CHAPTER

19 Mental Simulation: Looking Back in Order to Look Ahead

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Abstract

Mental simulation refers to the imagination of alternative, counterfactual realities. This chapter provides an overview of research on simulations of the past—*retrospective* simulation—and simulations of the future—*prospective* simulation. Two major themes run throughout. The first is that both retrospective and prospective thinking are inextricably linked, relying on a mixture of episodic and semantic memories that share common neural substrates. The second is that retrospective and prospective simulation present trade-offs for the individual. On the one hand, they are functional, identifying causal inferences and potential obstacles that prepare us to try harder and perform better in the future. On the other hand, they sometimes produce bias—retrospective thinking can enhance hindsight bias, whereas prospective thinking can evoke biased predictions about the likelihood of certain events as well how one is going to feel about those events in the future. Fortunately, however, these biases can be diminished with debiasing techniques.

Key Words: mental simulation, counterfactual, predictions, bias, debiasing, past, future, memories, functional

"To think . . . what might have been!" "And now, what lies ahead?" *Mental simulations* of this kind function as the glue that binds the tapestry of our past and present lives to our thoughts about the future. This chapter will provide an overview of 30 years of research on simulations of the past—*retrospective* simulation—and simulations of the future—*prospective* simulation. Two major themes will be echoed along the way. The first is that both retrospective and prospective thinking are inextricably linked, relying on a mixture of episodic and semantic memorial representations that share common neural substrates. The second is that retrospective and prospective simulation present trade-offs for the individual. On the one hand, they are functional, identifying causal inferences and potential obstacles that prepare us to try harder and perform better in the future. On the other hand, they sometimes produce bias—retrospective thinking can enhance the hindsight bias, whereas prospective thinking can evoke biased predictions about the likelihood of certain events as well how one is going to feel about those events in the future. Importantly, however, we will also point out how such biases can be attenuated by employing debiasing strategies such as counterexplanation and shifting attention away from focal outcomes.

Retrospection: Counterfactual Thinking and the Imagining of Alternative Paths

In 1982, Kahneman and Tversky wrote a short but provocative monograph about the *simulation heuristic*. They noted that, "There appear to be many situations in which questions about events are answered by an operation that resembles the running of a simulation model," and suggested that "we

construe the output of simulation as an assessment of the ease with which the model could produce different outcomes" (p. 201). Later, within the context of a theory of coping, Taylor and Schneider (1989) defined simulation as "the cognitive construction of hypothetical scenarios or the reconstruction of real scenarios" (p. 175). Essentially all of the research that has followed the publication of these two papers is indebted to their basic conceptualization of mental simulation.

Kahneman and Tversky (1982) and Taylor and Schneider (1989) devoted significant attention in their respective papers to counterfactual thinking, a phenomenon that philosophers have been discussing for centuries. The term *counterfactual thinking* refers to the ubiquitous human tendency to imagine alternatives to the past (e.g., "If only I had studied harder in college," "If only I had proposed to her when I had the chance"). Early theorizing about counterfactual thinking suggested that exemplars from memory composed the basic substrate of counterfactual generation. In 1986, Kahneman and Miller published an important paper about counterfactuals that described norm theory. According to norm theory, counterfactuals are mental representations of alternatives to the past that are constructed from stored representations that combine traces from episodic and semantic memory. To illustrate, the counterfactual "If I only I hadn't changed my answer on the exam…" is directly linked to an episodic memory involving a past event when an individual switched from the correct answer to an incorrect answer. In turn, the counterfactual also draws on semantic memory by referring to a generalization about how one perceives the world (e.g., always stick with your first instinct).

Norm theory (Kahneman & Miller, 1986) highlights the psychological importance of discrepancies between an experienced factual outcome and a counterfactual standard. For instance, the comparison between a student's B on an exam and the A that the student would have preferred elicits disappointment, exemplifying a *contrast effect* on judgment. However, the innovation of norm theory over previous social judgment formulations [e.g., Helson's (1964) adaptation level theory; Thibaut & Kelley's (1959) comparison level theory] was the assertion that judgmental standards are constructed *on-line* in response to specific outcomes. Thus, although the basis for a norm is certainly constructed from prior beliefs and expectancies, the particular character of each norm is, as Roese and Olson (1995) described it, "a combination of a priori beliefs reconstructed uniquely in light of a specific outcome" (p. 7). Kahneman and Miller also employed the term *mutability* to describe the relative ease with which aspects of reality (i.e., antecedent to a factual outcome) can be cognitively altered in order to construct a counterfactual (see also Hofstadter, 1985). When mutable antecedents (e.g., effort, action) precede a factual outcome, the outcome will be perceived as abnormal, and (normal) counterfactual alternatives will become more available, whereas when immutable antecedents (e.g., height, gravity) precede a factual outcome, counterfactual alternatives will become less available, and the outcome will be perceived as normal.

Contrastive Effects on Judgments

Counterfactual thinking has implications for a variety of social judgments, including expressions of sympathy and blame. With regard to sympathy, Miller and McFarland (1986) found that thinking about how a victim's misfortune could easily have been avoided rendered the outcome more poignant, thereby causing participants to feel more sympathy for the victim and to recommend a higher level of monetary compensation. In a similar vein, Branscombe and Weir (1992) found that rape victims who offered a high degree of resistance were blamed more for their misfortune than those offering more moderate resistance. These types of effects have also been observed for ascriptions of personal blame. For instance, Davis, Lehman, Silver, Wortman, and Ellard (1996) found that the degree to which respondents with spinal cord injuries believed they could have avoided their accident predicted their level of self-blame.

More generally, the role of counterfactual thinking in assessing causality has received a great deal of attention (e.g., Alicke, 2000; Cheng & Novick, 1990; Hilton & Slugoski, 1986; Lipe, 1991; Mandel, 2003; McGill, 1989). Wells and Gavanski (1989) hypothesized that a factual event will be judged as causal to the extent that its default—the alternative event that most readily comes to mind when a factual event is mentally mutated—successfully undoes the outcome. In one study, a woman was described as having died from an allergic reaction to a meal ordered by her boss. When the boss was described as having considered ordering another meal without the allergic ingredient, his causal role in the death was judged to be greater than when the alternative meal was also described as having had the allergic ingredient. However, although additional demonstrations of the role of counterfactual

thinking in shaping causal assessments can be found in the literature (e.g., Branscombe, Crosby, & Weir, 1993; Branscombe & Weir, 1992; Roese & Olson, 1996), current theorizing (e.g., Mandel, 2003, 2005; Mandel & Lehman, 1996) suggests that counterfactual thinking may be more directed toward establishing perceptions of avoidability and preventability than toward assessing causality.

In addition to disappointment, regret is a negative emotion that derives from imagining how one's present situation would have or could have been better (for reviews, see Markman & Beike, 2012; Roese, 1997; Zeelenberg, 1999), and Kahneman and Miller (1986) suggested that regret is elicited by counterfactual generation (see also Landman, 1993; Lecci, Okun, & Karoly, 1994). Other types of emotions may also be evoked as a function of the types of counterfactual antecedents that are mutated. For instance, Niedenthal, Tangney, and Gavanski (1994) showed that the experience of shame relies on counterfactual inferences that mutate characterological aspects of the self (e.g., "If only I were a more honest person…"), whereas guilt is engendered by counterfactual inferences that mutate one's behavior (e.g., "If only I had listened to her more closely…").

Counterfactuals and the Hindsight Bias

A common finding regarding reactions to unexpected events is that after having learned the outcome, the event in hindsight seems to have been more predictable and inevitable than it would have been without the benefit of outcome knowledge. This phenomenon, known as the *hindsight bias,* has been described as a projection of new knowledge into the past paired with a denial of the influence of outcome information (Hawkins & Hastie, 1990). In an initial study exploring the hindsight bias (Fischhoff, 1975), participants read about an obscure historical event, the 19th-century wars between the British and the Ghurka of Nepal. Some participants read of a battle that ended with a British victory, others with a Ghurka victory, and some were provided with no outcome information. Those participants who received outcome information reported a higher a priori likelihood of that outcome occurring than did those who did not receive outcome information. The result is what Fischhoff (1975) described as "creeping determinism": a post hoc perception of outcome inevitability. Attempts to make sense of the outcome and create a coherent causal narrative lead one to selectively recall outcome-consistent antecedent information and assimilate it with outcome knowledge.

It seems intuitive that the consideration of counterfactuals would diminish the hindsight bias. Indeed, counterfactual thinking was originally thought to reduce inevitability perceptions by illustrating how alternative outcomes were in fact possible. Sherman (1991) argued that, "to the extent that counterfactuals are easily and spontaneously generated, the past seems less inevitable: other outcomes were clearly possible" (p. 182), and Fischhoff and colleagues were, in fact, able to reduce the strength of the hindsight bias by instructing participants to consider alternative outcomes (Fischhoff, 1976; Slovic & Fischhoff, 1977). Considering opposing or alternative outcomes apparently aids in shifting the focus from the focal hypothesis—that the focal outcome had to occur—to an alternative hypothesis, that a different outcome could have occurred (Hirt & Markman, 1995; Koehler, 1991). Thus, the consideration of how the same antecedent events could lead to a different outcome has been found to reduce the hindsight bias.

On the other hand, others have argued that counterfactual thinking could lead individuals to perceive events as *more* rather than less determined. Roese and colleagues proposed that counterfactual thinking enhances the hindsight bias to the extent that counterfactual thinking aids in the identification of a coherent causal narrative (Roese, 2004; Roese & Maniar, 1997; Roese & Olson, 1996). These researchers suggested that counterfactual thinking does not necessitate the consideration of an alternative outcome but, rather, can be utilized to make sense of the outcome. To illustrate, Roese and Maniar (1997) described how a sports fan could make sense of a team's loss with the counterfactual that the team would have won had it not been for an injury earlier in the game. In the absence of the injury, the team would have won, but given the injury, the loss is construed as inevitable. Utilizing both laboratory and field studies, Roese and colleagues found that counterfactual thinking directed toward an explanation leads to increases in the hindsight bias (Roese & Maniar, 1997; Roese & Olson, 1996). Similarly, Nestler and von Collani (2008) found that priming counterfactual thinking and activating a counterfactual mindset led to increases in the hindsight bias.

Functions of Retrospective Thinking

UPWARD AND DOWNWARD COUNTERFACTUALS

Early research on counterfactual thinking focused nearly exclusively on the negative emotions that accrue from contrastive counterfactual comparisons. Later, researchers (e.g., Markman,

Gavanski, Sherman, & McMullen, 1993; McMullen, Markman, & Gavanski, 1995; Roese, 1994; Sanna, 1996) found it useful to classify counterfactuals on the basis of their direction of comparison. Borrowing a theoretical distinction drawn in the social comparison literature between upward and downward comparisons (e.g., Collins, 1996; Taylor, Buunk, & Aspinwall, 1990; Wood, 1989), counterfactuals were classified into those that construct imagined alternatives that are better than reality (i.e., *upward* counterfactuals) and those that are worse than reality (i.e., *downward* counterfactuals). In an initial demonstration of contrastive emotional responses following the generation of upward and downward counterfactuals, Markman et al. (1993) employed a computer-simulated blackjack game that allowed for an examination of the spontaneous generation of counterfactuals within the context of two manipulated situational factors—outcome valence and event repeatability. Evidencing contrast, negative and repeatable outcomes evoked a greater tendency to engage in upward than downward counterfactual thinking, which in turn heightened feelings of dissatisfaction (see also McMullen, Markman, & Gavanski, 1995). In a more direct test, Roese (1994) induced participants to consider either upward or downward counterfactuals about a recent life event. Those who generated upward counterfactuals subsequently reported more negative affect than those who generated downward counterfactuals.

Medvec and her colleagues subsequently provided some particularly compelling demonstrations of counterfactual contrast. In observations of Olympic athletes, Medvec, Madey, and Gilovich (1995) found that silver medalists actually experienced less satisfaction with their achievement than did bronze medalists, presumably because the former were focused on not having won the gold medal (i.e., an upward counterfactual), whereas the latter were focused on the possibility of not having won a medal at all (i.e., a downward counterfactual). Similarly, Medvec and Savitsky (1997) found more negative affect expressed by students who nearly attained a cutoff point (i.e., a grade of 89%), than by students who just barely attained a cutoff point (i.e., a grade of 87%). According to Medvec and colleagues, proximity to category boundaries draws attention to counterfactual outcomes, thereby eliciting contrastive effects on subsequent affective responses (see also Mellers, Schwartz, Ho, & Ritov, 1997; Sanna, Turley-Ames, & Meier, 1999; Wohl & Enzle, 2003).

Affective Contrast and Affective Assimilation

The first wave of research on counterfactual thinking assumed that contrast-based reactions to counterfactual generation—by which judgments are displaced way from the counterfactual standard—were the default: Upward counterfactuals elicit negative affect, whereas downward counterfactuals elicit positive affect (e.g., Larsen, McGraw, Mellers, & Cacioppo, 2004; Markman et al., 1993; Medvec et al., 1995; Sanna, 1996; Wohl & Enzle, 2003). However, subsequent work (e.g., Boninger, Gleicher, & Strathman, 1994; Landman & Petty, 2000; Markman, McMullen, & Elizaga, 2008; Markman & Tetlock, 2000; McMullen, 1997; McMullen & Markman, 2000, 2002; McMullen et al., 1995; Sanna, 1997; Teigen, 2005; Tetlock, 1998) indicated that assimilation-based reactions to counterfactual generation—by which judgments are pulled toward the counterfactual standard—are also common, meaning that upward counterfactuals can also elicit positive affect, and downward counterfactuals can also elicit negative affect. Markman and McMullen (2003, 2005) developed a process model—reflection and evaluation model of comparative thinking—that accounts for the elicitation of assimilative and contrastive responses to upward and downward counterfactuals. At the heart of the model is the assertion that two psychologically distinct modes of mental simulation operate during comparative thinking. The first of these modes is *reflection*, an experiential ("as if") mode of thinking whereby one vividly simulates that information about the comparison standard is true of, or is part of, oneself or one's present standing, and the second of these modes is *evaluation*, whereby the outcome of a mental simulation run is used as a reference point against which to evaluate oneself or one's present standing.

To illustrate with a counterfactual thinking example, consider the student who receives a B on an exam but realizes that an A was easily attainable with some additional studying. In the case of upward evaluation, the student switches attention between the outcome (a grade of B) and the counterfactual standard (a grade of A). According to the reflection and evaluation model, such attentional switching ("I got a B; I could have gotten an A, but instead I got a B") involves using the standard as a reference point and thereby instigates evaluative processing. In the case of upward reflection, however, the student's attention is focused mainly on the counterfactual itself. Focusing on the counterfactual instigates reflective processing whereby the student considers the implications of the counterfactual

and temporarily experiences the counterfactual as if it were real ("What if I had actually gotten an A?"). In a sense, the student is "transported" into the counterfactual world (Green & Brock, 2000). Likewise, consider the case of a driver who pulls away from the curb without carefully checking rear- and side-view mirrors, and subsequently slams on the brakes as a large truck whizzes by. In the case of downward evaluation, the driver switches attention between the counterfactual standard (being hit by the truck) and the outcome (not being hit by the truck), thereby instigating evaluative processing ("I was fortunate to not have been hit by that truck"). In the case of downward reflection, however, the driver's attention is mainly focused on the counterfactual itself, thereby instigating reflective processing ("I nearly got hit by that truck").

Content-Specific and Content-Neutral Pathways

More recently, Epstude and Roese (2008) drew a distinction between content-specific and content-neutral pathways that link counterfactual thinking to action (see also Gollwitzer and Moskowitz, 1996). According to Epstude and Roese, counterfactual thought is directly converted into action along the content-specific pathway by eliciting inferences (e.g., "I didn't study the right material") that are channeled into behavioral intentions that then direct the performance of corresponding behavior. Along the content-neutral pathway, by contrast, counterfactual thinking indirectly affects behavior by inducing emotional responses, motivational states, or information processing styles (e.g., mindsets) that then affect performance and induce behavior change.

There is indirect evidence that the content-specific pathway can lead to behavior change. For instance, Smallman and Roese (2009) used a sequential priming paradigm to demonstrate that counterfactual thinking (e.g., "might have eaten more carefully") facilitates behavioral intentions to perform specific content-related acts (e.g., "In the future I will eat more carefully"). More generally, an extensive program of research conducted by Gollwitzer and colleagues (e.g., Gollwitzer, 1993, 1999; Gollwitzer & Sheeran, 2006) has provided evidence for a link between the expression of implementation intentions (e.g., "I will study for the chemistry exam next Tuesday evening for 3 hours") and subsequent content-related behavior. It should be noted, however, that implementation intentions have been shown to have a stronger relationship to subsequent behavior than do behavioral intentions because the former are more specific, more concrete, and linked to a specific moment of opportunity. Thus, in order for counterfactuals to influence actions through the content-specific pathway, specific moments of opportunity need to arise (Fazio, 1990), and the individual needs to be both willing and able to seize on the opportunity to act (Azjen & Fishbein, 1980).

According to Epstude and Roese's (2008) distinction, the thought-to-behavior pathway described by the reflection and evaluation model (Markman & McMullen, 2003) would tend to fall into the content-neutral category because of the model's emphasis on the role of affect in mediating the relationship between mental simulation and motivation. Drawing on Schwarz and Clore's (1983) feelings-as-information perspective, the reflection and evaluation model posits that counterfactuals that elicit negative affect should encourage greater task persistence than should counterfactuals that elicit positive affect. Thus, because upward evaluation is more likely than upward reflection to elicit negative affect, upward evaluation should also be more likely to heighten motivation. Conversely, the reflection and evaluation model argues that downward reflection should heighten motivation, whereas downward evaluation should engender complacency. According to the model, the negative affect elicited by downward reflection raises an individual's awareness of the possibility that a negative goal state may be attained (see also Lockwood, Jordan, & Kunda, 2002), whereas the positive affect elicited by downward evaluation suggests that a negative goal state has been successfully avoided. Providing support for these suppositions, Markman, McMullen, and Elizaga (2008) instructed participants to generate either upward or downward counterfactuals regarding their anagram performance and were further instructed to do this within a reflective mode (i.e., "Vividly imagine the counterfactual outcome you just described") or an evaluative mode (i.e., "Vividly imagine the counterfactual outcome you just described and compare that outcome to the outcome that actually happened"). Consistent with predictions, subsequent anagram performance showed the greatest improvement following upward evaluative and downward reflective counterfactuals, and the relationship between simulation type and anagram persistence was mediated by (negative) affect.

Mental Simulation Mindsets

Another process that can effect behavior change along the content-neutral pathway involves the elicitation of information processing styles. As described earlier, scenarios that contain salient

mutable components tend to elicit counterfactual thoughts (Kahneman & Miller, 1986). In a separate literature, research on mindset priming has demonstrated how completing a cognitive activity in one domain can carry over to another domain (Gollwitzer, Heckhausen, & Steller, 1990; Kulpe, 1904). This idea has been imported into research on counterfactuals by demonstrating how counterfactual thinking in one context (e.g., reading a scenario about Jane, who switches her seat at a rock concert and subsequently wins a free trip to Hawaii) elicits a mindset that encourages the consideration of alternatives in a completely unrelated context (e.g., Galinsky & Kray, 2004; Galinsky & Moskowitz, 2000; Kray & Galinsky, 2003). For instance, counterfactual mindset activation was shown to improve decision accuracy by promoting synergistic coordination—the tendency of group members to build on and develop relationships between each other's ideas (Galinsky & Kray, 2004; Liljenquist, Galinsky, & Kray, 2004). In addition, counterfactual mindsets reduce the confirmation bias by encouraging skepticism about the dominant hypothesis (Galinsky & Moskowitz, 2000; Kray & Galinsky, 2003).

In earlier studies it was assumed that the activation of counterfactual mindsets elicits a general tendency to consider a wider range of alternatives. However, Kray, Galinsky, and Wong (2006) found that counterfactual mindsets actually impaired performance on tasks involving the generation of novel ideas. To clarify the effects of counterfactual mindsets, Markman, Lindberg, Kray, and Galinsky (2007) noted that previous research had manipulated them through the use of scenarios that tended to elicit subtractive counterfactuals—counterfactuals that remove an antecedent action (i.e., "If only I *had not,*" see Roese & Olson, 1993). According to these researchers, subtractive counterfactuals activate a relational processing style in which people consider associations and relationships among stimuli, leading them to "think *within* the box." On the other hand, Markman et al. reasoned that additive counterfactuals—counterfactuals that add an antecedent action (i.e., "If only I *had*") should enhance creativity by activating an "expansive processing style that broadens conceptual attention" (p. 312), thereby encouraging people to generate novel ideas and to "think *outside* the box." In support, they found that additive counterfactual mindsets enhanced performance on idea generation tasks (e.g., uses for a brick, Scattergories), whereas subtractive counterfactual mindsets enhanced performance on association tasks (Remote Associates Test, syllogisms). More recently, Kray, Galinsky, and Markman (2009) demonstrated that negotiators who generated additive counterfactuals about a past negotiation were subsequently more likely to create an integrative deal than negotiators who generated subtractive counterfactuals. Because additive counterfactuals add hypothetical elements to the past, they likely evoke an expansive processing style that aids in creative generation (cf. Guilford, 1950).

Prospection: Looking Back in Order to Look Ahead

At one point in the film *Inception* (Nolan, 2010), Dom Cobb (played by Leonardo DiCaprio), a master at extracting secret information from others' dreams, enters into a shared dream-space with young apprentice Ariadne (played by Ellen Page) in order to share his knowledge about the inner workings of dreams and the subconscious mind. As he observes her manipulating the architecture of the dream, he cautions her to, "Never recreate from your memory. Always imagine new places." This observation about the relationship between waking life and dreaming life is striking in the way it maps onto the hypothesized relationship between memory and (waking life) mental simulation. The idea is that just as individuals can vividly recollect their personal pasts, they can also travel forward in time to vividly "pre-experience" or "pre-feel" their personal futures (Atance & O'Neill, 2001; Buckner & Carroll, 2007; Gilbert & Wilson, 2007; Schacter & Addis, 2007; Suddendorf & Corballis, 1997; Tulving, 1972). When individuals simulate the future, they sample exemplars from remembered events that help generate a virtually unlimited number of potential future scenarios (Corballis, 2003; Suddendorf & Corballis, 1997). In this way, episodic memory is a constructive system that enables individuals to simulate both their personal pasts and their possible futures (Schacter & Addis, 2007).

In support, recent empirical work has shown that there is considerable overlap in the psychological and neural processes involved in remembering the past and simulating the future. For example, it has been shown that personal past and future thought can be impaired in amnesic patients (e.g., Klein, Loftus, & Kihlstrom, 2002; Tulving, 1985) and that both share common neural correlates (Addis, Wong, & Schacter, 2007; Okuda et al., 2003; Szpunar, Watson, & McDermott, 2007) traditionally associated solely with remembering the past (Maguire, 2001). To illustrate, Szpunar et al. (2007) instructed participants to remember specific

past events, imagine specific future events, or imagine specific events involving Bill Clinton. These researchers found that imagining specific past and future events resulted in similar patterns of activity in the bilateral frontopolar and medial temporal lobe regions, as well as posterior cingulated cortex. The fact that these regions were *not* activated to the same magnitude when imagining events involving Bill Clinton appears to demonstrate a neural signature that is unique to the construction of events in one's personal past or future.

More generally, it appears that human beings spend a great deal of time musing about possible futures. Neuroimaging studies reveal that both the prefrontal cortex and the media temporal lobes are strongly activated by prospection (Schacter, Addis, & Buckner, 2007; Szpunar, Watson, & McDermott, 2007), and these regions appear to be part of a "default network" that is activated when individuals are not specifically engaged in other tasks (Raichle et al., 2001). The intriguing implication of this work is that when the mind is not busy perceiving the present it tends to gravitate toward simulations of the future (Buckner & Carroll, 2007).

Biasing Effects of Prospective Simulations

The term *reality monitoring* refers to one's ability to discriminate between what has been generated and what has been perceived. Thus, individuals can confuse what they imagined with what they saw (e.g., Durso & Johnson, 1980), and the more often they think about something, the more often they think they saw it (Johnson, Raye, Wang, & Taylor, 1979; Johnson, Taylor, & Raye, 1977). Related work on the phenomenon of "imagination inflation" has shown how imagination can lead to the creation of false memories (e.g., Bernstein, Godfrey, & Loftus, 2009; Goff & Roediger, 1998; Seamon, Philbin, & Harrison, 2006), and explaining how particular events might have occurred in one's life (Sharman, Manning, & Garry, 2005) can enhance confidence that these events actually occurred in adolescence.

Explanation Bias

People often mentally simulate the future in order to predict whether a particular outcome is likely to occur. There is a considerable amount of research (Johnson & Sherman, 1990; Koehler, 1991), however, demonstrating that merely specifying a particular future outcome to think about leads people to subsequently perceive that outcome as more likely. This is referred to as the *explanation bias*. Typically, study participants who are asked to imagine or explain how a hypothetical outcome might be true show increased subjective likelihood estimates for the target outcome relative to participants who are not asked to imagine an outcome. For instance, Ross, Lepper, Strack, and Steinmetz (1977) instructed participants to read clinical case histories of psychiatric patients, after which they were asked to write explanations for why patients might have engaged in various behaviors (e.g., participating in the Peace Corps) later in their lives. Even though the behaviors to be explained were known to be hypothetical, participants who had explained behaviors believed that the patients were more likely to perform those behaviors in the future (see also Anderson, Lepper, & Ross, 1980; Carroll, 1978; Hirt & Sherman, 1985; Sherman, Zehner, Johnson, & Hirt, 1983). Research has also indicated that explanation biases can occur when one is explaining hypothetical future events involving themselves. Sherman, Skov, Hervitz, and Stock (1981) found that participants who explained hypothetical success on a future anagram task believed that success was more likely in the future. The changes in likelihood estimates that occur after explanation tasks also appear to be quite resistant to change. For instance, Anderson (1983) found that participants continued to exhibit increased confidence in the validity of explanation-induced social theories a week after they completed an explanation task.

The underlying mechanism that is assumed to account for the explanation bias is the availability heuristic (Tversky & Kahneman, 1973), whereby individuals judge the likelihood of future outcomes on the basis of the ease with which similar instances can be brought to mind. Outcomes whose instances readily come to mind are judged more likely than outcomes whose instances do not readily come to mind. Thus, bias results because causal arguments consistent with that outcome are more readily and easily retrieved at the time of judgment than are arguments consistent with alternative outcomes (Anderson et al., 1980; Anderson, New, & Speer, 1985).

Debiasing the Effects of Explanations

Although explanations can lead to bias, it is also possible to diminish, if not completely eradicate, the biasing effects of explanations. Fischhoff (1982) suggested that one of the most effective strategies for reducing judgmental biases is to prompt individuals to consider alternatives. In fact, subsequent studies have shown that a consideration of alternatives can be an effective debiasing strategy for reducing the hindsight bias (Sanna & Schwarz, 2003; Sanna, Schwarz, & Stocker, 2002), the explanation effect

(Hirt & Markman, 1995; Lord, Lepper, & Preston, 1984), and overconfidence (Hoch, 1985; Koriat, Lichtenstein, & Fischhoff, 1980).

By what mechanism does considering alternatives reduce bias? In the lab, a counterexplanation task presents participants with the task of considering one alternative outcome for the event in question: Participants must undo their prior explanation for the event and construct an explanation supporting a different outcome. Hirt and Markman (1995) posited that successful completion of a counterexplanation task should lead participants to realize that the outcome of an event is not as predictable as previously believed. This realization may then lead participants to consider additional alternatives (beyond those specified in the explanation and counterexplanation tasks) in making their likelihood judgments. To do so, participants are presumed to use the simulation heuristic and engage in multiple simulation runs of the potential outcomes of the event. According to the simulation heuristic, people judge the likelihood of an outcome on the basis of the ease with which scenarios leading to a particular outcome can be constructed (Kahneman & Tversky, 1982); outcomes that are easily simulated are judged to be relatively likely, and outcomes more difficult to imagine are judged to be relatively unlikely (Sherman, Cialdini, Schwartzman, & Reynolds, 1985). Notably, however, to the extent that scenarios consistent with an alternative outcome are found to be easy to simulate, counterexplanation participants will be spurred on to consider *additional* alternatives and engage in mental simulation runs for those alternatives. In this way, the counterexplanation task leads participants to consider a fuller, more complete set of alternatives when they judge the likely outcome of the event. Thus, debiasing results from the fact that the simulation of additional alternative outcomes for the event reveals that plausible alternatives to the initially explained outcome exist. Participants then base their likelihood judgments on the results of the simulation process, judging the most easily simulated outcome to the event to be most probable.

To provide evidence for the debiasing effects of counterexplanations, Hirt and Markman (1995, Study 2) had participants first explain a focal event (a win by a particular football team) and then explain an alternative outcome. The nature of the alternative outcome was varied such that in some cases it was opposite to the first outcome (e.g., a convincing win by team B after explaining a convincing win by team A), but in other cases, it was an alternative version of the same outcome (e.g., a convincing win by Team B after explaining a narrow victory by team B). The results indicated that in all cases, the consideration of an alternative outcome debiased likelihood judgments. Moreover, the consideration of an alternative to the focal outcome led participants to spontaneously consider and mentally simulate additional alternatives beyond those they were asked to explicitly consider. Thus, it appears that simply having individuals consider alternatives, even when the alternative does not undo the outcome, is sufficient to break the inertia that sets in after the initial explanation, resulting in a more thorough evaluation of the evidence at the time of judgment. Notably, the consideration of alternatives can be motivated as well. For example, accountability pressure can lead individuals to engage in preemptive self-criticism, whereby one anticipates the potential objections of others by considering multiple perspectives (Lerner & Tetlock, 1999; Tetlock, 1983).

Adding complexity to the story, research has also shown that the consideration of alternatives as a debiasing strategy can sometimes backfire as a function of the influence of metacognitive thoughts. That is, when the consideration of alternatives is experienced as particularly difficult, bias is amplified rather than attenuated (Hirt, Kardes, & Markman, 2004; Sanna et al., 2002). The reason appears to be that the process of generating or retrieving information from memory renders two sources of information accessible: the specific content that comes to mind (accessible content) and the subjective ease with which that content comes to mind (accessibility experiences; Schwarz, 1998; Schwarz & Vaughn, 2002). When asked to consider alternatives that are easy to generate, bias is reduced because individuals acknowledge that there are many other plausible alternatives to the focal outcome. However, when the consideration of alternatives is perceived to be difficult, individuals conclude that few if any plausible alternatives exist and become more convinced that the focal outcome is inevitable.

Sanna et al. (2002) demonstrated the implications of these accessibility experiences for hindsight bias. Participants were provided with descriptions of the British-Gurkha war (Fischhoff, 1975) and asked to generate two or 10 examples about how the war could have turned out differently. Participants asked to generate two examples found the task easy, leading them to infer that there were several plausible alternatives for this event, significantly reducing hindsight bias. By contrast, participants asked to generate 10 examples found the task difficult.

Their negative accessibility experience apparently led them to believe that there were few plausible alternatives to the focal outcome, thereby increasing hindsight bias.

Affective Forecasting

It is common for individuals to make predictions or have expectations about how they are going to feel in the future. A great deal of recent research, however, has demonstrated that individuals' mental simulations regarding their prospective feelings are often inaccurate, leading them to overestimate (e.g., Buehler & McFarland, 2001; Gilbert, Morewedge, Risen, & Wilson, 2004) and sometime underestimate (e.g., Dunn, Biesanz, Human, & Finn, 2007; Gilbert, Gill, & Wilson, 2002) the extremity of emotional responses they will experience in the future. Such miscalibrated judgments have been referred to as "affective forecasting errors." Affective forecasts necessarily rely on memory, including most notably, memories of feelings. The problem is that individuals often use unrepresentative memories as a basis for simulation (Gilbert & Wilson, 2007). To illustrate, when people experience unpleasant episodes that end in relief—such as waiting on several interminably long check-in lines in order to board multiple planes for a vacation destination—they tend to remember peak moments of the experience (e.g., swimming in crystal-clear water when they finally arrive at the beach) rather than the most typical moments. They then use these more unrepresentative memories to construct a simulation of what it will be like to repeat that event (e.g., taking another vacation to a beach locale) that leads them to underestimate how frustrating the repeat experience will be (Frederickson & Kahneman, 1993).

One mechanism that is suggested to account for affective forecasting errors is implicit in our earlier discussion of the biasing effects of explanations, namely, *focalism*. When perceivers engage in focalism, they are directing their attention solely to the focal event while failing to take into consideration the impact of other events (Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000). Consider a study in which students were asked to imagine living in California versus the Midwest (Schkade & Kahneman, 1998). Students residing in both places anticipated that living in California would lead to greater life satisfaction than living in the Midwest. However, this prediction stemmed from the fact that students focused heavily on the differences between the two regions—particularly California's superior weather—when imagining what it would be like to live in the other region. Yet, actual satisfaction may depend on a much broader set of life conditions (e.g., job opportunities, daily hassles) that are fairly similar across regions. Indeed, students living in the Midwest reported life satisfaction levels that were equivalent to those of their counterparts in California.

Affective forecasters also commonly exhibit an *impact bias*, a tendency to overestimate the intensity and duration of their own emotional responses to events (Gilbert, Driver-Linn, & Wilson, 2002). For example Gilbert, Pinel, Wilson, Blumberg, and Wheatley (1998) asked Democrats to predict how they would feel if George W. Bush were elected governor of Texas. Although they predicted that they would be miserable, their default levels of happiness had not only returned by the time Bush was elected governor, but they had also developed a more positive view of Bush, suggesting that they were finding silver linings in the situation. Gilbert et al. (1998) suggested that forecasters succumb to the impact bias because they fail to foresee the palliative influence of the *psychological immune system*, which tends to minimize the extremity of negative and positive emotional responses (see also Taylor, 1991). Employing the language of cognitive-experiential self-theory (Epstein, 1994, 1998), immune neglect emerges because the rational system fails to appreciate the important role that the experiential system plays in shaping emotional experience (Dunn, Forrin, & Ashton-James, 2009).

In addition, affective forecasters tend to ignore the influence of visceral factors. If, as cognitive-experiential self-theory suggests, the rational system is a cold system driven by reason whereas the experiential system is a hot system driven by emotions, then individuals commonly find themselves imagining how they will feel in a hot state when they are in fact in a cold state. This creates what Loewenstein and colleagues have called a *hot/cold empathy gap* (e.g., Loewenstein, O'Donoghue, & Rabin, 2003; Loewenstein & Schkade, 1999; Van Boven & Loewenstein, 2003). The hot/cold empathy gap reflects a struggle between the cold rational system and the hot experiential system. As Gilbert and Wilson (2007) noted, "People do not imagine feeling anxious while having a colonoscopy so much as they imagine a colonoscopy, feel anxious, and then take this anxiety as an indicator of the feelings they can expect to experience during the procedure itself" (p. 1352). In one study, individuals who completed a quiz were offered, as reimbursement, either a candy bar or the answers to the quiz

questions (Loewenstein, Prelec, & Shatto, 1998). Among those who made their choice before taking the quiz, only 21% chose the answers. However, a significantly higher proportion of individuals (60%) chose the answers after having taken the quiz. In their cold state, before taking the quiz, individuals apparently underestimated their subsequent curiosity and its effect on their behavior.

Debiasing Affective Forecasts

Just as there are debiasing techniques to counter the effects of focalism on explanations (e.g., Hirt & Markman, 1995; Hirt et al., 2004), there are also ways to increase the accuracy of affective forecasts. Recently, Dunn et al. (2009) made the observation that, "affective forecasting depends in part on the extent to which the rational system has access to complete and correct information about the reality of emotional experiences in everyday life" (p. 341). In support, Dunn, Brackett, Ashton-James, Schneiderman, and Salovey (2009) had participants complete a measure of emotional intelligence (Salovey & Mayer, 1990). Emotional intelligence reflects knowledge about the causes and consequences of one's own and others' experience of emotions. Participants were then asked to predict how they would feel two days after a U.S. presidential election (Study 1a), three weeks after an academic exam (Study 1b), or the morning after a college basketball game (Study 2). Next, participants were asked to report how they were actually feeling after each event. Consistent with predictions, the discrepancies between the affective forecasts and experiences of individuals high in emotional intelligence were smaller in comparison to the discrepancies reported by individuals low in emotional intelligence. Thus, when making affective forecasts, it would appear useful to teach the rational system to incorporate and utilize inputs (e.g., feelings, "vibes") that it receives from the experiential system (see also Hoerger, Quirk, Lucas, & Carr, 2009). More directly, Wilson et al. (2000) conducted a diary study and found that simply thinking about peripheral future activities decreased focalism and enhanced the accuracy of affective forecasts.

Functions of Prospective Thinking

Prospective mental simulations are a particularly powerful means by which to strengthen links between thinking, motivation, and behavior. Pham and Taylor (1999; Taylor & Pham, 1999) drew a distinction between simulations of desired goals (outcome simulations) and simulations of the steps leading to desired goals (process simulations). In one study (Pham & Taylor, 1999), for five to seven days before a midterm examination, college freshmen either mentally simulated the steps that needed to be taken in order to do well on the exam (good study habits) or simply simulated the desired outcome (getting a good grade). Results indicated that compared with outcome simulations, process simulations enhanced studying and improved grades. Thus, it is apparently not enough to merely envision a better future outcome in order to attain a desired goal. Rather, individuals also need to simulate the means by which they will pursue that goal.

The importance of thinking about routes to goal achievement and the obstacles one might encounter along the way has been formalized in an important theory developed by Oettingen and her colleagues. Fantasy realization theory (e.g., Oettingen, Pak, & Schnetter, 2001) describes three routes to goal setting that result from how individuals deal with their fantasies about desired futures. The expectancy-based route involves mentally contrasting fantasies about a desired future with aspects of present reality that stand in the way of reaching the desired future. According to the theory, mental contrasting transforms the desired future into something that is to be achieved, and reality into something that is to be changed. This induces a necessity to act that activates relevant expectations that in turn determine the strength of commitment to fantasy realization. The second route involves merely fantasizing about a positive future (indulging). Unfortunately, such indulgences only lead one to mentally enjoy the desired future in the here and now. In this case, a necessity to act is not induced, and expectations of success are not activated. Finally, the third route involves reflecting on negative realities, but such dwellings wind up being merely ruminative. Once again, a necessity to act is not induced, and expectations are not activated. Overall, the superiority of mental contrasting to indulging and dwelling with regard to increasing goal pursuit and enhancing performance has been documented in many studies and across many contexts (e.g. Oettingen, 2000; Oettingen, Hönig, & Gollwitzer, 2000; Oettingen et al., 2001, 2009; Oettingen, Mayer, Thorpe, Janetzke, & Lorenz, 2005).

In sum, it appears that human beings need to look back in order to look ahead because thoughts about the future emerge from a blend of episodic and semantic memories. Moreover, prospective thinking can become biased, as when individuals inflate their beliefs about the probability of certain

outcomes and mispredict how they are going to feel about those outcomes in the future. Fortunately, however, these biases can be counteracted. The effect of explanations on biasing predictions can be attenuated by considering alternatives, and attending to input from the experiential system can minimize affective forecasting errors. More generally, human beings spend a lot of time thinking about the future, and this appears to be the case because prospective simulation is functional. As long as they are contrasted against obstacles in reality that might stand in the way, such simulations are a critical impetus for goal setting and goal commitment. Without mentally simulating the future, we could not make goals for the future.

Conclusion

Although this chapter focused on work examining prospective and retrospective mental simulations, we would be remiss in not pointing out that a great deal of research has also focused on mental simulation in the present. For instance, recent neuropsychological work on empathy (e.g., Decety & Jackson, 2004, 2006; Jeannerod, 1994; Lamm, Batson, & Decety, 2007) demonstrating that the same neurons involved in acting are also involved in *simulating* those actions provides further evidence of the powerful connection between mental simulation and action. Likewise, visual imagery has been shown to exert significant effects on behavior (for a review, see Kosslyn & Moulton, 2009). Revealing what is being simulated or imagined in the brain would seem to offer much with regard to furthering our understanding of the role that mental simulations play in creating action, and why some simulations might be more effective than others.

Even though mental simulations can become biased, they are functional in many respects. Although past research focused on the negative emotional consequences of counterfactual simulations, more recent research has demonstrated their motivational value. Mental simulations of past failures, though at times emotionally painful, allow us nevertheless to recognize our mistakes and potentially identify avenues by which we can improve on them in the future. And, in kind, mental simulations of the future allow us to set and commit to goals, enhancing goal directed persistence and performance. When contrasted against obstacles that might stand in our way, mental simulations are absolutely necessary for effective goal formation and pursuit, energizing us to try harder and perform better than we did before.

References

Addis, D. R., Wong, A. T., & Schacter, D. L. (2007). Remembering the past and imagining the future: Common and distinct neural substrates during event construction and elaboration. *Neuropsychologia*, *45*, 1363–1377.

Alicke, M. (2000). Culpable control and the psychology of blame. *Psychological Bulletin*, *126*, 556–574.

Anderson, C. A. (1983). Abstract and concrete data in the perseverance of social theories: When weak data lead to unshakable beliefs. *Journal of Experimental Social Psychology*, *19*, 93–108.

Anderson, C. A., Lepper, M. R., & Ross, L. (1980). Perseverance of social theories: The role of explanation in the persistence of discredited information. *Journal of Personality and Social Psychology, 39*, 1037–1049.

Anderson, C. A., New, B. L., & Speer, J. R. (1985). Argument availability as a mediator of social theory perseverance. *Social Cognition, 3*, 235–249.

Atance, C. M., & O'Neill, D. K. (2001). Episodic future thinking. *Trends in Cognitive Science*, *5*, 533–539.

Bernstein, D. M., Godfrey, R. D., & Loftus, E. F. (2009). False memories: The role of plausibility and autobiographical belief. In K. D. Markman, W. M. P. Klein, & J. A. Suhr (Eds.), *The handbook of imagination and mental simulation* (pp. 89–102). New York: Psychology Press.

Boninger, D. S., Gleicher, F., & Strathman, A. (1994). Counterfactual thinking: From what might have been to what might be. *Journal of Personality and Social Psychology, 67*, 297–307.

Branscombe, N., Crosby, P., & Weir, J. A. (1993). Social inferences concerning male and female homeowners who use a gun to shoot an intruder. *Aggressive Behavior, 19*, 113–124.

Branscombe, N. R., & Weir, J. A. (1992). Resistance to stereotype-inconsistency: Consequences for judgments of rape victims. *Journal of Social and Clinical Psychology, 11*, 80–102.

Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in Cognitive Science, 11*, 49–57.

Buehler, R., & McFarland, C. (2001). Intensity bias in affective forecasting: The role of temporal focus. *Personality and Social Psychology Bulletin, 27,* 1480–1493.

Carroll, J. S., (1978). The effect of imagining an event on expectations for the event: An interpretation in terms of the availability heuristic. *Journal of Experimental Social Psychology, 14*, 88–96.

Chen, P. W., & Novick, L. R. (1990). Causes versus enabling conditions. *Journal of Personality and Social Psychology, 58*, 545–567.

Collins, R. L. (1996). For better or for worse: The impact of upward social comparison on self-evaluations. *Psychological Bulletin, 119,* 51–69.

Corballis, M. (2003). Recursion is the key to the human mind. In K. Sterelny & J. Finess (Eds.), *From mating to mentality: Evaluating evolutionary psychology* (pp. 155–171). New York: Psychology Press.

Davis, C. G., Lehman, D. R., Silver, R. C., Wortman, C. B., & Ellard, J. H. (1996). Self-blame following a traumatic life event: The role of perceived avoidability. *Personality and Social Psychology Bulletin*, *22*, 557–567.

Decety, J., & Jackson, P. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews, 3*, 71–100.

Decety, J., & Jackson, P. (2006). A social neuroscience perspective on empathy. *Current Directions in Psychological Science, 12*, 406–411.

Dunn, E. W., Biesanz, J. C., Human, L. J., & Finn, S. (2007). Misunderstanding the affective consequences of everyday social interactions: The hidden benefits of putting one's best face forward. *Journal of Personality and Social Psychology, 92*, 990–1005.

Dunn, E. W., Brackett, M.A., Ashton-James, C., Schneiderman, E., & Salovey, P. (2009). On emotionally intelligent time travel: Individual differences in affective forecasting ability. *Personality and Social Psychology Bulletin*, *33*, 85–93.

Dunn, E. W., Forrin, N. D., & Ashton-James, C. E. (2009). On the excessive rationality of the emotional imagination: A two systems account of affective forecasts and experiences. In K. D. Markman, W. M. P. Klein, & J. A. Suhr (Eds.), *The handbook of imagination and mental simulation* (pp. 331–346). New York: Psychology Press.

Durso, F. T., & Johnson, M. K. (1980). The effects of orienting tasks on recognition, recall, and modality confusion of pictures and words. *Journal of Verbal Learning and Verbal Behavior*, *19*, 416–429.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist, 49,* 709–724.

Epstein, S. (1998). Cognitive-experiential self-theory. In D. F. Barone, M. Hersen, & V. B. Van Hasselt (Eds.), *Advanced personality* (pp. 211–238). New York: Plenum Press.

Epstude, K., & Roese, N. J. (2008). The functional theory of counterfactual thinking. *Personality and Social Psychology Bulletin, 12*, 168–192.

Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 23, pp. 75–109). New York: Academic Press.

Fischhoff, B. (1975). Hindsight does not equal foresight: The effect of outcome knowledge on judgment under uncertainty. *Journal of Experimental Psychology: Human Perception and Performance, 1*, 288–299.

Fischhoff, B. (1976). The effect of temporal setting on likelihood estimates. *Organizational Behavior and Human Decision Processes, 15*, 180–194.

Fischhoff, B. (1982). Debiasing. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 422–444). Cambridge, UK: Cambridge University Press.

Fredrickson, B. L., & Kahneman, D. (1993). Duration neglect in retrospective evaluations of affective episodes. *Journal of Personality and Social Psychology*, *65*, 45–55.

Galinsky, A. D., & Kray, L. J. (2004). From thinking about what might have been to sharing what we know: The effects of counterfactual mind-sets on information sharing in groups. *Journal of Experimental Social Psychology, 36*, 257–383.

Galinsky, A. D., & Moskowitz, G. B. (2000). Counterfactuals as behavioral primes: Priming the simulation heuristic and consideration of alternatives. *Journal of Experimental Social Psychology, 36*, 257–383.

Gilbert, D. T., Gill, M. J., & Wilson, D. T. (2002). The future is now: Temporal correction in affective forecasting. *Organizational Behavior and Human Decision Processes, 88,* 690–700.

Gilbert, D. T., Morewedge, C. K., Risen, J. L., & Wilson, T. D. (2004). Looking forward to looking backward: The misprediction of regret. *Psychological Science, 15,* 346–350.

Gilbert, D. T., Pinel, E. C., Wilson, T. D., Blumberg, S. J., & Wheatley, T. P. (1998). Immune neglect: A source of durability bias in affective forecasting. *Journal of Personality and Social Psychology, 75,* 617–638.

Gilbert, D. T., & Wilson, T. D. (2007). Prospection: Experiencing the future. *Science, 317*, 1351–1354.

Goff, L. M., & Roediger, H. L. III (1998). Imagination inflation for action events: Repeated imaginings lead to illusory recollections. *Memory & Cognition, 26*, 20–33.

Gollwitzer, P. M. (1993). Goal and achievement: The role of intentions. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 4, pp. 141–185). Chichester, UK: Wiley.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*, 493–503.

Gollwitzer, P. M., Heckhausen, H., & Steller, B. (1990). Deliberative and implemental mind-sets: Cognitive tuning toward congruous thoughts and information. *Journal of Personality and Social Psychology, 59*, 1119–1127.

Gollwitzer, P. M., & Moskowitz, G. B. (1996). Goal effects on action and cognition. In E. T. Higgins, & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 361–399). New York: Guilford Press.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69–119.

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology, 79*, 701–721.

Guilford, J. P. (1950). Creativity. *American Psychologist, 5*, 444–454.

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

Helson, H. (1964). *Adaptation-level theory.* New York: Harper.

Hilton, D. J., & Slugoski, B. R. (1986). Knowledge-based causal attribution: The abnormal conditions focus model. *Psychological Review, 93,* 75–88.

Hirt, E. R., Kardes, F. R., & Markman, K. D. (2004). Activating a mental simulation mind-set
through generation of alternatives: Implications for debiasing in related and unrelated domains. *Journal of Experimental Social Psychology*, *40*, 374–383.

Hirt, E. R., & Markman, K. D. (1995). Multiple explanation: A consider-an-alternative strategy for debiasing judgments. *Journal of Personality and Social Psychology, 69*, 1069–1086.

Hirt, E. R., & Sherman, S. J. (1985). The role of prior knowledge in explaining hypothetical events. *Journal of Experimental Social Psychology, 21*, 519–543.

Hoch, S. J. (1985). Counterfactual reasoning and accuracy in predicting personal events. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 11*, 719–731.

Hoerger, M., Quirk, S. W., Lucas, R. E., & Carr, T. H. (2009). Immune neglect in affective forecasting. *Journal of Research in Personality, 43*, 91–94.

Hofstadter, D. R. (1985). *Metamagical themas*. New York: Basic Books.

Jeannerod, M. (1994). The representing brain: Neural correlates of motor intention and imagery. *Behavioral and Brain Sciences*, *17*, 187–202.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88*, 67–85.

Johnson, M. K., Raye, C. L., Wang, A. Y., & Taylor, T. H. (1979) Fact and fantasy: The roles of accuracy and variability in

confusing imaginations with perceptual experiences. *Journal of Experimental Psychology: Human Learning and Memory, 5*, 229–240.

Johnson, M. K., & Sherman, S. J. (1990). Constructing and reconstructing the past and future in the present. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and social cognition: Foundations of social behavior* (pp. 482–526). New York: Guilford Press.

Johnson, M. K., Taylor, T. H., & Raye, C. L. (1977). Fact and fantasy: The effects of internally generated events on the apparent frequency of externally generated events. *Memory & Cognition, 5*, 116–122.

Klein, S. B., Loftus, J., & Kihlstrom, J. F. (2002). Memory and temporal experience: The effects of episodic memory loss on an amnesic patient's ability to remember the past and imagine the future. *Social Cognition*, *20*, 353–379.

Kosslyn, S. M., & Moulton, S. T. (2009). Mental imagery and implicit memory. In K. D. Markman, W. M. P. Klein, & J. A. Suhr (Eds.), *The handbook of imagination and mental simulation* (pp. 35–52) New York: Psychology Press.

Kray, L. J., & Galinsky, A. D. (2003). The debiasing effect of counterfactual mind-sets: Increase the search for disconfirmatory information in group decisions. *Organizational Behavior and Human Decision Processes, 91*, 69–81.

Kulpe, O. (1904). Versuche uber Abstraktion. In, *Bericht uber den erste Kongress fur experimentelle Psychologie* (pp. 56–68). Leipzig: Barth.

Lamm, C., Batson, C. D., & Decety, J. (2007). The neural substrate of human empathy: Effects of perspective-taking and cognitive appraisal. *Journal of Cognitive Neuroscience, 19*, 42–58.

Landman, J. (1993). *Regret: The persistence of the possible.* New York: Oxford University Press.

Lecci, L., Okun, M., & Karoly, P. (1994). Life regrets and current goals as predictors of psychological adjustment. *Journal of Personality and Social Psychology, 66*, 731–741.

Lipe, M. G. (1991). Counterfactual reasoning as a framework for attribution theories. *Psychological Bulletin, 109*, 456–471.

Kahneman, D., & Miller, D. T. (1986). Norm theory: Comparing reality to its alternatives. *Psychological Review, 93,* 136–153.

Kahneman, D., & Tversky, A. (1982). The simulation heuristic. In D. Kahneman, P. Slovic & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 201–208). Cambridge, UK: Cambridge University Press.

Koehler, D. J. (1991). Explanation, imagination, and confidence in judgment. *Psychological Bulletin, 110*, 499–519.

Koriat, A., Lichtenstein, S., & Fischhoff, B. (1980). Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory, 6*, 107–118.

Kray, L. J., & Galinsky, A. D. (2003). The debiasing effect of counterfactual mind-sets: Increasing the search for disconfirmatory information in group decisions. *Organizational and Human Decision Processes, 91*, 69–81.

Kray, L. J., & Galinsky, A. D., & Markman, K. D. (2009). Counterfactual structure and learning from experience in negotiations. *Journal of Experimental Social Psychology, 45*, 979–982.

Kray, L. J., & Galinsky, A. D., & Wong, E. M. (2006). Thinking within the box: The relational processing style elicited by counterfactual mind-sets. *Journal of Personality and Social Psychology, 91*, 33–48.

Landman, J., & Petty, R. (2000). "It could have been you": How states exploit counterfactual thought to market lotteries. *Psychology and Marketing, 17*, 299–321.

Larsen, J. T., McGraw, A. P., Mellers, B. A., & Cacioppo, J. T. (2004). The agony of victory and the thrill of defeat: Mixed emotional reactions to disappointing wins and relieving losses. *Psychological Science, 15*, 325–330.

Lerner, J. S., & Tetlock, P. E. (1999). Accounting for the effects of accountability. *Psychological Bulletin, 125*, 255–275.

Loewenstein, G. F., & Schkade, D. (1999). Wouldn't it be nice? Predicting future feelings. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 85–105). New York: Russell Sage Foundation.

Loewenstein, G., O' Donoghue, T., & Rabin, M. (2003). Projection bias in predicting future utility. *Quarterly Journal of Economics, 118*, 1209–1248.

Loewenstein, G., Prelec, D., & Shatto, C. (1998). *Hot/cold intrapersonal empathy gaps and the underprediction of curiosity*. Unpublished manuscript, Carnegie Mellon University, Pittsburg, PA.

Lockwood, P., Jordan, C. H., & Kunda, Z. (2002). Motivation by positive or negative role models: Regulatory focus determines who will best inspire us. *Journal of Personality and Social Psychology, 83*, 854–864.

Lord, C. G., Lepper, M. R., & Preston, E. (1984). Considering the opposite: A corrective strategy for social judgment. *Journal of Personality and Social Psychology, 47*, 1231–1243.

Maguire, E. A. (2001). Neuroimaging studies of autobiographical event memories. *Philosophical Transactions of the Royal Society, 356*, 1441–1451.

Mandel, D. R. (2003). Judgment dissociation theory: An analysis of differences in causal, counterfactual and covariational reasoning. *Journal of Experimental Psychology: General, 137*, 419–434.

Mandel, D. R. (2005). Are risk assessments of a terrorist attack coherent? *Journal of Experimental Psychology: Applied, 11*, 277–288.

Mandel, D. R., & Lehman, D. R. (1996). Counterfactual thinking and ascriptions of cause and preventability. *Journal of Personality and Social Psychology, 71*, 450–463.

Markman, K. D., & Beike, D. R. (2012). Regret, consistency, and choice: An opportunity X mitigation framework. In B. Gawronski & F. Strack (Eds.), *Cognitive consistency: A fundamental principle in social cognition* (pp. 305–325). New York: Guilford Press.

Markman, K. D., Elizaga, R. A., Ratcliff, J. J., & McMullen, M. N. (2007). The interplay between counterfactual reasoning and feedback dynamics in producing inferences about the self. *Thinking and Reasoning, 13*, 188–206.

Markman, K. D., Gavanski, I., Sherman, S. J., & McMullen, M. N. (1993). The mental simulation of better and worse possible worlds. *Journal of Experimental Social Psychology, 29*, 87–109.

Markman, K. D., Lindberg, M. J., Kray, L. J., & Galinsky, A. D. (2007). Implications of counterfactual structure for creative generation and analytical problem solving. *Personality and Social Psychology Bulletin, 33*, 312–314.

Markman, K. D., & McMullen, M. N. (2003). A reflection and evaluation model of comparative thinking. *Personality and Social Psychology Review, 7*, 244–267.

Markman, K. D., & McMullen, M. N. (2005). Reflective and evaluative modes of mental simulation. In D. R. Mandel, D. J. Hilton, & P. Catellani (Eds.), *The psychology of counterfactual thinking* (pp. 77–93). London: Routledge.

Markman, K. D., McMullen, M. N., & Elizaga, R. (2008). Counterfactual thinking, persistence and performance:

A test of the reflection and evaluation model. *Journal of Experimental Social Psychology, 44*, 421–428.

Markman, K. D., & Tetlock, P. E. (2000). Accountability and close-call counterfactuals: The loser who nearly won and the winner who nearly lost. *Personality and Social Psychology Bulletin, 26*, 1213–1224.

McGill, A. L. (1989). Context effects in judgments of causation. *Journal of Personality and Social Psychology, 57,* 189–200.

McMullen, M. N. (1997). Affective contrast and assimilation in counterfactual thinking. *Journal of Experimental Social Psychology, 33*, 77–100.

McMullen, M. N., & Markman, K. D. (2000). Downward counterfactual and motivation: The wake-up call and the Pangloss effect. *Personality and Social Psychology Bulletin, 26*, 575–584.

McMullen, M. N., & Markman, K. D. (2002). Affect and close counterfactuals: Implications of possible futures for possible pasts. *Journal of Experimental Social Psychology, 38*, 64–70.

McMullen, M. N., Markman, K. D., & Gavanski, I. (1995). Living in neither the best nor worst of all possible worlds: Antecedents and consequences of upward and downward counterfactual thinking. In N. J. Roese & J. M. Olson (Eds.), *What might have been: The social psychology of counterfactual thinking* (pp. 133–167). Hillsdale, NJ: Erlbaum.

Medvec, V. H., Madey, S. F., & Gilovich, T. (1995). When less is more: Counterfactual thinking and satisfaction among Olympic medalists. *Journal of Personality and Social Psychology, 69*, 603–610.

Medvec, V. H., & Savitsky, K. K. (1997). When doing better means feeling worse. *Journal of Personality and Social Psychology, 72*, 1284–1296.

Mellers, B. A., Schwartz, A., Ho, K., & Ritov, I. (1997). Decision affect theory: Emotional reactions to the outcomes of risky options. *Psychological Science, 8,* 423–429.

Miller, D. T., & McFarland, C. (1986). Counterfactual thinking and victim compensation: A test of norm theory. *Personality and Social Psychology Bulletin, 12*, 513–519.

Niedenthal, P. M., Tangney, J. P., & Gavanksi, I. (1994). "If only I weren't" versus "If only I hadn't": Distinguishing shame and guilt in counterfactual thinking. *Journal of Personality and Social Psychology, 67*, 584–595.

Nestler, S., & von Collani, G. (2008). Hindsight bias and the activation of counterfactual mind-sets. *Experimental Psychology, 55*, 342–349.

Nolan, C. (Producer & Director). (2010). *Inception* [Motion Picture]. United States: Warner Bros.

Oettingen, G. (2000). Expectancy effects on behavior depend on self-regulatory thought. *Social Cognition, 18*, 101–129.

Oettingen, G., Hönig, G., & Gollwitzer, P. M. (2000). Effective self-regulation of goal attainment. *International Journal of Education Research, 33*, 705–732.

Oettingen, G., Mayer, D., Sevincer, A. T., Stephens, E. J., Pak, H., & Hagenah, M. (2009). Mental contrasting and goal commitment: The mediating role of energization. *Personality and Social Psychology Bulletin, 35*, 608–622.

Oettingen, G., Mayer, D., Thorpe, J. S., Janetzke, H., & Lorenz, S. (2005). Turning fantasies about positive and negative futures into self-improvement goals. *Motivation and Emotion, 29*, 237–267.

Oettingen, G., Pak, H., & Schnetter, K. (2001). Self-regulation of goal setting: Turning free fantasies about the future into binding goals. *Journal of Personality and Social Psychology, 80*, 736–753.

Okuda, J., Fujii, T., Ohtake, H., Tsukiura, T., Tanji, K., Suzuki, K., et al. (2003). Thinking of future and past: The roles of the frontal pole and the medial temporal lobes. *Neuroimage, 19*, 1369–1380.

Pham, L., & Taylor, S. (1999). From thought to action: Effects of process- versus outcome-based mental simulations on performance. *Personality and Social Psychology Bulletin, 25*, 250–260.

Raichle, M. E., MacLeod, A.M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. *Proceedings of the National Academy of Sciences USA, 98*, 676–682.

Roese, N. J. (1994). The functional basis of counterfactual thinking. *Journal of Personality and Social Psychology, 66*, 805–818.

Roese, N. J. (1997). Counterfactual thinking. *Psychological Bulletin*, *121*, 133–148.

Roese, N. J. (2004). Twisted pair: Counterfactual thinking and the hindsight bias. In D. Koehler & N. Harvey (Eds.), *Blackwell handbook of judgment and decision making* (pp. 258–273). Oxford, UK: Blackwell.

Roese, N. J., & Hur, T. (1997). Affective determinants of counterfactual thinking. *Social Cognition, 15*, 274–290.

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

Roese, N. J., & Olson, J. M. (1993). The structure of counterfactual thought. *Personality and Social Psychology Bulletin*, *19*, 312–319.

Roese, N. J., & Olson, J. M. (1995). Counterfactual thinking: A critical overview. In N. J. Roese & J. M. Olson (Eds.), *What might have been: The social psychology of counterfactual thinking* (pp. 1–55). Mahwah, NJ: Erlbaum.

Roese, N. J., & Olson, J. M. (1996). Counterfactuals, causal attributions, and the hindsight bias: A conceptual integration. *Journal of Experimental Social Psychology, 32*, 197–227.

Ross, L., Lepper, M. R., Strack, F., & Steinmetz, J. (1977). Social explanation and social expectation: Effects of real and hypothetical explanations on subjective likelihood. *Journal of Personality and Social Psychology, 35*, 817–829.

Salovey, P., & Mayer, J. D. (1990). Emotional intelligence. *Imagination, Cognition, and Personality, 9,* 185–211.

Sanna, L. J. (1996). Defensive pessimism, optimism, and simulating alternatives: Some ups and downs of prefactual and counterfactual thinking. *Journal of Personality and Social Psychology, 71*, 1020–1036.

Sanna, L. J. (1997). Self-efficacy and counterfactual thinking: Up a creek with and without a paddle. *Personality and Social Psychology Bulletin, 23*, 654–666.

Sanna, L. J., & Schwarz, N. (2003). Debiasing hindsight: The role of accessibility experiences and attributions. *Journal of Experimental Social Psychology, 39*, 287–295.

Sanna, L. J., Schwarz, N., & Stocker, S. L. (2002). When debiasing backfires: Accessible content and accessibility experiences in debiasing hindsight. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 28*, 497–502.

Sanna, L.J., Turley-Ames, K.J., & Meier, S. (1999). Mood, self-esteem, and simulated alternatives: Thought provoking affective influences on counterfactual direction. *Journal of Personality and Social Psychology, 76*, 543–558.

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: Remembering the past and

imagining the future. *Philosophical Transactions of the Royal Society B: Biological Sciences, 362,* 773–786.

Schacter, D. L., Addis, D. R., & Buckner, R. (2008). Episodic simulation of future events: Concepts, data and applications. *Annals of the New York Academy of Sciences, 1124*, 39–60.

Schkade, D. A., & Kahneman, D. (1998). Does living in California make people happy? A focusing illusion in judgments of life satisfaction. *Psychological Science, 9*, 340–346.

Schwarz, N. (1998). Accessible content and accessibility experiences: The interplay of declarative and experiential information in judgment. *Personality and Social Psychology Review, 2*, 87–99.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*, 513–523.

Schwarz, N., & Vaughn, L. A. (2002). The availability heuristic revisited: Recalled content and ease of recall as information. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: New perspectives on judgment under uncertainty* (pp. 103–119). Cambridge, UK: Cambridge University Press.

Seamon, J. G., Philbin, M. M., Harrison, L. G. (2006). Do you remember promising marriage to the Pepsi machine? False recollections from a campus walk. *Psychonomic Bulletin and Review, 13*, 752–756.

Sharman, S. J., Manning, C. G., & Garry, M. (2005). Explain this: Explaining childhood events inflates confidence for those events. *Applied Cognitive Psychology, 19*, 67–74.

Sherman, S. J. (1991). Thought systems for the past as well as for the future. In R. S. Wyer, Jr., & T. K. Srull (Eds.), *Advances in social cognition* (Vol. 4, pp. 173–195). Hillsdale, NJ: Erlbaum.

Sherman, S. J., Cialdini, R. B., Schwartzman, D. F., & Reynolds, K. D. (1985). Imagining can heighten or lower the perceived likelihood of contracting a disease: The mediating effect of ease of imagery. *Personality and Social Psychology Bulletin, 11,* 118–127.

Sherman, S. J., Skov, R. B., Hervits, E. F., & Stock, C. B. (1981). The effects of explaining hypothetical future events: From possibility to probability to actuality and beyond. *Journal of Experimental Social Psychology, 17*, 142–158.

Sherman, S. J., Zehner, K. S., Johnson, J., & Hirt, E. R. (1983). Social explanation: The role of timing, set, and recall on subjective likelihood estimates. *Journal of Personality and Social Psychology, 44,* 1127–1143.

Smallman, R., & Roese, N. J. (2009). Counterfactual thinking facilitates behavioral intentions. *Journal of Experimental Social Psychology, 45*, 845–852.

Suddendorf, T., & Corballis, M. C. (1997). *Mental time travel and the evolution of the human mind*. New York: Basic Books.

Szpunar, K. K., Watson, J. M., & McDermott, K. B. (2007). Neural substrates of envisioning the future. *Proceedings of the National Academy of Sciences USA, 104*, 642–647.

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin, 110*, 67–85.

Taylor, S. E., Buunk, B. P., & Aspinwall, L. (1990). Social comparison, stress and coping. *Personality and Social Psychology Bulletin, 16,* 74–89.

Taylor, S., & Pham, L. (1999). The effect of mental simulation on goal-directed performance. In Sheikh, A. (Ed.), *Imagery and Human Development*. New York, NY: Baywood.

Taylor, S. E., & Schneider, S. K. (1989). Coping and the simulation of events. *Social Cognition, 7*, 176–196.

Teigen, K. H. (2005). When a small difference makes a big difference: Counterfactual thinking and luck. In D. R. Mandel, D. J. Hilton, & P. Catellani (Eds.), *The psychology of counterfactual thinking* (pp. 129–146). Oxon, UK: Routledge.

Tetlock, P. E. (1983). Accountability and complexity of thought. *Journal of Personality and Social Psychology, 45*, 74–83

Tetlock, P. E. (1998). Close-call counterfactual and belief-system defense: I was not almost wrong, but I was almost right. *Journal of Personality and Social Psychology, 75*, 639–652.

Thibaut, J. W., & Kelley, H. H. (1959) *The social psychology of groups.* New York: Free Press.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381–403). New York: Academic Press.

Tulving, E. (1985). How many memory systems are there? *American Psychologist, 40*, 385–398.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology, 5*, 207–232.

Van Boven, L., & Loewenstein, G. (2003). Social projection of transient drive states. *Personality and Social Psychology Bulletin, 29*, 1159–1168.

Wells, G. L., & Gavanski, I. (1989). Mental simulation of causality. *Journal of Personality and Social Psychology, 56*, 161–169.

Wohl, M. J. A., & Enzle, M. E. (2003). The effects of near wins and near losses on self-perceived personal luck and subsequent gambling behavior. *Journal of Experimental Social Psychology, 39*, 184–191.

Wilson, T. D., Wheatley, T. P., Meyers, J. M., Gilbert, D. T., & Axsom, D. (2000). Focalism: A source of the durability bias in affective forecasting. *Journal of Personality and Social Psychology, 78*, 821–836.

Wood, J. V. (1989). Theory and research concerning social comparison of personal attributes. *Psychological Bulletin, 106,* 231–248.

Zeelenberg, M. (1999). The use of crying over spilt milk: A note on the rationality and functionality of regret. *Philosophical Psychology, 12*, 325–340.