

METACOGNITIVE EXPERIENCES AND HINDSIGHT BIAS: IT'S NOT JUST THE THOUGHT (CONTENT) THAT COUNTS!

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Theories of hindsight bias have emphasized the role of declarative information. However, accumulating evidence suggests that the production and reduction of hindsight bias involves an intricate interplay of declarative information and metacognitive experiences. These experiences are informative in their own right and may qualify or even reverse the implications of thought content. We summarize and integrate the available findings in terms of a new model of hindsight bias that includes the interplay between: (a) declarative information, (b) metacognitive experiences, (c) their informational value, and (d) the naive theories used to interpret experiences.

Hindsight bias (Fischhoff, 1975; Fischhoff & Beyth, 1975) refers to people's tendency to exaggerate the perceived inevitability of events after outcomes

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are known, relative to foresight estimates, when outcomes are unknown. Sometimes referred to as the “knew-it-all-along” effect (Wood, 1978), hindsight bias has been documented in diverse areas, including medical diagnoses (Arkes, Wortmann, Saville, & Harkness, 1981; Detmer, Fryback, & Gassner, 1978), legal decisions (LaBine & LaBine, 1996; Rachlinski, 2000), electoral results (Leary, 1982; Powell, 1988), athletic outcomes (Roese & Maniar, 1997; Sanna & Schwarz, 2003), and organizational responses (Louie, Curren, & Harich, 2000; Mark & Mellor, 1991).

Consistent with most theories of judgment and decision making (for reviews see Kerr & Tindale, 2004; Lopes, 1994; Wyer & Srull, 1989), accounts of hindsight bias typically focus on declarative information—that is, on *what* people think about. These theories share the assumption that hindsight bias is produced by thinking about known outcomes and is reduced by thinking about alternatives to known outcomes (for reviews see Christensen–Szalanski & Willham, 1991; Guilbault, Bryant, Posavac, & Brockway, 2004; Hawkins & Hastie, 1990; Hoffrage & Pohl, 2003). This exclusive focus on thought content misses that human reasoning is accompanied by various subjective experiences, including emotions and metacognitive experiences, like ease of recall and thought generation or fluency of information processing. These subjective experiences can qualify and even reverse the implications of thought content. Hence, judgments are best understood as a joint function of declarative and experiential information (for reviews see Pham, 2004; Schwarz, 1998, 2004; Schwarz & Clore, 1996), as our discussion will illustrate. In the case of hindsight bias, subjective experiences can come into play: (a) when people initially learn about outcomes, and (b) when people think about why the outcomes were obtained or (c) how things might have turned out otherwise.

We review evidence indicating that people’s subjective experiences are a critical, but thus far mostly neglected, variable that must be taken into account to fully understand hindsight bias. Our discussion focuses on representative findings, with particular attention to people’s metacognitive experiences. We summarize and integrate the reviewed findings in terms of a new model that conceptualizes the interplay of declarative and experiential information in producing and reducing hindsight bias. We end by identifying open issues and suggest promising avenues for future research, noting possible relations to other models.

SUBJECTIVE EXPERIENCES AT EXPOSURE TO THE OUTCOME

Exposure to outcome information can elicit subjective experiences that convey information about one’s prior state of knowledge. Subjective experiences like feelings of surprise or familiarity can be related to the fluency with which known or alternative outcomes come to mind. These experiences can accurately reflect the true relationship between outcome information and

pre-event knowledge or can be misleading when they are elicited by variables unrelated to one's pre-event knowledge.

SURPRISE

Surprise is "a cognitive state having to do with unexpectedness" (Ortony, Clore, & Collins, 1988, p. 33). At one extreme, an outcome may elicit high surprise, indicating that it deviates strongly from expectations; at another extreme, an outcome may seem unsurprising, indicating that it is consistent with expectations. Because hindsight bias can only be observed when the obtained outcome deviates from pre-event expectations (or else participants with and without outcome knowledge would arrive at the same judgment), participants may often experience some level of surprise. The intensity of surprise plays a crucial role and high surprise has been found to curtail hindsight bias—after all, an event would not be very surprising if one "knew it all along." As Ofir and Mazursky (1997; Mazursky & Ofir, 1990; Pohl, Bender, & Lachmann, 2002) observed in several experiments, the usual hindsight bias effect is limited to conditions under which outcome information elicits low or moderate surprise. When surprise is high, hindsight bias is *reversed*: In light of their high surprise, people infer that they would not have expected the outcome and report pre-event expectations that are *lower* than the expectations of control participants who received no outcome information.

Theoretically, surprise is a function of the discrepancy between expected and obtained outcomes and the relative contribution of discrepancy (a content variable) and surprise (an experiential variable) is often difficult to disentangle. Consistent with the content focus of much hindsight bias research, effects of expectancy–outcome discrepancies are sometimes framed in terms of surprise in the absence of any evidence of a subjective experience. For example, Schkade and Kilbourne (1991) observed that the size of hindsight bias increased with the size of the discrepancy and concluded that "surprise" increases hindsight bias. In light of the above research, their participants' surprise did probably not exceed the moderate level at which hindsight bias has been observed in studies that assessed the subjective experience (e.g., Ofir & Mazursky, 1997). One option to disentangle the contribution of discrepancy and surprise is the use of misattribution procedures, which have been successfully employed to discredit the informational value of diverse subjective experiences (e.g., Sanna & Schwarz, 2003; Schwarz & Clore, 1983; Schwarz et al., 1991). Once experienced high surprise is attributed to another source, it should no longer attenuate hindsight bias and Müller and Stahlberg (this issue) report supporting evidence. As a second option, Müller and Stahlberg (this issue) suggest that surprise might be disentangled from people's a priori expectations by varying task demands (e.g., cognitive load). A third way to independently vary surprise may be

through outcome closeness (Sanna & Turley-Ames, 2000; Teigen, 1998). In the former case, greater surprise may result when outcomes occur within the context of a cognitively demanding task; in the latter case, close outcomes may make thoughts about alternatives more readily available, intensifying experiences of surprise. At the minimum, however, any inferences about the influence of surprise (an experiential variable) require an assessment of the subjective experience rather than reliance on expectancy–outcome discrepancies (a content variable).

FLUENCY AND FAMILIARITY

New information seems more familiar the easier it is to process. Thus, characteristics of the presentation format that facilitate fluent processing—like long exposure time, high figure–ground contrast, or rhyming versus nonrhyming form—result in a sense of familiarity as reflected in high familiarity ratings, high rates of false recognition, and increased acceptance of statements as true (for reviews see Jacoby, Kelley, & Dywan, 1989; Reber, Schwarz, & Winkielman, 2004; Schwarz, 2004). Given these linkages, we anticipate that hindsight bias will be greater when outcome information is easy to process (leading to inferences of high familiarity) and lesser when outcome information is difficult to process (leading to inferences of low familiarity).

Empirically, this is the case. Werth and Strack (2003), for example, gave participants general knowledge questions along with answers (e.g., “How high is the Eiffel Tower?”—“300 m”) and asked participants what they would have answered had they not been given solutions. To manipulate processing fluency, questions and answers were presented in colors that were easy or difficult to read against the background. High processing fluency increased the size of hindsight bias, and participants’ confidence in their answers, whereas low processing fluency attenuated hindsight bias. Presumably, participants found the easy-to-read material more familiar and hence concluded that they knew this information all along and “would have” provided the correct answer.

SUMMARY AND IMPLICATIONS

In sum, hindsight bias is more likely when outcomes seem familiar or elicit low to moderate surprise, and less likely when outcomes seem unfamiliar and highly surprising. Most importantly, these inferences can be drawn on the basis of subjective experiences (e.g., feelings of surprise or familiarity), without detailed consideration of the implications of the declarative information—what is familiar is not unexpected; conversely, what is surprising is unexpected. This suggests the possibility that any variable that facilitates fluent processing of outcomes may increase hindsight bias by making the

outcome appear less novel (more familiar), whereas any variable that impairs fluent processing of outcomes may decrease hindsight bias.

Other potentially relevant variables range from the accessibility of related concepts in memory to fluency increasing features of the presentation format (for a review see Reber et al., 2004). For example, news repetition in the media may increase fluency over repeated exposures, possibly resulting in increased hindsight bias over time. These possibilities provide promising avenues for future research, with potentially important applied implications.

SUBJECTIVE EXPERIENCES WHEN THINKING ABOUT OUTCOMES AND ALTERNATIVES

Most theories of hindsight bias share the assumption that the bias will be more pronounced when many rather than few reasons for the known outcome come to mind. Conversely, thinking about alternatives to known outcomes in an attempt “to convince oneself that it might have turned out otherwise” (Fischhoff, 1982, p. 343) is one of the most frequently recommended strategies to attenuate hindsight bias. However, these content-focused assumptions fail to account for all of the available data.

ACCESSIBLE CONTENT VERSUS ACCESSIBILITY EXPERIENCE

Sanna, Schwarz, and Small (2002, Experiment 1) had participants read a story of a battle in the British–Gurkha war (adapted from Fischhoff, 1975) in which they were told that the British won. Some participants were asked to list either two or ten reasons supporting this outcome, whereas others were asked to list either two or ten reasons supporting the alternative outcome. If only thought content mattered, hindsight bias should be more pronounced when participants list 10 rather than two thoughts supporting a British victory (known outcome); conversely, hindsight bias should be attenuated when they list ten rather than two thoughts supporting a Gurkha victory (alternative outcome). However, the exact opposite occurred: Listing more thoughts favoring the known outcome *decreased* hindsight bias, whereas listing more thoughts favoring the alternative outcome *increased* hindsight bias (see also Sanna, Schwarz, & Stocker, 2002). These findings are incompatible with thought–content focused accounts, but follow directly from an experiential perspective.

Consistent with Tversky and Kahneman’s (1973) availability heuristic, our participants inferred that it was unlikely that the British won when it was difficult to generate thoughts favoring this known outcome, as reflected in a significant negative correlation between the rated difficulty of thought generation and the judged likelihood of a British victory. Conversely, partic-

ipants concluded that it was unlikely that the war could have turned out otherwise when it was difficult to generate thoughts favoring the alternative outcome, as reflected in a significant positive correlation between the rated difficulty of thought generation and the likelihood of a British victory. In both cases, participants' inferences were *only* consistent with the implications of accessible thought content when thought generation was easy; however, their inferences were opposite to the implications of accessible thought content when thought generation was difficult.

One may wonder, however, whether the quality of generated reasons deteriorated as more thoughts were listed, leaving those in the ten-thoughts condition with a poorer set of reasons. If so, differences in the quality of generated reasons may be required to observe the obtained pattern. Empirically, this is not the case. Sanna, Schwarz, and Small (2002, Experiment 2) asked all participants to list five thoughts, holding content constant. Subjective experiences of difficulty were varied by asking some participants to contract the corrugator muscle during thoughts listing, resulting in a furrowed brow, which conveys a sense of mental effort paralleling difficult thoughts listing (Strack & Nuemann, 2000). Replicating our prior results, people listing five thoughts favoring a British victory (known outcome) considered a British victory *less* likely when they furrowed their brow than when they did not. People listing five thoughts favoring a Gurkha victory (alternative outcome) considered a British victory *more* likely when furrowing their brows than when they did not.

SUMMARY AND IMPLICATIONS

In sum, whether metacognitive experiences resulted from task difficulty or bodily feedback, hindsight bias decreased when it was difficult to generate thoughts supporting known outcomes; however, these same experiences increased hindsight bias when thinking about alternative outcomes. Neither finding is predictable on the basis of thought content alone.

The most general implication is that people's metacognitive experiences are a critical, but thus far mainly neglected, variable when it comes to fully understanding hindsight bias. Thinking about known outcomes may indeed produce hindsight bias and thinking about alternative outcomes may reduce hindsight bias as prior theories have presumed, but only when respective thoughts come to mind easily. When thoughts are difficult to generate, people instead infer that outcomes or alternatives are unlikely, resulting in the opposite pattern.

A METACOGNITIVE MODEL OF HINDSIGHT BIAS

Next, we turn to a conceptual integration in the form of a metacognitive model of hindsight bias. Before doing so, however, it is useful to place the re-

viewed findings into a broader context and to address general issues of the interplay of thought content and metacognitive experience.

CONTENT AND EXPERIENCE

The reviewed findings are not unique to hindsight bias and parallel patterns have been obtained across a wide range of content domains, highlighting the robust interplay of declarative and experiential information. For example, people judge themselves as more assertive after recalling few rather than many assertive behaviors (Schwarz et al., 1991), perceive higher health risks after recalling few rather than many risk-increasing behaviors (Rothman & Schwarz, 1998), and are more likely to choose a product after generating few rather than many reasons for doing so (Novemsky, Dhar, Schwarz, & Simonson, *in press*). Throughout, their judgments and choices are consistent with the implications of accessible thought content when the content is easy to bring to mind, but opposite to the implications of accessible content when it is difficult to bring to mind (Schwarz, 1998, 2004). Because information search and thought generation is usually truncated early (for a review, see Bodenhausen & Wyer, 1987), judgments in everyday life are mostly formed before any difficulty is experienced, that is—under conditions of subjective ease. Accordingly, they are usually consistent with accessible content. This has led to the erroneous conclusion that judgments can be predicted on the basis of thought content alone, without also taking metacognitive experiences into account.

Empirically, this is not the case, as the judgment reversals under conditions of experienced difficulty illustrate. To handle these reversals within solely content focused models, one needs to assume that participants' early thoughts are more compelling than their later ones. Several lines of evidence rule this out. First, ratings of the quality of participants' thoughts provide no evidence that their early thoughts are more compelling than their later ones (e.g. Schwarz et al., 1991). Second, holding the number of required thoughts constant and manipulating the subjective experience of difficulty through bodily feedback has parallel effects (e.g., Sanna, Schwarz, & Small, 2002; Stepper & Strack, 1993). Third, Wänke, Bless, and Biller (1996) controlled for accessible content by asking some participants to generate a few or many examples and subsequently presented these examples to other, yoked participants. Participants who actively generated examples drew on their metacognitive experiences and were more influenced after listing few rather than many examples. However, yoked participants, who merely read the examples generated by others and were deprived of the metacognitive experience, were more influenced the more examples they read—indicating that the content was compelling, unless accompanied by an experience of difficulty. Finally, misattribution experiments show that participants' own judgments are in line with the thoughts they generated when the experi-

enced difficulty is attributed to another source (e.g., Schwarz et al., 1991; Sanna & Schwarz, 2003), again indicating that the thoughts are compelling when not qualified by experienced difficulty.

There are at least two possible responses to the observed interplay of thought content and metacognitive experience. First, we can continue to treat reliance on accessible declarative information as the default, making any deviation a special case that needs a separate explanation. Second, and more parsimoniously, we can assume that thinking is always accompanied by metacognitive experiences and that the outcome of the thought process is a *joint* function of declarative and experiential information. The implications of accessible content are qualified by metacognitive experiences; in terms of the earlier examples, the same declarative information has different implications when it is easy rather than difficult to bring to mind, fluently rather than disfluently processed, or elicits high rather than low surprise. Conversely, the implications of metacognitive experiences depend on the content to which the experience pertains; in terms of the earlier examples, finding it difficult to generate thoughts in favor of the obtained outcome has different implications than finding it difficult to generate thoughts in favor of an alternative outcome. This approach provides a coherent account of the conditions under which judgments are consistent as well as inconsistent with the implications of thought content.

METACOGNITIVE MODEL OF HINDSIGHT BIAS

The metacognitive model depicted in Figure 1 integrates the reviewed findings and conceptualizes the interplay of declarative information and metacognitive experiences in the emergence of hindsight bias. The box at the top indicates that hindsight bias is a joint function of thought content and metacognitive experiences. When the metacognitive experience is uninformative, it does not qualify the implications of accessible declarative information and judgments are consistent with accessible thought content, as shown in the lower left-hand box. When the metacognitive experience is informative, it qualifies the implications of accessible thought content as shown in the lower right-hand box, which summarizes the reviewed findings. In this case, judgments are consistent with the implications of accessible thought content under conditions of low to moderate surprise, high fluency, or ease of recall or thought generation, but opposite to the implications of accessible thought content under conditions of high surprise, low fluency or difficulty of recall or thought generation.

It is worth emphasizing an important difference between the content-congruent judgments predicted in the lower left-hand and right-hand boxes: Generating a small number of thoughts has a more pronounced impact on judgments when the accompanying metacognitive experience of ease is considered informative than when it is not (e.g., Schwarz et al., 1991).

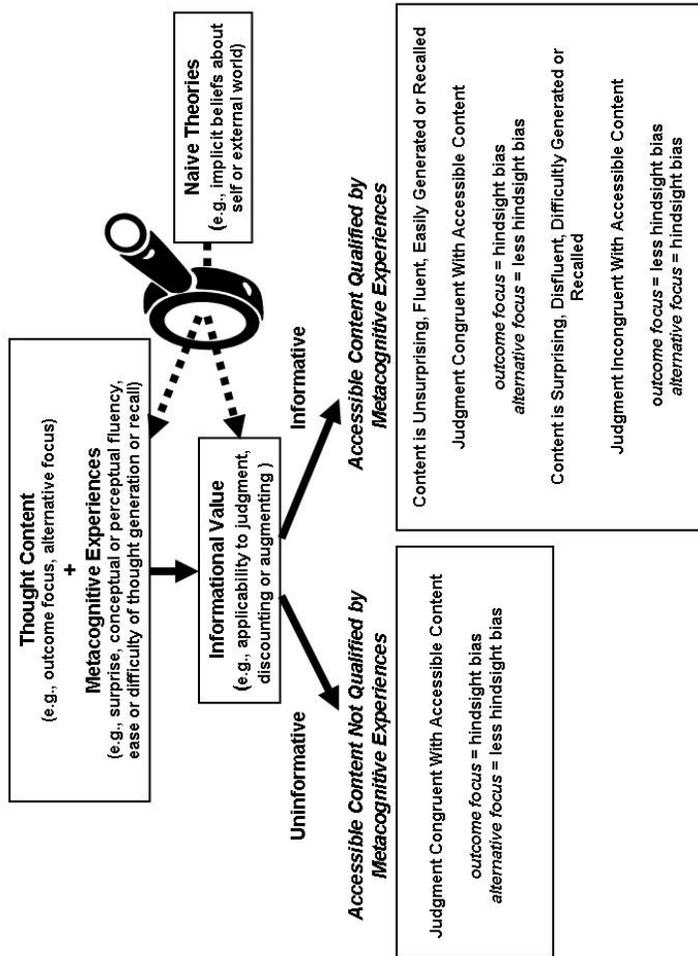


FIGURE 1. A metacognitive model of hindsight bias. Metacognitive experiences are informative and qualify hindsight bias by default; metacognitive experiences are not used in hindsight judgments only when they are rendered uninformative to the judgment at hand.

Put otherwise, two arguments are just two arguments when the ease of generating them is discredited (left-hand box); when the ease of generation is not discredited (right-hand box), it indicates that there are many more arguments from where those two came, consistent with the availability heuristic (Tversky & Kahneman, 1973). We return to the issue of perceived informational value below.

This model results in the following predictions for the emergence and reduction of hindsight bias. When known outcomes elicit low to moderate surprise, feel familiar (high fluency), or supporting thoughts are easy to recall or generate, hindsight bias will result. These conditions are usually given in hindsight bias research because outcome knowledge increases the accessibility of related supporting information, as most content-focused models assume (see Hawkins & Hastie, 1990). Thus, our predictions are consistent with prior research when presuming metacognitive experiences of ease. However, our model also accounts for findings that prior theories cannot. When known outcomes are highly surprising, feel unfamiliar (low fluency), or supporting thoughts are difficult to recall or generate, hindsight bias is lessened. The latter results cannot be explained on the basis of thought content alone, but can be readily accounted for by the present model.

We further predict that thinking about alternatives to known outcomes may lessen hindsight bias when alternatives elicit low surprise, feel familiar, or are easy to generate. However, we also predict and find (Sanna, Schwarz, & Small, 2002; Sanna, Schwarz, & Stocker, 2002) that thinking about alternatives can increase hindsight bias when these thoughts are difficult to bring to mind. This possibility had not been addressed in prior research and may help to explain why the usually recommended debiasing strategy is sometimes ineffective (Hawkins & Hastie, 1990): The harder people try to convince themselves that events might have turned out otherwise (Fischhoff, 1982), the more they experience metacognitive difficulty, leaving them even more convinced that the outcome was very inevitable.

Next, we turn to additional predictions that uniquely derive from a metacognitive perspective on hindsight bias.

PERCEIVED INFORMATIONAL VALUE

Like the impact of other sources of experiential information, the impact of metacognitive experiences is a function of their perceived informational value for the judgment in question: People do not rely on metacognitive experiences as information when they attribute the experience to sources unrelated to the judgment at hand, such as background music (e.g., Schwarz et al., 1991), presentation format (e.g., Wänke et al., 1996), or other context variables (for reviews, see Schwarz, 1998, 2004). Similarly, attributions to internal sources, such as one's own lack of knowledge, renders metacognitive

experiences uninformative for judgments unrelated to one's knowledge (Schwarz, 1998). Whenever metacognitive experiences are considered uninformative for the judgment, they do not qualify the implications of thought content (e.g., Schwarz et al., 1991).¹

Our model thus predicts that the influence of metacognitive experiences on hindsight bias is limited to conditions under which the respective experience is considered informative for the judgment at hand. Sanna and Schwarz (2003) tested this directly in a study of the 2000 U.S. Presidential election. Participants who were asked to list many ways in which Gore could have won the election concluded that they never expected Gore to win by a large margin—even though they had predicted a large margin of victory for Gore over Bush prior to the election. However, when we first asked participants how much they know about politics, they attributed their difficulty of thought generation to their own lack of political expertise, rendering their metacognitive experiences uninformative with regard to Gore's pre-election likelihood of winning. In this case, participants drew on the content of their thoughts despite their difficulty and concluded that Gore could have won instead—even to the extent of *overestimating* the margin of victory they predicted for Gore over Bush prior to the election.

Similar augmentation and discounting effects should be observed when misattribution manipulations are applied to feelings of surprise and familiarity. Supporting this prediction, Müller and Stahlberg (this issue) report that surprise only attenuated hindsight when its informational value was not called into question. Similarly, people may not infer low familiarity from low processing fluency when the experience is attributed to interference from another source (e.g., like noise next door), whereas high processing fluency may seem particularly informative under these conditions (for reviews of relevant findings from diverse domains see Kelley & Rhodes, 2002; Schwarz, 2004).

NAIVE THEORIES

A growing body of research indicates that the specific inferences drawn from a given metacognitive experience depend on the naive theories of mental processes that people bring to bear on the task (Schwarz, 2004). Naive theories act like a lens through which metacognitive experiences and perceived informational value are focused and interpreted. Our results (Sanna

1. It is important to note that people generally presume that any thoughts that come to mind, or feelings they have, while thinking about x are in fact "about" X —or else why would they have these thoughts or feelings at this point in time? Hence, people are likely to rely on their metacognitive experiences by default, unless their attention is drawn to influences that call their informational value into question for the judgment (Clore et al., 2001; Higgins, 1998; Schwarz & Clore, 1996).

& Schwarz, 2003; Sanna, Schwarz, & Small, 2002; Sanna, Schwarz, & Stocker, 2002; see also Sanna & Chang, 2003) are compatible with a common naive theory at the heart of Tversky and Kahneman's (1973) availability heuristic: When there are many (few) examples or reasons, it is easy (difficult) to bring some to mind. Applying this naive theory, people infer from the experienced ease or difficulty that there are many or few reasons of the sought after type.

However, people also hold a variety of other naive theories about the difficulty of recall and thought generation. One theory holds that recent events are easier to recall than distant events, making ease of recall a cue for temporal distance (Sanna, Chang, & Carter, 2004; Schwarz, Cho, & Xu, 2005). Other naive theories hold that important events are easier to recall than unimportant ones, and that thought generation is easier when one has high rather than low expertise, making ease a cue for importance and expertise (e.g., Schwarz et al., 2005). Drawing on these naive theories, people may consider ease of thought generation more informative, and difficulty less informative, when the event is distant rather than recent, unimportant rather than important, and when they lack rather than have domain expertise. Hence, different naive theories of mental processes suggest variables that may moderate the size of hindsight effects by influencing the perceived informational value of metacognitive experiences. We consider this a particularly promising area for future research.

Importantly, once a specific naive theory is applied, it renders the metacognitive experience uninformative for later judgments that require application of a different theory (Schwarz, 2004). For example, Schwarz et al.'s (2005) participants inferred from the difficulty of listing many "fine Italian restaurants" that there are few in town when asked for a frequency judgment, but that they did not know much about town when asked for a knowledge judgment. Each of these judgments, however, entails an attribution of the recall experience, either to the number of restaurants in town or to one's own expertise. Once this implicit attribution is made, the experience is uninformative for the next judgment that requires a different theory and people turn to thought content instead. Hence, those who first concluded that their difficulty reflects a lack of knowledge subsequently inferred that there are many fine Italian restaurants in town—after all, they listed quite a few and they did not even know much about town. Conversely, those who first concluded that there are not many restaurants in town subsequently reported high expertise—after all, there are not many such restaurants and they nevertheless listed quite a few, so they must know a lot about town.

We anticipate similar judgment-order effects for hindsight bias. Whenever a preceding judgment entails an attribution of one's metacognitive experience, it may render the experience uninformative for other judgments, paralleling the misattribution effects reviewed above. To date, the implications of different naive theories of mental processes for hindsight judgments

have not been investigated and we consider this another promising avenue for future research.

GENERAL CONCLUSIONS AND OPEN ISSUES

We summarized and integrated the reviewed findings in terms of a metacognitive model of hindsight bias that highlights the interplay of: (a) declarative information, (b) metacognitive experiences, (c) their perceived informational value, and (d) naive theories used to interpret experiences. We end by identifying open issues and possible relations to other models, suggesting potentially promising avenues for future research.

POSSIBLE RELATIONS TO OTHER MODELS

From our perspective, many predictions offered by content-focused models may derive part of their empirical support from the natural confound between *what* comes to mind and how easily it comes to mind. For example, Hell, Gigerenzer, Gauggel, Mall, and Müller (1988) proposed that hindsight bias is a function of the relative accessibility of two memory traces, one for predictions and one for outcomes. Because outcomes are by definition encoded more recently than predictions, outcome information is more accessible than information about pre-event predictions, producing hindsight bias. We agree, but suggest that the advantage of outcome-related information derives in part from the accompanying metacognitive experience of ease. Similarly, the observation that hindsight bias increases with temporal distance between prediction and outcome (Blank, Fischer, & Erdfelder, 2003; Bryant & Guilbault, 2002) is presumably not only a function of *what* comes to mind, but of the relatively higher difficulty of recalling more distant pre-event information.

Hindsight bias may also involve anchoring (Hawkins & Hastie, 1990). Pohl, Eisenhauer, and Hardt (2003), for example, suggested that anchoring and hindsight bias may involve similar processes. In hindsight research, participants receive outcome information and are asked what they would have estimated before knowing outcomes. In anchoring research, participants receive an anchor and are asked to estimate the true answer. People's judgments are biased by known values (outcomes or anchors) in each case. Again, metacognitive experiences may play an important role in both cases, as suggested by Epley and Gilovich's (2001) observation that anchoring is influenced by head nodding and shaking, which provides metacognitive agreement-disagreement information (Brinol & Petty, 2003).

Harley, Carlsen, and Loftus (2004) recently identified a visual hindsight bias that is driven by the metacognitive experience of processing fluency. They asked participants to identify degraded celebrity faces while they were resolved to full clarity. Participants then predicted how others would per-

form. Having just seen the faces, they mistook their own processing fluency to indicate that naive observers could identify the faces earlier, or that others “saw the faces all along.” Similar results would presumably be observed with other perceptual or conceptual determinants of processing fluency (for a review see Winkielman et al., 2003), unless their informational value is called into question.

SENSE MAKING AND TEMPORAL BIASES

The role of metacognitive experiences in hindsight bias further suggests possible changes over time, particularly with regard to sense making. Suppose, for example, that initial exposure to outcome information elicits surprise. High surprise indicates that outcomes were unexpected and curtails hindsight bias (e.g., Ofir & Mazursky, 1997). However, metacognitive experiences are not only relevant to initial inferences, but also to later sense-making processes. Surprising events additionally elicit more explanatory activity than unsurprising events (see Pezzo, 2003). When plausible explanations for outcomes later come to mind easily (or another person provides explanations), hindsight bias may then creep in—“I was surprised but I should have expected this.” With the passage of time, initial surprise may fade from memory, consistent with the idea that subjective experiences are not well represented and need to be reconstructed on the basis of episodic information (for a review, see Robinson & Clore, 2002). Thus, a variable that attenuates, and sometimes reverses, hindsight bias at the time of initial exposure to outcome information may set in motion processes that later result in increased hindsight bias.

Suppose, similarly, that a person tries to guard against hindsight bias by thinking about alternative outcomes. Finding this difficult, the person will likely conclude that the event was inevitable (e.g., Sanna, Schwarz, & Stocker, 2002). However, on a later occasion, those initially difficult to generate thoughts may now come to mind more easily, attenuating hindsight at a later time. To date, little is known about possible temporal trajectories. However, related research by Sanna and Schwarz (2004) demonstrates the importance of metacognitive experiences beyond hindsight bias to several future-oriented temporal biases, including planning fallacy, impact bias in affective forecasting, and confidence changes related to temporal distance of events. As with hindsight bias, generating thoughts that give rise to the respective biases do so only when they are easy to bring to mind; finding it difficult to generate thoughts attenuates or reverses the respective bias. Conversely, thoughts that are presumed to debias judgment do so only when they are easy to bring to mind, whereas difficulty of thought generation increases the respective bias (Sanna & Schwarz, 2004).

As our review illustrates, understanding the production and reduction of hindsight bias requires close attention to the interplay of accessible declara-

tive information and metacognitive experiences. We suggest that in order to fully understand hindsight bias one must consider: (a) declarative information (accessible thought content), (b) the accompanying metacognitive experiences, (c) their perceived informational value, and (d) the naive theories used to interpret the experience. In short, it is not just the thought (content) that counts.

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