

MAKING SENSE OF THE PAST: INFORMATIONAL ORDER AND HINDSIGHT  
JUDGMENTS

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## **ABSTRACT**

PAUL MICELI: Making Sense of the Past: Informational Order and Hindsight Judgments  
(Under the direction of Lawrence J. Sanna)

Past research has explored the effects of receiving details leading up to an event in a logical, coherent fashion versus a random, fragmented fashion (e.g. Carroll & Korukina, 1999), but no research has considered these effects for judgments of the past, such as the hindsight bias. Also, no past research has looked at the hindsight bias when receiving outcome knowledge before, as opposed to after, learning details leading up to an event. In this thesis, I examined the hypothesis that the order in which people receive details leading up to an event (Narrative Order: Logical vs. Random) and the order in which people receive outcome knowledge (Outcome Order: Before vs. After learning details leading up to an event) will affect people's judgments of that past event. A significant interaction between Narrative Order and Outcome Order was found for hindsight judgments. The implications of this finding are discussed.

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## **CHAPTER 1**

### **INTRODUCTION**

How do people make sense of past events, and does the way in which information is received make a difference? Consider the example of September 11, 2001 (9/11), a date that will be forever burned into the minds of people across the U.S. and much of the world. The massive scale and unexpected nature of the terrorist attacks led people to search for explanations. Every American may have had his or her own opinion about the cause of the attacks and the appropriate response that the U.S. government should have taken. Information about the attacks was disseminated to the general public through various media outlets that constantly offered new developments and evidence to consider in our collective search for meaning. Although most people searched for explanations, not everyone had the same perspective on the events of 9/11, either before or after the event occurred. These varying perspectives could have profound effects on how people make sense of this and other events. These issues are of focus in my thesis.

To understand these ideas further, consider what it might have been like from the perspective of a person in an intelligence agency, such as the Central Intelligence Agency (C.I.A.), prior to and after 9/11. Part of the C.I.A.'s job is to collect and process information about potential terrorist attacks in order to thwart them before they happen. The C.I.A. collected many fragmented pieces of evidence that potentially warned of these attacks. This scattered evidence even led to classified intelligence reports with titles such as "Bin Ladin

Threatening to Attack US Aircraft [with antiaircraft missiles]” in June, 1998 and “Bin Ladin Determined to Strike in the US” in August, 2001 (National Commission on Terrorist Attacks Upon the United States, 2004, p. 342). Unfortunately, the C.I.A. was not able to put all the relevant information together before the attacks occurred. However, after the events of 9/11 were already known, it became somewhat easier to put together the fragmented pieces of evidence they had collected earlier and to make sense of circumstances that led up to the event. Not only could someone in this position tie the relevant bits of evidence together to tell a coherent story, “connecting the dots” in hindsight, but a person in this position could also more easily weed out the bits of information that were irrelevant to the final outcome (i.e., terrorist attacks).

In contrast, consider another perspective that a person may have on the events of 9/11, such as the generation of Americans for whom the events of 9/11 are now already well-known. This perspective may be illustrated by textbook descriptions of 9/11, such as the following in one of the most commonly used, current high-school textbooks, *The American Promise* (Roark et al., 2009, pp. 1171-1172):

In the most deadly attack ever launched on American soil, nineteen terrorists hijacked four planes and flew three of them into the twin towers of New York City’s World Trade Center and the Pentagon in Washington, D.C.; the fourth crashed in a field in Pennsylvania. The hijackers were members of Osama bin Laden’s Al Qaeda international terrorist network, some of whom had been living in the United States for several years... Islamic extremists were enraged by the spread of Western goods, culture, and values into the Muslim world. Acting on a distorted interpretation of one of the world’s great religions, bin Laden sought to rid the Middle East of Western influence and install puritanical Muslim control... [The] 9/11 terrorists and others who came after them saw the West, and especially the United States, as the evil source of their humiliation and the supporter of Israel’s oppression of Palestinian Muslims. In this account, in contrast with the previous example with the C.I.A., both the outcome and possible explanations for it are already known and presented together. That is, this textbook description presents the information about 9/11 in a logical fashion, along with an explanation. In short, receiving the information in this way likely will affect how people make sense of the event in a way that differs from

that of receiving some information beforehand and that could only be pieced together after the outcome is known (e.g., as in the case of the C.I.A.).

There are at least two key differences between the first, C.I.A., example and the second example of our current—and “textbook”—understanding of 9/11. The first difference is the order in which each group received information regarding the outcome of the event. The C.I.A. received information about circumstances potentially leading to a terrorist attack before it happened—albeit in fragmented form—and then the outcome occurred later. In other words, the C.I.A. received the outcome information after first receiving information leading up to that outcome. But the information leading up to the outcome only made sense in hindsight. In contrast, generations learning about 9/11 through the lens of a textbook have both the knowledge of the outcome and information about events that might have led up to it. These are both now well-known historical facts. In short, order of outcome is one key difference: In the first (C.I.A.) instance, outcome information is obtained after having received information about circumstances potentially leading to it, whereas in the second (textbook) instance, the outcome is known already (first), and one comes to understand it with the explanation that is already concurrently provided.

The second key difference is the sequence in which information leading up to the event is received. From the perspective of the C.I.A., information was received beforehand in a more random and fragmented way. That is, they had been collecting random bits of information prior to 9/11, but they were not able to put it all together until the event occurred. In other words, this perspective is akin to putting together pieces of a puzzle without knowing exactly what the overall target image looks like until you are finished. In contrast, current generations, like those understanding 9/11 from historical records or textbooks, received the relevant information about 9/11 in a logical, coherent way from the outset. In

short, people can receive information about an event in a random fashion wherein the information is acquired in a very fragmented way, or they can receive this information in a logical fashion where it is already put together in a more structured and coherent way.

Following the preceding ideas, my thesis examines whether the order in which people receive information about an event (“Logical Order” vs. “Random Order”) and the order in which people receive outcome information (“Outcome Before Event” vs. “Outcome After Event”) affects how they make sense of events. The actions on 9/11 led to a direct military response by the U.S. government. The U.S. chose to begin a War in Afghanistan as a first response to a “War on Terror.” Thus, the questions addressed in this thesis not only have theoretical implications but also strong implied implications for how people make important decisions. In the following sections, I will review the literature on hindsight bias and informational order effects, two areas related to how people make sense of and understand events but which have not as of yet been considered together.

## **CHAPTER 2**

### **HINDSIGHT BIAS**

The main dependent measure of interest in my thesis is the perceived inevitability of an outcome, a concept closely related to the hindsight bias, or “knew it all along” effect. Fischhoff (1975) was the first to describe the hindsight bias in which people with knowledge of an event outcome mistakenly believe that, in foresight, they would have predicted that outcome. They believe that the outcome was more inevitable after knowing that it actually occurred. The hindsight bias can give people the impression of a clear understanding of the past, which may result in overconfidence or “prevent[ing] us from learning anything” from past events or experiences (Fischhoff, 1982, p. 343).

The hindsight bias is a robust phenomenon that has been identified in variety of different domains such as political elections (Sanna & Schwarz, 2003; Blank, Fischer, & Erdfelder, 2003), legal judgments (Kamin & Rachlinski, 1995), medical diagnoses (Detmer, Fryback, & Gassner, 1978), and sporting events (Roese & Maniar, 1997; Leary, 1981). The mechanism underlying the bias has to do with the way in which people mentally model events. Having the added insight of outcome information allows people to update their mental models of an event – causing them to give more weight to previous information that affirms the outcome and less weight to previous information that is less relevant to the outcome (see Hawkins & Hastie, 1990). Therefore, outcome information biases old knowledge about an event, and this biasing results in a skewed view of the old knowledge

that is more likely to lead people to think that they would have “known it all along” (Fischhoff, 1975, p. 298). Almost all previous research on the hindsight bias has focused exclusively on presenting participants with evidence or information leading up to an event and then having them predict outcomes before the actual outcome is known and comparing this to judgments after the outcome is known.

## CHAPTER 3

### ORDER EFFECTS AND JUDGMENTS

There is extensive research that suggests the existence of an “order effect,” or the phenomenon that the order that information is presented affects people’s final judgments (Asch, 1946; Hogarth & Einhorn, 1992; Zhang, Johnson, & Wang, 1998; Wang, Johnson, & Zhang, 2006). Most of the previous research in this area has focused on the sequence of information leading up to a single decision. No existing studies have examined the effect of receiving information *after* the outcome (as opposed to before). Most research has shown order effects when the sequence of information is presented *before* the outcome, but even this research sometimes arrives at different conclusions. Sense-making is multi-faceted, but one way to measure how we make sense of information is the weight that we put on information presented in a sequence. Some studies have found a primacy effect (Dennis & Ahn, 2001; Yates & Curley, 1986), in which people give more weight to information early on in a sequence, while others have found a recency effect (Lopez, Shanks, Almaraz, & Fernandez, 1998), in which people give more weight to information presented near the end of a sequence.

Collins and Shanks (2002) replicated both primacy and recency effects and found that judgment frequency influenced these effects. A recency effect was found when participants were probed for multiple judgments throughout the task, while a primacy effect was found when participants were only asked for an ultimate judgment at the end of the task. These

results relate to the concepts of on-line versus memory-based judgments (Hastie & Park, 1986). If spontaneous judgments are made as information is processed (on-line), a recency effect is more likely, whereas if judgments are made based on information from memory (memory-based), a primacy effect is more likely. These previously described contradictory effects illustrate the need for further research in this area in order to better understand this phenomenon, as well as to address the dearth of research in the domain of receiving outcome information either before or after the information leading up to the event. For example, people receiving outcome knowledge before the information leading up to an event may exhibit more of this on-line processing while those receiving outcome knowledge after the information leading up to an event may exhibit this memory-based processing. These differing forms of information processing affect sense-making and subsequently inevitability and hindsight judgments.

There is also research that suggests that the coherence of the information, along with the general order of presentation, affects judgments. This research shows differences when receiving information in a logical versus a random fashion. For example, Carroll and Korukina (1999) examined the effects of text coherence on recall and metamemory judgments. They found that narratives presented in a coherent, ordered context, as opposed to a disordered sequence, led to better recall and higher ratings of metamemory judgments (i.e. judgments about one's knowledge of their own memory processes). Abele and Petzold (1998) found that participants made different attributions in an impression formation task when the information about a target person's occupation and behavior was presented either randomly or blocked together in a more logical way. Therefore, varying the order in which information was presented changed how people made sense of, and subsequently made

attributions about, different people. Therefore, receiving information leading up to an event in a logical versus a random fashion affects sense-making processes that contribute to how we understand and explain people and events.

All of this research shows that the order in which information is presented can have profound effects on people's judgments and how we make sense of information.

Informational order has been found to affect clinical judgments (Chapman, Bergus, & Elstein, 1996), juror decisions (Kassin, Reddy, & Tulloch, 1990), impression formation and ability attributions (Asch, 1946; Abele & Petzold, 1998; Greenlees, Dicks, Holder, & Thelwell, 2007), hypocrisy judgments (Barden, Rucker, & Petty, 2005), and tactical decisions (Zhang et al., 1998). The present research will build on these previous findings and expand on them by considering new, yet common, ways of receiving information as well as by applying these different ways of receiving information to inevitability and hindsight judgments.

## **CHAPTER 4**

### **THE PRESENT RESEARCH**

In this thesis, I examine several unique issues that expand on the previous hindsight and informational order effect literature. I use a scenario that attempts to mirror, within an experimental setting, some of the different perspectives that people have after receiving information about an event and its outcome from different orders. By drawing on the previously described literature on hindsight bias and order effects, I make predictions about the varying effects of informational order on hindsight bias. In short, I attempt to model some of the issues involved in making sense of an event, like the 9/11 example of which I began this thesis, using a laboratory task.

My main manipulation involves varying the order in which participants received information about the outcome of a fictional event. The information leading up to an event outcome was given in either a random, fragmented order (“Random Order”) or a more logical, coherent order (“Logical Order”). Additionally, participants received the outcome to this event after reading the information leading up to the event outcome (“Outcome After Event”), before reading the information leading up to the event outcome (“Outcome Before Event”– reflecting the textbook readers’ perspective in the 9/11 example), or not at all (“No Outcome”).

## Hindsight Bias Predictions

The inevitability of the event outcome will be measured as an index of hindsight bias. Figure 1 depicts my predictions for inevitability judgments in the respective conditions, as described in more detail below. Other exploratory judgments are assessed to see if varying orders of information affect other judgments, and Need for Cognition is also examined as a possible moderator, but no specific predictions were made for any of these.

I predicted that participants who receive information leading up to an event in a logical fashion and then receive the outcome information (“Logical Order”/“Outcome After Event” condition) will show a moderate amount of hindsight bias, evidenced by inevitability ratings. This condition is most similar to the usual hindsight bias paradigm. I also predicted that participants who receive information leading up to an event in logical fashion but receive outcome information first (“Logical Order”/“Outcome Before Event” condition) will show a higher degree of hindsight bias, indexed by higher inevitability ratings, than the previously described condition (“usual paradigm”). This latter condition may be most similar to textbook readers’ perspective of 9/11. I believe that participants in this condition will show this greater degree of hindsight bias because people will be able to integrate the outcome information on-line; that is, as they receive details about the event (for a review see Hastie & Park, 1986). This direct biasing of incoming information will make it even more difficult for participants to see the event turning out any other way.

In contrast, I predicted that participants who receive information leading up to an event in a random fashion and then receive the outcome information (“Random Order”/“Outcome After Event” condition) will react in either of two ways. On the one hand, these participants may show a lesser degree of hindsight bias, indexed by lower inevitability

ratings, than the usual paradigm. For instance, this condition might be most similar to the C.I.A.'s perspective on 9/11. Participants may show a lesser degree of hindsight bias because the outcome will be harder to integrate into previous information because information leading up to the event is disordered and less coherent. This may follow Carroll and Korukina's (1999) finding that people show better recall when reading coherent, logically ordered narratives as opposed to randomly ordered narratives. Lesser hindsight bias in this condition could also result from motives to avoid blame or self-recrimination for not having foreseen the outcome coming ("I couldn't have known it all along").

On the other hand, participants in this "Random Order"/"Outcome After Event" condition could alternatively display greater hindsight bias, indexed by higher inevitability ratings. That is, after event outcomes become known, people may experience a type of "revelation" when looking back on events leading up to it; people may, for example, find it easy to put together the fragmented pieces of evidence collected earlier and to make sense of circumstances that led up to the event. For example, research on the "Revelation Effect" (Watkins & Peynircioglu, 1990) has shown that people are more likely to believe that they have previously seen a slowly revealed word than a word that appeared all at once, regardless of if they had actually seen or studied the word before. Receiving the outcome information after the fragmented information leading up to event outcome could lead people to believe that they have seen (or *foreseen*, in this instance) the actual outcome. Therefore, "connecting the dots" in hindsight, or a retrospective sense-making process, may lead one to experience an even greater sense of inevitability (e.g., "Now it all makes sense, and I should have seen it coming").

I did not make any specific prediction for participants who receive information leading up to an event in a random fashion but who receive outcome information first (“Random Order”/“Outcome Before Event” condition). Finally, I included two control conditions, in which participants did not receive any outcome information (“Logical Order”/“No Outcome” and “Random Order”/“No Outcome” conditions), for comparison purposes.

### Exploratory Judgments

In addition to the main judgment of interest, hindsight bias as reflected by perceived inevitability of the outcome, there are other judgments that could be made. These judgments can also shape people’s overall impressions about the event and the subsequent actions taken in response to it. A few of these judgments, specifically blame, risk, fairness, and general dispositional judgments about people involved in the event, were included in my thesis for exploratory purposes.

## CHAPTER 5

### INITIAL (PILOT) RESEARCH

An initial experiment was conducted in order to examine the potential effects of informational order on judgment. To do this, a narrative was constructed describing four unrelated characters whose lives inexplicably cross paths. The structure of the narrative was loosely based on popular movies such as *Crash*, *Syriana*, and *Babel*. The narrative led to multiple outcomes involving various characters. It was split into 16 paragraphs of equal length with each character having four paragraphs that exclusively followed their perspective of the story.

Two versions of the narrative were created in order to vary the order in which participants received the information in the narrative. The “Logical Order” narrative followed a time-line sequence beginning with the earliest paragraph, which took place on early Wednesday morning, all the way to the final paragraph, which took place on late Saturday night. The “Random Order” narrative blocked each character’s entire storyline into four paragraphs. Each four paragraph block was then presented randomly to the participants. Additionally, the outcomes of the narrative were presented to participants before reading the narrative (“Outcome Before Event” condition), after reading the narrative (“Outcome After Event” condition), or not at all (“No Outcome” condition). Therefore it was a 2 (Narrative Order) x 3 (Outcome Order) between-participants factorial design.

The results of this initial attempt shed some light on a potential problem, and, more importantly, pointed to crucial improvements for the main experiment, described next. There was a marginally significant interaction between Narrative Order (“Logical Order” vs. “Random Order”) and conditions with outcomes or no outcome (composite of “Outcome Before Event” and “Outcome After Event” vs. “No Outcome”),  $F(1,89) = 3.30, p = .07$ . Participants in the “Random Order” conditions that received outcome information rated the overall narrative as having followed a more *logical* progression while participants in the “Logical Order” conditions that received outcome information rated the overall narrative as having followed a more *random* progression. Therefore, being told the outcomes of the narrative greatly affected participants reported thoughts about the progression of the narrative and Narrative Order somewhat qualified this effect.

There were some interesting results in this pilot study, but the manipulations did not appear to be strong enough. To rectify this issue, I modified the narrative and then pilot tested it in order to ensure the issue was corrected. First, the new narrative includes only one ultimate outcome for the characters involved, as opposed to individual outcomes for each character. This outcome involves all the relevant characters converging at the end of the narrative. Secondly, it is 25% shorter than the previous narrative, and there are less characters overall in order to reduce confusion. Lastly, the “Random Order” version of the narrative was made by a complete randomization of all the paragraphs, instead of blocking specific storylines or characters together. These changes to the narrative were expected to strengthen the main manipulation between the “Logical Order” and “Random Order” versions of the narrative and counteract any interaction between the Narrative Order and the outcomes, as was found in the initial research.

The results of this modification indicated that the changes were effective in making the manipulations stronger, and they all performed as intended. There was no longer any interaction between Narrative Order and the conditions receiving the outcomes or no outcome,  $F(1,26) = 0.32, p = .57$ . More specifically, participants in the “Random Order” condition rated the progression of the narrative as following a more random progression ( $M = -3.13$  on an 11-point bipolar Likert-type scale anchored at -5 “*very random*” to +5 “*very logical*”) than those in the “Logical Order” condition ( $M = +1.53$ ). A one-way analysis of variance (ANOVA) showed a significant difference between the two versions,  $F(1,28) = 16.47, p < .001$ . The new scenarios therefore corrected the issue from the initial research; the narrative now reflects a strong dichotomy between the “Logical Order” and “Random Order” conditions. Thus, this new version was used in the main study.

## **CHAPTER 5**

### **MAIN STUDY**

To summarize, my thesis addresses three main questions. First, does the order in which people receive information leading up to an event (Narrative Order: Logical vs. Random) affect people's subsequent judgments about that particular event and the people involved in it? Secondly, does the order in which people receive the outcome knowledge of an event (Outcome Order: Before Event vs. After Event) affect people's subsequent judgments about that particular event and the people involved in it? Third, do Narrative Order and Outcome Order interact?

For hindsight judgments, I predicted that participants who receive information leading up to an event in a logical fashion and then receive the outcome information ("Logical Order"/"Outcome After Event" condition) will show moderate inevitability ratings. This condition will also provide a comparison for the other conditions because it follows the usual paradigm often used in hindsight bias research. I also predicted that participants who receive information leading up to an event in a logical fashion but receive outcome information first ("Logical Order"/"Outcome Before Event" condition) will show a higher degree of hindsight bias, or higher inevitability ratings, than this comparison condition. In contrast, I predicted that participants who receive information leading up to an event in a random fashion and then receive the outcome information ("Random Order"/"Outcome After

Event” condition) will show either a lower or higher degree of hindsight bias, because of the two possibilities described earlier in the Introduction, than this comparison condition. No explicit predictions were made for participants who receive information leading up to an event in a random fashion but receive outcome information first (“Random Order”/“Outcome Before Event”).

These hypotheses were tested in a laboratory experiment designed to mirror ways in which people acquire information about an event in real life. After reading a fictional narrative, participants made various judgments about the outcome of the narrative and various characters in the narrative. Moreover, other judgments (e.g., blame) and Need for Cognition were included for exploratory purposes.

## Method

### *Participants*

186 introductory psychology students at UNC-CH participated in this experiment for course credit.

### *Scenario*

A narrative was constructed as a scenario for use in this experiment. The narrative follows three distinct storylines about unrelated characters. The storylines come together at the end of the narrative, resulting in one final outcome in which one of the characters, Tom Wright, is struck and killed by a cab driven by another one of the characters, Bob Gatwick. This outcome was given to participants before reading the narrative (“Outcome Before Event” condition), after reading the narrative (“Outcome After Event” condition), or not at all (“No Outcome” condition).

The narrative was split into 23 individual paragraphs, and each paragraph was additionally paired with a picture that matches the content of that paragraph (see Figure 2). Two versions of the narrative were used in the experiment. The “Logical Order” narrative is ordered following a time-line sequence beginning with the earliest paragraph, which takes place on early Wednesday morning, all the way to the final outcome, which takes place on late Friday night (see Figure 3). The “Random Order” narrative was a random ordering of the 23 paragraphs. The narratives were presented to participants via computer using MediaLab software (Empirisoft, 2006). Each individual paragraph and its corresponding picture were presented for at least ten seconds before participants manually pressed a button to move onto the next paragraph.

### *Measures*

After reading the narrative, participants completed dependent measures, also using MediaLab software. Questions assessing inevitability judgments were asked first. These questions presented participants with the stated outcome of the story (“Outcome Before Event” and “Outcome After Event” conditions) or a possible outcome of the story (“No Outcome” condition) and then asked them to rate to what extent that outcome was probable, predictable, and likely. Participants responded to these three questions using an 11-point bipolar scale from -5 to +5 anchored at “*very improbable*” to “*very probable*” (for the “probable” inevitability question; each anchor corresponds to the particular judgment asked in the question). An additional inevitability judgment question in which participants rated the probability of the outcome from 0% to 100% was then asked.

Exploratory judgments were included. These judgments assessed participants’ attributions of blame to specific characters (no blame vs. full blame), participants’ personal

feelings of risk associated with being hit by a car (no risk vs. risk), the fairness of the outcome (unfair vs. fair), and inferences about the behaviors of specific characters (dispositional vs. situational). Manipulation checks were also asked concerning the order that the narrative was presented (logical vs. random), how much the overall narrative made sense (nonsensical vs. sensible), and the ease of recalling specific aspects of the narrative (easy vs. difficult). These were also asked on 11-point bipolar scales.

Memory questions followed, asking participants to recall specific aspects of the narrative as well as implied connections from the narrative. Examples of these questions include “*What company did Bob Gatwick invest in?*” and “*Who was Sean Agnello chasing?*”. Finally, the 18-item Need for Cognition scale (Cacioppo, Petty, & Kao, 1984) was administered at the end of the experiment.

### *Procedure*

Participants were randomly assigned to one of six conditions following a 2 (Narrative Order: Random or Logical) x 3 (Outcome Order: Before Event, After Event, No Outcome) between-participants factorial design. After participants finished reading the narrative on the computer, they then completed the inevitability judgments. Next, all participants completed the questions concerning the exploratory judgments. After that, there were questions assessing narrative order, degree of sense-making, and ease of recall. The additional memory test questions followed. Finally, participants completed the Need for Cognition scale. Lastly, all participants were debriefed and thanked.

## CHAPTER 6

### RESULTS

#### Manipulation Check: Logical vs. Random Order

Participants read the narrative in either logical or random order. As anticipated, participants who read the narrative in logical order rated the narrative as following a more logical progression ( $M = 1.12$ ,  $SD = 2.57$ ) than those who read the narrative in random order ( $M = -3.20$ ,  $SD = 1.81$ ),  $F(1, 184) = 176.29$ ,  $p < .001$ , supporting the effectiveness of this manipulation. In addition, they rated the narrative as making more overall sense ( $M = 3.10$ ,  $SD = 1.85$ ) than those who read the narrative in random order ( $M = 0.91$ ,  $SD = 2.77$ ),  $F(1, 184) = 39.91$ ,  $p < .001$ . They also rated it easier to recall specific details from the story ( $M = 2.17$ ,  $SD = 2.20$ ) than those who read the narrative in random order ( $M = -0.03$ ,  $SD = 2.57$ ),  $F(1, 184) = 39.59$ ,  $p < .001$ . Therefore, the manipulation was successful in that participants who read the narrative in logical order found the narrative to follow a more logical progression, make more sense, and it was easier to recall specific details than those who read the narrative in random order.

#### Inevitability Ratings

Inevitability ratings were used as an index of hindsight bias. An identical pattern of results emerged for all three hindsight judgments (probable, predictable, and likely), so these ratings were averaged together to create an “inevitability rating” (Cronbach’s  $\alpha = .71$ ). These

inevitability ratings were analyzed using a 2 (Narrative Order: Logical or Random) x 3 (Outcome Order: Before Event, After Event, No Outcome) analysis of variance (ANOVA). Contrasts (Rosenthal, Rosnow, & Rubin, 2000) were used to compare means.

There was a marginal main effect of Narrative Order,  $F(1, 184) = 3.11, p = .08$ , which was qualified by the hypothesized Narrative Order x Outcome Order interaction,  $F(2, 180) = 4.13, p = .016$  (see Figure 4). As predicted, for participants who read the narrative in logical order, those receiving outcome information before ( $M = 2.87, SD = 1.52$ ) viewed the outcome as more inevitable than those receiving outcome information after ( $M = 1.56, SD = 1.88$ ),  $t(180) = 2.59, p = .011$ . This pattern is consistent with the idea that people more easily integrate incoming information (“on-line”) in accordance with the already known outcome when they receive the outcome information first (Hastie & Park, 1986). Additionally, participants who read the narrative in logical order viewed the outcome as more inevitable than those reading the narrative in random order ( $M = 1.61, SD = 2.35$ ) when outcome information was presented first,  $t(180) = 2.49, p = .014$ . This pattern is consistent with Carroll and Korukina’s (1999) research demonstrating that text coherence affects recall and metamemory judgments.

For participants who received the outcome information after, an opposite pattern emerged: Specifically, participants reading the narrative in random order viewed the outcome as more inevitable ( $M = 2.23, SD = 2.21$ ) than those reading the narrative in logical order ( $M = 1.56, SD = 1.88$ ), though the contrast was nonsignificant,  $t(180) = 1.32, p = .188$ . At the outset, there were two possibilities for people reading the narrative in random order and receiving outcome information after: on the one hand, people could view the outcome as less inevitable because of unforeseeability or motivational concerns (“I couldn’t have known

it all along”) or more inevitable because they are “connecting the dots,” making sense of the outcome in hindsight, similar to the Revelation Effect (Watkins & Peynircioglu, 1990). My results lend more support to the latter possibility.

It is also relevant to consider the comparison of participants receiving outcome information after to those not receiving any outcome information at all because this comparison is most similar to the comparisons made in previous hindsight bias research. The overall pattern of comparisons is interesting because for participants who read the narrative in logical order, those receiving outcome information after viewed the outcome as less inevitable than those who did not receive outcome information ( $M = 2.42$ ,  $SD = 1.36$ ),  $t(180) = 1.70$ ,  $p = .091$ , while for participants who read the narrative in random order, those receiving the outcome information after viewed the outcome as more inevitable than those who did not receive outcome information ( $M = 1.44$ ,  $SD = 2.40$ ),  $t(180) = 1.56$ ,  $p = .121$ , though both contrasts did not reach significance.

Finally, within the no outcome conditions, participants who read the narrative in logical order viewed the (predicted) outcome as more inevitable than those who read the narrative in random order,  $t(180) = 1.94$ ,  $p = .055$ . This pattern is, again, consistent with Carroll and Korukina’s (1999) work on the effects of text coherence.

### Exploratory Judgments

Exploratory judgments were also analyzed using a 2 (Narrative Order: Logical or Random) x 2 (Outcome Order: Before Event or After Event) ANOVA. The two no outcome conditions were omitted from these analyses because the exploratory judgments concerned judgments of an actual outcome and not a possible outcome, which was the case in these two conditions. Only one judgment of possible interest, blame for the character Sean Agnello,

showed a main effect of Narrative Order,  $F(1, 122) = 12.70, p = .001$ , whereby those reading the narrative in logical order attributed more blame to Sean Agnello ( $M = 2.66, SD = 2.08$ ) than those reading the narrative in random order ( $M = 0.97, SD = 3.11$ ). These results could be consistent with previous research on the Story Model for juror decision making (Pennington & Hastie, 1988). However, no other exploratory judgments revealed any significant differences based on the experimental manipulations, so it is premature to make much of any of them. Need for Cognition also did not produce any significant results in my thesis.

## **CHAPTER 7**

### **GENERAL DISCUSSION**

Three key questions regarding the order of information and hindsight bias were addressed in my thesis. First, does the order in which people receive information leading up to an event (Narrative Order: Logical vs. Random) affect people's subsequent judgments about that particular event and the people involved in it? Secondly, does the order in which people receive the outcome of an event (Outcome Order: Before Event vs. After Event) affect people's subsequent judgments about that particular event and the people involved in it? Third, do Narrative Order and Outcome Order interact? Results showed that Narrative Order and Outcome Order did, in fact, affect participants' judgments about the outcome of the narrative. The predicted interaction between these two variables was also found.

Following the hypotheses presented in Figure 1, participants who read the narrative in logical order but received the outcome information before viewed the outcome as more inevitable than those who read the narrative in logical order then received the outcome information after (comparison condition). Additionally, those who read the narrative in random order then received the outcome information after also viewed the outcome as more inevitable than the comparison condition. The following sections elaborate on possible explanations and implications of these findings as well as other key comparisons worth

noting in relation to the hindsight bias, general order effects, and exploratory judgments. Finally I suggest some future directions following from the present research.

### Implications for Hindsight Bias

My thesis addressed two underrepresented areas in the hindsight bias literature. First, the hindsight bias literature has focused almost exclusively on judgments for scenarios and events where people do not have any outcome information (e.g. “No Outcome” conditions) or for judgments where they do have outcome information, but only after receiving information leading up to an event (e.g., “Outcome After Event” conditions). This current study expands on the previous literature by also introducing a third order in which people can receive outcome information: *before* receiving information leading up to an event (“Outcome Before Event”). The second underrepresented area in the literature deals with how the hindsight bias differs when we receive information in logical, coherent ways as opposed to random, fragmented ways. The current study expands on the previous literature by presenting information leading up to an event in either a logical or random fashion.

In order to understand the implications for the former underrepresented area, it is necessary to consider two key comparisons. The first comparison is within those people who read the narrative in logical order. As predicted, those people receiving outcome information before viewed the outcome as more inevitable than those receiving the outcome information after. These results lend support for the idea that people receiving outcome information before can more easily integrate this outcome information “on-line” into incoming information (see Hastie & Park, 1986). This form of direct biasing of incoming information, in which people can emphasize outcome-consistent information and deemphasize outcome-

inconsistent information, makes it even more difficult for people to see the event turning out any other way.

The second key comparison involves comparing those people who received outcome information before reading the narrative to those who did not receive any outcome information because this type of “Outcome” vs. “No Outcome” comparison is the typical comparison made in previous hindsight bias research. Within both these conditions, those reading the narrative in logical order viewed the outcome as more inevitable than those reading the narrative in random order. This pattern, along with the findings that those reading the narrative in logical order found the narrative to make more overall sense and easier to recall specific details about the narrative than those reading the narrative in random order, are consistent with Carroll and Korukina’s (1999) research indicating that text coherence affects recall and metamemory judgments.

In order to understand the implications for the second underrepresented area in the literature, logical or random narrative order, it is also necessary to consider two other key comparisons. The first comparison is within those people who received the outcome information after reading the narrative. Those people who read the narrative in random order viewed the outcome as more inevitable than those who read the narrative in logical order. These results lend support for the idea that people “connect the dots” or make sense of the outcome in hindsight when they receive outcome information after reading the narrative. People might have experienced a type of “revelation” after receiving the outcome that helps them to retrospectively make sense of the previously random information already presented to them. This process might lead people to say “Now it all makes sense, and I should have seen it coming.”

The second key comparison involves comparing those people who received outcome information after reading the narrative to those who did not receive any outcome information at all because this comparison is the typical comparison made in previous hindsight bias research. Here I speculate on the interesting pattern of results found in these conditions. The conditions involving no outcome information can be thought of prospective, or trying to make sense of a future event, while the conditions involving receiving outcome information after can be thought of as retrospective, or trying to make sense of an event in the past. Two opposing patterns emerged in the comparisons between those people who received outcome information after and those who did not receive any outcome information, depending on Narrative Order. For people who read the narrative in logical order, those who received outcome information after viewed the outcome as less inevitable than those who did not receive outcome information. Conversely, for people who read the narrative in random order, those who received outcome information after viewed the outcome as more inevitable than those who did not receive outcome information.

The finding that people who read the narrative in logical order and received the outcome information after viewed the outcome as less inevitable than those who did not receive outcome information might be understood through the lens of the “Propensity Effect” (Roese et al., 2006). Previous research on this “Propensity Effect” has shown that people can become more confident of an impending outcome than an already known outcome. This same pattern exists here, where people viewed a *possible* outcome that might occur (“No Outcome” condition) as more inevitable than for an *actual* outcome that they know had occurred (“Outcome After Event” condition). The simulation heuristic (Kahneman & Tversky, 1982), or the tendency to simulate or construct a mental image of a hypothetical

outcome, might explain this result. Participants not receiving the outcome might construct multiple possible outcomes before knowing the actual outcome. All these outcomes seem very plausible, and, when presented with one of these possible outcomes, they rate it as highly inevitable. Conversely, those receiving the outcome after reading the narrative do not have the multiple possible outcomes; instead they only have the one given outcome. Accordingly, they rate the outcome as less inevitable (than those not receiving the outcome), unless it fully matches their best simulation. However, in this experiment participants were not asked if the outcome matched their expectations, simulations, or mental constructions. Therefore it is not known if the outcome was seen as surprising for those participants who read the narrative in logical order and received outcome information after. Nonetheless, those who read the narrative in logical order but received no outcome information could view the outcome as more inevitable because of prospective sense-making processes, or using forward construction, in which they are more likely to construct multiple potential outcomes in order to make sense of a future event.

The finding that people who read the narrative in random order and received the outcome information after viewed the outcome as more inevitable than those who did not receive outcome information might be understood through the lens of the “Revelation Effect” (Watkins & Peynircioglu, 1990). People who receive information leading up to an outcome in a random, fragmented fashion are similar to those who have a word slowly revealed to them. Previous research on this “Revelation Effect” has shown that people are more likely to think that they had previously seen a slowly revealed word than a word that appeared all at once, regardless of if they had actually seen or studied the word before. In the current study, people who read the narrative in random order and received outcome

information after obtained information leading up to the outcome in a way that is much like the experience of the participants in the original “Revelation Effect” studies. Here, the outcome can be seen as just another piece of information that is slowly revealed in the puzzle that is the event. Therefore, participants are more likely to think that they have previously seen (or *foreseen*, in this instance) this particular outcome, leading them to view the outcome as more inevitable than those not receiving outcome information. This phenomenon can be thought of as a form of retrospective sense-making, in which participants receiving the outcome after reading the narrative reconstruct their idea of the outcome and the event, fully taking into account that they think they have previously foreseen that particular outcome. Those not receiving the outcome do not have this same ability to reconstruct the event or the outcome through these retrospective sense-making processes.

There is also an alternative explanation that may account for the discrepancies in this comparison between those people receiving outcome information after and those not receiving any outcome information. Previous hindsight bias research has defined the bias as having higher inevitability ratings in conditions in which people receive outcome information compared to conditions in which people predict the inevitability of the outcome (e.g. “No Outcome” condition). Using this definition, this hindsight bias effect was found for those people who read the narrative in random order and received outcome information after, but a reverse hindsight bias effect was found for those who read the narrative in logical order and received outcome information after. The reversal of the hindsight bias in this condition can be understood through the literature on surprising outcomes and the hindsight bias. Highly surprisingly outcomes have been shown to eliminate or reverse the hindsight bias (Ofir & Mazursky, 1997). These feelings of surprise cue people to the fact that the outcome was not

consistent with their expectations gained from the information presented about an event. This inconsistency thus leads people to rate a particular outcome as less inevitable when that outcome is surprising.

It is possible that those receiving the outcome after reading the narrative in logical order showed this reverse hindsight bias effect because the given outcome was highly surprising, or it did not fit well with their expectations for the event. In other words, those participants in this condition were led to expect a certain outcome from the narrative in logical order, and the given outcome did not match this expectation. The narrative in logical order was constructed, and validated through the manipulation check, to present a straightforward story leading to a particular outcome. This type of narrative construction could lead participants through a close-minded thought process that focused their thinking on a narrow set of possible outcomes that followed from their interpretation of the narrative. If the given outcome did not conform to this narrow selection of possible outcomes, then a reverse hindsight bias effect would be expected because the outcome would be highly surprising.

Conversely, those receiving the outcome after reading the narrative in random order would not be expected to show a reverse hindsight bias effect, according to this logic. Instead, as was shown in the current study, these participants should display the normal hindsight bias effect. The narrative in random order was constructed to present a fragmented story not necessarily leading to a particular outcome. This type of narrative construction could lead participants through an open-minded thought process that kept their thinking open to the possibility of multiple different outcomes. Once they are given the actual outcome, it is not seen as highly surprisingly since they were open to multiple possibilities. Thus the

normal hindsight bias effect, as seen in countless previous studies providing the outcome after reading the narrative, is expected in this instance. A simple analogy can further illustrate this point. Imagine two tree limbs. One tree limb has multiple branches stemming outward from it while the other limb only has a couple branches. The former limb represents those receiving the outcome after reading the narrative in random order in which there is an openness to possibilities and multiple potential outcomes, leaving a low chance of having a surprising outcome. On the other hand, the latter limb, with its narrow selection of branches, represents those receiving the outcome after reading the narrative in logical order in which there is a closed-minded thought process, leaving a high chance of having a surprising outcome.

My thesis expanded on the hindsight bias literature by better addressing those two underrepresented areas. Future research will further unpack the mechanisms underlying the effects found in these new areas.

### Implications for Order Effects

General order effects have been found in various domains, and, as described in the previous section, an order effect was found for hindsight judgments in the current study. This finding alone adds further evidence to the vast literature suggesting an order effect, but this research also expanded on the previous literature in two important ways. First, the main addition to this literature is the extension of this order effect to outcome information presented *before* the information leading up to an event. Most of the previous research has focused exclusively on a sequence of information leading up to a single outcome or decision. The new paradigm presented in the current study added another possibility for potential order effects based on receiving this outcome information before the other information leading up

to an event. The results showed multiple mean differences between the usual paradigm (“Outcome After Event” conditions) and the new paradigm (“Outcome Before Event” conditions), successfully extending these order effects to include a new paradigm.

Second, the current study expanded on the previous literature on text coherence. Participants read the narrative in either the logical, coherent order or the random, fragmented order. Narrative Order greatly affected participants’ perceptions of how much the narrative made sense and how easy it was to recall specific details about the narrative. More importantly, these two different narratives affected how participants made sense of the outcome to the narrative and, as I’ll describe in the following section, how they attributed blame to a character in the narrative based on the outcome. An important conclusion from this research is that we should analyze exactly how people receive information leading up to an event (Narrative Order) as well as the order in which they receive outcome information (Outcome Order) in order to adequately surmise the sense-making processes that lead people to their judgments about an event.

The previous literature has also shown potential moderators to the general informational order effects. The personality trait Need for Cognition (Cacioppo, Petty, & Kao, 1984), or the degree to which people regularly engage in effortful cognitive activity, has been identified as one such potential moderator (Kassin, Reddy, & Tulloch, 1990). Need for Cognition was measured in this study, but was not found to moderate any of the effects.

#### *Exploratory Judgments - Blame*

Participants who read the narrative in logical order attributed more blame to the character Sean Agnello than those who read the narrative in random order. These results can be understood through the lens of the Story Model. Multiple studies on the Story Model

have shown that the order in which information about a criminal case is presented has a large effect on the mental stories that jurors construct during a trial (for a review, see Pennington & Hastie, 1993). Jurors tend to agree more with evidence presented in “Story Order”, which preserves temporal and causal order of the evidence, as opposed to “Witness Order”, which does not preserve temporal and causal order of the evidence and instead presents evidence on a witness by witness basis (Pennington & Hastie, 1988). The two different Narrative Orders in the present experiment map onto these two orders in the Story Model studies. The “Logical Order” narrative resembles the “Story Order”, in that it preserves temporal and causal order. The “Random Order” narrative resembles the “Witness Order”, in that it does not preserve temporal and causal order. In fact, the “Random Order” condition goes beyond the “Witness Order” by presenting participants with an even more fragmented view of the information.

In the narrative, the character Sean Agnello, in an ill-fated attempt at regaining his pride, forces a suspected drunk driver off the road. The overall sequence of events leads to the unfortunate death of an innocent bystander. The narrative was written to imply Sean Agnello played a large role in causing this death. The results showed that those reading the “Logical Order”, or “Story Order”, narrative attributed more blame to Sean Agnello for this death than those who read the “Random Order” narrative. The temporal and causal chain of events was necessary to understand Sean Agnello’s role in the death. Therefore, the Story Model would predict the same pattern of results because the “Logical Order” narrative kept that temporal and causal chain intact, while the “Random Order” narrative did not. These findings lend further support for and extend the Story Model beyond courtroom judgments

into the more general realm of fictional narratives. It also shows another example of how the order in which we receive information can affect how we make sense of an event.

## **CHAPTER 8**

### **FUTURE DIRECTIONS**

My thesis successfully expanded upon the literatures for the hindsight bias as well as for general order effects for judgments. The results showed some promising findings, but future studies will have to address some of the potential explanations for the mechanisms underlying the results. For instance, a future study could explore the idea of unexpected or surprising outcomes. This current study did not ask participants how surprising the actual (or potential) outcome was to them. As previously mentioned, the level of unexpectedness or surprise of the outcome could have driven some of the key mean differences found in my results. A future study could address this limitation by not only asking participants to rate the unexpectedness of the outcome, but also by manipulating this dimension by using multiple different outcomes previously rated as high or low in unexpectedness.

A further study could investigate the idea of closed-minded vs. open-minded thinking in regards to potential outcomes. One alternative explanation for the mean differences between the two “Outcome After Event” conditions centered around the idea that those who read the narrative in logical order were put into a more closed-minded thought process leading them to expect a smaller number of possible outcomes. Alternatively, those who read the narrative in random order were put into a more open-minded thought process leading them to expect a larger number of possible outcomes. Future research could address this

explanation by measuring closed-mindedness and open-mindedness or by directly manipulating these processes.

Another study could more directly manipulate the retrospective and prospective sense-making processes described earlier. The current study set up conditions (“Outcome Before Event” and “No Outcome”, respectively) meant to represent these opposing processes, but it did not manipulate these processes directly.

Although Need for Cognition did not moderate the effects, other individual differences may play a role in the mechanisms at work here. Need for Closure (Webster & Kruglanski, 1994), or the desire to have definite knowledge about an issue and avoid uncertainty or confusion, and Causal Uncertainty (Weary & Edwards, 1994), or a person’s uncertainty to understand causal relationships in the social world, are two individual differences that might account for some of the results. These concepts might relate to how people understand, process, and make sense of actual (or potential) outcomes. Future research could measure these differences and include them in any subsequent analyses.

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Figure 1. Hindsight Bias Predictions, based on Inevitability Ratings, made in relation to the Usual Hindsight Bias Paradigm (“Logical Order”/”Outcome After Event” condition in lower right-hand corner).




	Outcome Before Event	Outcome After Event
Random Order		 or  Inevitability Ratings
Logical Order	 Inevitability Ratings	Comparison Condition (Moderate Hindsight Bias)

Figure 2. Example of one of the 23 individual paragraphs (paired with a corresponding picture) used to construct the narrative.



In the early hours of Wednesday morning, Bob Gatwick is driving a couple guys from the casinos back to their condo. One of the guys in the back of his cab starts running his mouth about how they're all going to get rich off of ElectroCorp. Bob is intrigued by the topic of conversation and presses the man about this ElectroCorp company.

Figure 3. “Logical Order” progression of the narrative. Each of the 23 paragraphs are presented to participants in a time-order sequence from the earliest point in time (Wednesday Morning) through the middle of the narrative (Friday afternoon) and finally to the end of the narrative immediately before the ultimate event outcome (Friday night).

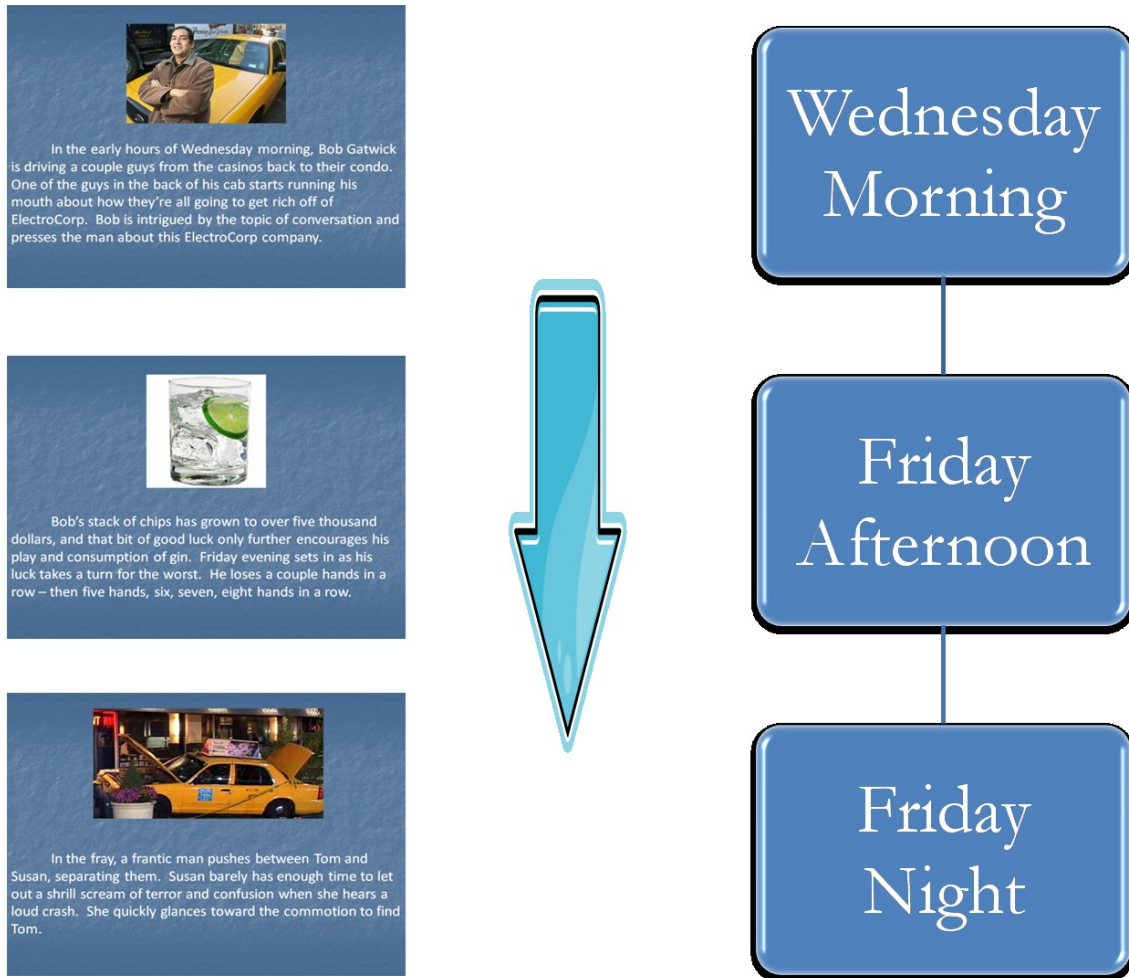


Figure 4. Inevitability Ratings for the six conditions of the Main Study.

