsight bias in the current study is similar to the average effect identified by Christensen-Szalanski and Willham (present study d = 0.31). In order to detect moderation in such a subtle effect, a much larger sample size would be necessary (about four times as many participants to reach 80% Power, see Cohen, 1988). The chances of detecting this type of interaction effect in the present study were unacceptably low (17%). Therefore, in order to test the predictions of the different hindsight bias theories, the size of the hindsight bias effect in each of the post-outcome conditions was compared by calculating Cohen's d. By focusing on effects sizes, we can access whether the magnitude of the hindsight bias effect followed the one of the two overall patterns predicted by the different theories (see Table 1) in a way that is not as susceptible to Type II error.

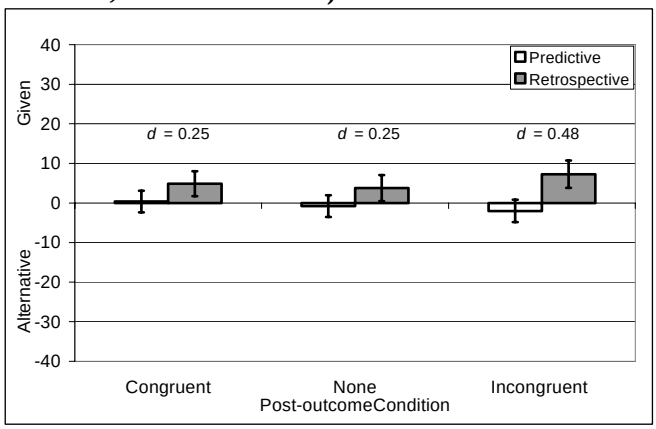
Figure 2 displays the hindsight bias effects as a function of post-outcome congruency conditions. A positive change in ratings between the predictive and retrospective judgments is indicative of the hindsight bias. The size of the hindsight bias effect for the no post-outcome condition can be thought of as a baseline to measure the effect that the outcome information itself had on retrospective judgments. In the no post-outcome condition participants displayed the usual small effect, $d = 0.25$. In the congruent post-outcome condition participants showed a same small effect, $d = 0.25$. Finally, in the incongruent post-outcome condition participants showed a larger, medium-sized effect, $d = 0.48$.

In summary, the no post-outcome and congruent post-outcome conditions showed the same normal sized hindsight bias effect. However, the incongruent post-outcome information condition led to greater surprise ratings and a larger hindsight bias effect.

Discussion

Ever since Fischoff's (1975) initial investigations into retrospective judgment-making showed that people's recollections or reconstructions of prior predictions are influenced by outcome knowledge, investigators have been proposing explanations of this hindsight bias and attempting to find ways to "debias" people's retrospective judgments.

Figure 2: Predictive and Retrospective Likelihood Ratings as a Function of Post-outcome Condition. (*d* = Cohen's d, error bars = SEM)



One of the initial methods people proposed for "debiasing" was to expose people to post-outcome information that reminded them of why other outcomes may have occurred. This method for counteracting the hindsight bias appeals to common sense and is consistent with some of the theoretical explanations of the hindsight bias. However, the effects of post-outcome information and it's congruency with outcome information has never been systematically investigated in an unconfounded and complete design. As mentioned earlier, most prior studies focused solely on incongruent post-outcome information and relied on a generation paradigm that confounded a*ccessible information* with *accessibility experiences*.

The present study investigated the effects of post-outcome information by actually manipulating the nature of the post-outcome information presented to the participants. This simple manipulation revealed a rather interesting and some-what counter intuitive result. The "creeping determinism" and metacognitive cue theories of hindsight bias both predict that exposure to post-outcome information presenting reasons why the given outcome *may not have happened* should attenuate the hindsight bias. This prediction also makes intuitive sense. If the outcome information is biasing one toward the given outcome, then being reminded of reasons for the alternative outcome should counteract this bias and remind one to his or her pre-outcome state of mind.

However, the present study did not show any evidence that outcome-incongruent post-outcome information attenuated the magnitude of the hindsight bias effect. In fact, the effect size analysis suggested the exact opposite effect. Exposure to post-outcome information that was incongruent with the given outcome actually increased the magnitude of the hindsight bias effect. Therefore, it seems that attempting to "debias" people's retrospective judgments by reminding them of information that supports other possible outcomes could actually make the hindsight bias *worse*.

These results not only call into question one of the most intuitive ways to counteract the hindsight bias effect, but also stand in contrast to the predictions of two widely cited explanations for the effect. Both the "creeping determinism" and metacognitve-cues accounts of hindsight bias predicted that incongruent post-outcome information should attenuate the bias while congruent post-outcome information should exacerbate it. These predictions were not supported. However, the predictions of the "surprise cued sense-making" approach were supported. The incongruent condition post-outcome information made the outcome seem more surprising, and also lead to a larger hindsight bias effect.

However, surprise cued sense-making theory is primarily descriptive in nature, and more research needs to be done to flush out the component processes and assumptions put forth by this view of representational change and retrospective judgment making. First of all, "sense-making" is not an explicitly defined cognitive mechanism. Instead it is a descriptive term that refers to the problem-solving, memory and reasoning processes that are involved in active comprehension. Therefore, defining the component processes and heuristics people use to make-sense of an outcome is necessary if one wants to use these processes to explain the hindsight bias. Furthermore, this theory proposes that "surprise" plays a role in cueing the sense-making process without offering a clear theory of surprise.

The necessity for an explicit surprise theory is clear when considering the effects of the congruent post-outcome information. This information had no effect on the magnitude of the hindsight bias. Sense-making theory can provide a backwards explanation for why there was no reduction in hindsight bias for this condition but this explanation is contingent on the observation that the manipulation did not have a substantial effect on surprise ratings. Therefore, without an explicit theory of surprise and expectation this model of hindsight bias is unable to make clear a priori predictions.

Finally, this theory assumes surprise-cued sense-making processes lead to an updated memory representation, and that this updated representation is used in retrospective judgment making. However, exactly how the representation changes and exactly how people use this representation to retrospectively estimate their predictive judgments also needs to be defined. Therefore, the present study can be seen as a starting point for a program of research that is designed to lead to an explicit and mechanistic account of hindsight bias that defines 1) how people represent information about events or situations, 2) how this information is used to make predictive judgments, 3) how outcome information cues sense-making processes, 4) what the component process of sense-making are, 5) how these processes effect people's representation of a situation, and 6) how people use this information to make retrospective judgments.

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