No Amplification of Hindsight Bias Due to Time Delay

John W. DenBoer, M.A.[1]

Abstract ~ Hindsight bias is a phenomenon in which individuals tend to overestimate the degree of accuracy to which they can recall an event after the fact. This study examined the effect of time delay on hindsight bias. Participants ($n = 66$) gave numerical responses to test questions (Phase 1) and were later provided with the solutions to these questions (Phase 2), at which time they were asked to recall their original answers. Group 1 received a short time delay of 1 day between Phases 1 and 2, while Group 2 experienced a medium delay (1 week) and Group 3 a long delay (3 weeks). Although non-significant results were obtained, a trend was found toward increased hindsight bias with longer time delay.

Introduction

Individuals who examine an event after learning the outcome tend to exaggerate their ability to predict the result prior to having the outcome revealed. This psychological tendency is known as hindsight bias, or the "I-knew-it-all-along" phen-

1: Department of Psychology, University of Montana, Missoula, MT, USA.

Address correspondence to John W. DenBoer: jwdenboer@yahoo.com.

omenon (Wood, 1978). Hindsight bias is inferred by comparing qualitative or quantitative estimates made by individuals after discovering the answers to knowledge problems or the outcome of an event with estimates they made prior to the test or event. Research has shown that participants' recollections of their original estimates tend to be systematically biased toward the actual solution to a problem (e.g., Fischoff, 1975; Hertwig, Fanselow, & Hoffrage, 2003; Pezzo, 2003; Pohl, Bender, & Lachmann, 2002).

Hindsight bias has been explored in an applied fashion in a variety of settings, including sporting events (Roese & Maniar, 1997), tests of difficult knowledge (Pohl & Hell, 1996), and perceptions of technological disaster (Brown, Williams, & Less-Haley, 1994). The study of hindsight bias is applicable to important political decisions (Blank, Fischer, & Erdfelder, 2003), health care behaviors (Renner, 2003), and academic performance (Leary, 1982). Hindsight bias has also been studied in the context of psychotherapy (Fischoff, 1975) and has been examined in relation to personality traits (Musch, 2003).

The reduction and elimination of hindsight bias has been explored in many experimental settings. Arkes, Faust, Guilmete, and Hart (1988) attempted to eliminate hindsight bias among 194 neuropsychologists, employing the factor of reasoning assess-ment in their work. In this study, participants were divided into two groups, with one group being asked to provide a reason why each of three possible diagnoses might be correct; members of the other group were not required to list reasons. The researchers found that the frequency of participants succumbing to hindsight bias was lower in the group asked to give explanations for the diagnoses than in the no-reasons group. These results suggest that although hindsight bias could not be fully eliminated, a brief measure of reasoning could be used to effectively reduce this cognitive distortion. Additionally, Pezzo (2003) examined cases

of memory reconstruction in which hindsight bias was absent, finding that hindsight bias was diminished when individuals did not possess a sense of responsibility for the outcome.

Select research suggests that hindsight bias may actually be an adaptive and efficient method of human cognition (Hoffrage, Hertwig, & Gigerenzer, 2000). Specifically, a model of memory reconstruction entitled Reconstruction After Feedback with Take the Best (RAFT) proposes that any correct information or feedback that an individual receives after they give their initial judgment will automatically update the underlying information that the original judgment rests on. This theory states that if an individual forgets their original estimate then they will use current (i.e., updated) information about the event, thus incorporating new feedback and information to more efficiently (although not always accurately) construct new memories.

Despite research examining the role of time in the development of hindsight bias (Bryant & DeHoek, 2006), no study has explored the influence of time delay on amplitude of hindsight bias. The present study aimed to fill this empirical gap. Based on research on anchoring and adjustment (e.g., Chapman & Johnson, 1994; Czaczkes & Ganzach, 1996; Hardt & Pohl, 2003), it was hypothesized that participants who experienced a greater time interval between an event (i.e., a difficult knowledge test) and a subsequent prompt to recall their initial response to this event (i.e., their original answers to this test) would exhibit an increased tendency toward hindsight bias.

Method

Participants

Participants in this study were 66 undergraduates (53 women and 13 men, $M = 18.6$ years) enrolled in three separate Introduction to Psychology courses. The groups for the present study were as

follows: Group 1 (*n* = 27; 21 female, 6 male, *M* age = 18.4 years), Group 2 (*n* = 20; 18 female, 2 male, *M* age = 18.7 years), Group 3 (*n* = 19; 14 female, 5 male, *M* age = 18.7 years). The gender distribution of these groups was representative of the larger college population. All participants received course credit for their study participation. This study was approved by the college's Institutional Review Board and met all American Psychological Association Ethical Guidelines for Treatment of Human Subjects.

Materials

A difficult knowledge exam was developed by the principal investigator for use in this study. This brief test consisted of 20 difficult-knowledge questions requiring numerical responses (see Appendix A). The questions were created on the premise that participants had been exposed to the answers in the past, but probably would not know the exact solutions to the majority of the questions at the time they took the test. This design was adapted from similar methodology employed by Pohl and Hell (1996). There were two main phases to the present study; the order of the questions remained the same during both phases.

Procedure

In Phase 1 participants completed the 20-question exam in a standard classroom environment. Although participants completed the measures in a group format, they were instructed to work individually, to answer as accurately as possible, and to answer all of the questions. When the participants completed the exam, the principle investigator instructed them that he would be returning on a future (unspecified) date for Phase 2 of the study. All groups received the same study instructions and were exposed to Phase 1 on the same day.

The principal investigator returned to the classrooms of the three participant groups for Phase 2 of the study. This phase of the

study required participants to complete a recall exam that was identical to the aforementioned difficult knowledge exam with the exception of different instructions and the inclusion of the correct answer (within parentheses and highlighted by bold type) following each question. Participants were given both verbal and written instructions to recall, to the best of their ability, their original answers to each of the 20 questions presented in Phase 1. All participants were instructed to recall answers only to questions they had answered during Phase 1. Participants were provided with as much time as needed to complete the recall exam. All measures were handed out in a group format by the principal investigator.

Participants in each group completed Phase 2 at different times after the completion of Phase 1 (i.e., Group 1 after 1 day, Group 2 after 1 week, and Group 3 after 3 weeks). Participants in Groups 1 and 2 received a general debriefing session following the completion of their participation in the study, while Group 3 was completely debriefed and given an informational sheet about the purpose of the study at the conclusion of their 3-week treatment condition. At this time Groups 1 and 2 also received the complete debriefing form.

Results

Following the work of Pohl and Hell (1996), the data of each participant were converted into standardized scores of hindsight bias. By using the solution and both the original and recalled estimates of all participants (separately for each question) each original and recalled response was transformed into a z score. Both original and recalled responses with a z score greater than 3 were removed from the data set. Scores of zero on either the general knowledge or recall exams were included among the data set, but were eventually eliminated because they yielded z scores greater than 3. The remaining values were then calculated again

in the same fashion.

A difference score *z was computed using the formula:

$$*z = |(z(E)-z(S))| - |(z(R)-z(S))|$$

where E, S, and R, denote original estimate, actual solution, and recalled estimate (respectively) and |...| denotes absolute value. In this equation, the difference score *z is a measure of the "drift" of the recalled estimate toward or away from the solution, expressed in units of standard deviation. A positive *z value shows evidence of drift toward the actual solution (i.e., hindsight bias), whereas a negative value indicates that the recalled estimate was further away from the correct answer than the original estimate. Difference scores were then averaged across participants and time delay conditions.

Mean *z scores were -.05 (*SD* = .15), -.06 (*SD* = .21), and .16 (*SD* = .77) for Groups 1, 2, and 3, respectively. The group z means were then subjected to a one-way ANOVA with an alpha level of .05. The differences between the three groups failed to reach statistical significance, $F(2, 62) = 1.61$, *p* = .21. The present findings do not support the notion that the length of time between participants' original answers and recall estimates affects level of hindsight bias displayed.

Discussion

Results did not support the hypothesis that participants who experienced the greater time delay between Phase 1 and Phase 2 of the study would demonstrate hindsight bias. In fact, participants in Groups 1 and 2 tended to recall their original estimates fairly accurately. In spite of these results, participants in Group 3 overestimated the accuracy of their original answers by rating them numerically closer to the correct answer than they

actually were.

One possible explanation for the unexpected results of the present study is that participants used a variation of solution-based rejudgment in their attempt to recall their original answers. Coined by Pohl and Hell (1996), "solution-based rejudgment" involves the independent memory decay of both original answers and solutions. In this case memory retrieval of either the original estimate or the solution becomes a judgment task for participants. "Rejudgments" of this type will normally be distributed around the solution (Pohl & Hell, 1996). If an individual has an accurate memory of the original answer, this should lead to either more perfect recollections or to more cases of insufficiently adjusted reconstructions (Hawkins & Hastie, 1990).

This seems likely based on the low $*z$ scores exhibited both toward and away from the solution. Although forgetting the solution in the present study would have been impossible for participants since the solution to all questions were included on the recall exam, it is possible that many participants may have overlooked the solution and thus did not use it as a cognitive anchor to bias their recollections of their original estimates, as originally hypothesized.

Another possible explanation is that participants, especially those in Groups 1 and 2, simply encoded their original responses better in memory than expected. This possibility is explored in the work of Pohl and Hell (1996) as a way to reduce the amount of hindsight bias displayed in an experimental context. If participants remembered their original answers to the general knowledge questions more successfully, then it is logical that this cognitive strategy would lead not only to a larger number of perfect recollections but also to reconstructions that would exhibit less bias toward (or away from) the solution. It is also possible that a floor effect was displayed by Groups 1 and 2, thus

accounting for the difference displayed between Groups 1 and 2 and Group 3.

Failure to learn from past mistakes may lead individuals toward an unsuccessful and ignorant future. If we systematically under-estimate the surprises that the past held (and holds for us in hindsight) we are subjecting those hypotheses to inordinately weak tests and, presumably, finding little reason to change them (Fischoff, 1975). As a result, the perceived knowledge that is a by-product of the hindsight bias effect may actually hinder our comprehension of past errors and prevent us from making better decisions in the future. Undoubtedly, the study of hindsight bias is important to both science and society and deserving of future research attention.

References

Arkes, H.R., Faust, D., Guilmette, T.J., & Hart, K. (1988). Eliminating the hindsight bias. *Journal of Applied Psychology, 73,* 305-307.

Blank, H., Fischer, V., & Erdfelder, E. (2003). Hindsight bias in political elections. *Memory, 11,* 491-504.

Brown, R.S., Williams, C.W., & Less-Haley, P.R. (1994). The effects of hindsight bias and causal attribution on human response to environmental events. *Journal of Applied Social Psychology, 24,* 661-674.

Bryant, F.B., & DeHoek, A. (2006). Looking Back on What We Knew and When We Knew It: The Role of Time in the Development of Hindsight Bias. In: L.J. Sanna and E.C. Chang (Eds.): *Judgments over time: The interplay of thoughts, feelings, and behaviors.* New York, NY, US: Oxford U. Press, 230-250.

Chapman, G.B. & Johnson, E.J. (1994). The limits of anchoring. *Journal of Behavioral Decision Making, 7,* 223-242.

Czaczkes, B. & Ganzach, Y. (1996). The natural selection of

prediction heuristics: Anchoring and adjustment versus representativeness. *Journal of Behavioral Decision Making, 9,* 125-139.

Fischoff, B. (1975). Hindsight ? foresight: The effect of outcome knowledge on judgment under uncertainty. *Journal of Experimental Psychology: Human Perception and Performance, 1,* 288-299.

Hardt, O. & Pohl, R.F. (2003). Hindsight bias as a function of anchor distance and anchor plausibility. *Memory, 11,* 379-394.

Hawkins, S.A. & Hastie, R. (1990). Hindsight: Biased judgments of past events after the outcomes are known. *Psychological Bulletin, 107,* 311-327.

Hertwig, R., Fanselow, C., Hoffrage, U. (2003). Hindsight bias: How knowledge and heuristics affect our reconstruction of the past. *Memory, 11,* 357-377.

Hoffrage, U., Hertwig, R., & Gigerenzer, G. (2000). Hindsight bias: A by-product of knowledge updating? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26,* 566-581.

Leary, M.R. (1982). Hindsight distortion and the 1980 presidential election. *Personality and Social Psychology Bulletin, 8,* 257-263.

Musch, J. (2003). Personality differences in hindsight bias. *Memory, 11,* 473-489.

Pezzo, M.V. (2003). Surprise, defence, or making sense: what removes hindsight bias? *Memory, 11,* 421-441.

Pohl, R.F., Bender, M., Lachmann, G. (2002). Hindsight bias around the world. *Experimental Psychology, 49,* 270-282.

Pohl, F. & Hell, W. (1996). No reduction in hindsight bias after complete information and repeated testing. *Organizational Behavior & Human Decision Processes, 67,* 49-58.

Renner, B. (2003). Hindsight bias after receiving self-relevant health risk information: a motivational perspective. *Memory, 11,* 455-472.

Roese, N.J. & Maniar, S.D. (1997). Perceptions of purple: Counterfactual and hindsight judgments at Northwestern Wildcats football games. *Personality & Social Psychology Bulletin, 23,* 1245-1253.

Wood, G. (1978). The I-knew-it-all-along effect. *Journal of Experimental Psychology: Human Perception and Performance, 4,* 345-353.

Appendix A

General Knowledge Exam (*Phase 1*)

Name: _____

Age: _____

Sex: _____

Please respond as accurately as possible to the following questions. Answer spaces are provided on the column on the right. Turn the test over on your desk when finished. Thank you.

1. What is the distance between Milwaukee,
WI and Chicago, IL?   _____ miles

2. In what year did South Africa become
fully independent of British colonial rule?   _____

3. How long is a marathon? (answer to the
nearest tenth of a mile)   _____ miles

4. How old was Princess Diana when she was
killed in a car crash in Paris, France?   _____

5. How many stories tall is the Sears Tower?   _____

6. Wisconsin was admitted into the United
States as the _____th state.   _____

7. How many fluid ounces are in a pint?   _____

8. What is the major league baseball single-
season home run record set by Mark McGwire
of the St. Louis Cardinals in 1998?   _____

9. Abraham Lincoln, in office from 1861 to
1865, was the _____ th President of the
United States.   _____

10. What is the approximate population of the
city of Waukesha, WI?   _____

11. How many years did the Vietnam War
last for?   _____

12. How many feet in length is a regulation
basketball court?   _____ ft.

13. In what year was Dr. Martin Luther King, Jr.
assassinated?   _____

14. The Titanic sank off the coast of the north
Atlantic in the year of _____.   _____

15. What is the distance between Madison,
WI and St. Paul, MN?   _____ miles

16. In what year did World War 1 end?   _____

17. The Berlin Wall was dismantled in what year?_____

18. What is the men's world track record in
the outdoor mile run (1600) (answer to the
nearest second)   _____

19. In what year did Richard Nixon become
the first American president to resign from office?_____

20. In what year was Carroll College
(Waukesha, WI) founded?   _____

Appendix B

Recall Exam (*Phase 2*)

Name: _____

Please recall your original test responses to the following questions. List these responses in the answer spaces provided on the right. *The correct answers to the questions are encompassed by parentheses and listed in bold type immediately following the respective question.* When finished, please turn the sheet over on your desk. Thank you.

1. What is the distance between Milwaukee,
WI and Chicago, IL?   (**93**) _____ miles

2. In what year did South Africa become
fully independent of British colonial rule?   (**1991**) _____

3. How long is a marathon? (answer to the
nearest tenth of a mile)   (**26.2**) _____ miles

4. How old was Princess Diana when she
was killed in a car crash in Paris, France?   (**36**) _____

5. How many stories tall is the Sears Tower?   (**110**) _____

6. Wisconsin was admitted into the United
States as the _____th state.   (**30th**) _____

7. How many fluid ounces are in a pint?   (**20**) _____

8. What is the major league baseball single-
season home run record set by Mark McGwire
of the St. Louis Cardinals in 1998?   (**70**) _____

9. Abraham Lincoln, in office from 1861 to 1865,
was the ____th president of the United States.   (**16th**) _____

10. What is the approximate population of
the city of Waukesha, WI?   (**57,000**)_____

11. How many years did the Vietnam War
last for?   (**18**) _____

12. How many feet in length is a regulation
basketball court?   (**94**) _____ ft.

13. In what year was Dr. Martin Luther
King, Jr. assassinated?   (**1968**) _____

14. The Titanic sank off the coast of the
north Atlantic in the year of ____.   (**1912**)____

15. What is the distance between Madison,
WI and St. Paul, MN?   (**258**)_____ miles

16. In what year did World War 1 end?   (**1918**) _____

17. The Berlin Wall was dismantled in
what year?   (**1989**) _____

18. What is the men's world track record in
the outdoor mile run (1600 meters)? (answer
to the nearest second)   (**3:44**) _____

19. In what year did Richard Nixon become
the first American president to resign from
office?   (**1974**) _____

20. In what year was Carroll College
(Waukesha, WI) founded?   (**1846**) _____

This concludes the study. Thank you very much for your partici-
pation.