



Coping with Hindsight Bias in the Field:

An Analysis of Coping Measures and their Applicability
for Decision Making in Social Institutions

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Abstract

In this work we examine the effect of hindsight bias on the functioning of social institutions, and possible ways to cope with this effect. Hindsight bias is the well documented psychological phenomenon by which when people possess information regarding the outcome of an event, they overestimate the ex-ante predictability of what actually occurred relative to alternative outcomes that may have seemed likely at the time of the event. This process biases the benchmark against which the quality of past decision making is evaluated, resulting in unfair judgment, and also hinders learning from experience.

As a first step we performed a typology of the various contexts in which hindsight bias affects the functioning of social institutions, and identified a number of important properties of these contexts that are relevant for selecting appropriate coping measures. These properties are: the degree of formality of the decision making context, whether the negative consequence of hindsight bias pertains to evaluating behavior or to learning from experience, and the degree of regularity of outcomes in the domain under consideration.

Next, we surveyed the coping measures that have been suggested in the literature on hindsight bias and analyzed them according to their effectiveness and applicability for the different types of decisions identified in the first section. This analysis suggests a number of novel ideas for measures worthy of further examination.

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Chapter 1: Introduction

The 1973 Arab-Israeli War (Yom Kippur War) began on October 6th 1973, with a surprise attack on Israeli forces that occurred on Yom Kippur, the holiest day in Judaism. The common Israeli historical perception identifies this war with a gross intelligence failure. The Israeli military was caught unprepared by a joint Egyptian and Syrian attack, despite the availability of intelligence information that was later perceived as sufficient to indicate preparations for the attack. The common wisdom maintains that this evidence was dismissed because of groupthink and confirmation bias, in an environment with an entrenched commitment to the assumption that Egypt would not attack as long as its air force capabilities remain inferior to Israeli capabilities. This intelligence failure led to a severe crisis of trust in government in the Israeli public, with political and social repercussions that are felt to this day. In addition, the structure of the intelligence services was subsequently reformed in an attempt to prevent such future oversights, and the lessons of this failure are studied routinely by the officers responsible for estimating the likelihood of future attacks.

However, an exercise which is part of every Israeli intelligence officer's training may indicate that the war was simply not foreseeable given the information available at the time. This exercise¹ consists of a simulation in which the cadets are required to estimate the likelihood of an attack, while being provided with intelligence items very similar to those available before the Yom Kippur War. The items are changed only enough to disguise their origin. Despite the lessons of the war being so widely popularized and the changes in the work environment, these intelligence professionals fail year after year to predict the Yom Kippur War given only the information available at the time. A plausible conclusion from this is that the strong common perception of responsibility for the Yom Kippur war is at least to a certain extent an instance of being wise in hindsight, or, to use the scientific term, 'hindsight bias'.

Hindsight bias is the psychological phenomenon by which people who possess information regarding the outcome of an event overestimate the ex-ante predictability of what actually occurred relative to alternative outcomes that may have seemed likely at the time of the event. As the example of the Yom Kippur War indicates, this judgmental bias can have a strong

¹ As related to us by a number of colleagues who served in the Israeli Intelligence Corps.

influence on the way the public, and history, judge government performance, and it affects subsequent political and policy decisions as well.

Adjusting behavior in reaction to events and determining blame and credit for outcomes are judgment tasks subject to hindsight bias which are common and consequential in many social institutions (as is discussed in much detail in chapters 3 and 4). For this reason, developing and validating methods for mitigating the effect of hindsight bias is important for improving the functioning of these institutions.

In the last forty years there has been a profusion of research on hindsight bias, including attempts to develop debiasing measures. A certain gap in the literature is that not enough attention is paid to the details of the specific contexts in which hindsight bias is expected to occur and to the appropriateness of debiasing measures for specific contexts (in terms of both effectiveness and feasibility). While the research has found hindsight bias to be ubiquitous across an impressively large range of fields, it manifests itself differently in different situations. As we discuss below, the size of the hindsight bias effect differs across decision types, as does the nature and degree of damage associated with it. Similarly, neither the effectiveness nor the feasibility of coping measures is uniform across decision contexts, and coping measures exhibit different costs and benefits in different situations. These details have to be considered when deciding if and how to deal with hindsight bias. To date, most research on debiasing hindsight bias has been conducted in psychology labs, with little concern for applicability to real-world contexts. An exception to this is the work done on coping with hindsight bias in court decision making, most notably with respect to negligence judgments.

This thesis attempts to begin bridging that gap by breaking down the general argumentation as to why hindsight bias poses a problem for social institutions into a map of the affected decision making contexts. In the course of this analysis we identify a number of dimensions across which hindsight judgment contexts differ, and that are relevant for choosing appropriate coping measures. We then provide an overview of prior efforts to cope with hindsight bias, and analyze each coping measure according to its effectiveness and applicability to the different types of decision making contexts we identified.

The overview of coping measures comprises the main analysis of this work. Its practical contribution is on two levels. First, it shows how and when coping measures that were developed in the lab or with regard to very specific contexts can be extended to other contexts. Second, an

in-depth analysis of the current state of the research on coping measures enables us to identify new directions for coping with hindsight bias that have not yet been sufficiently explored.

This thesis is organized as follows. Chapter 2 provides a review of the experimental literature on hindsight bias. Chapter 3 discusses, on a theoretical level, the negative consequences of hindsight bias on decision making quality. This discussion is meant to lay the foundations for identifying the specific real-world situations in which hindsight bias has negative consequences. Chapter 4 presents a map of decision making situations that occur in social institutions and which are expected to be negatively affected by hindsight bias. In addition, it introduces a number of dimensions across which hindsight judgment situations differ, and which are expected to be relevant for choosing appropriate coping measures. Chapter 5 presents the main analysis of this paper: a discussion of possible ways to cope with hindsight bias and improve judgment. For each coping measure that is expected to be at least somewhat effective, we discuss the types of situations for which it seems most promising, using the dimensions discussed in chapter 4. The coping measures included in this chapter are those suggested in previous literature on hindsight bias. In addition, a number of novel ideas that invite further research are suggested. Chapter 6 concludes.

Chapter 2: A review of the experimental literature

While the idea that "hindsight is 20/20" and reprimands against "Monday morning quarterbacking" have long been familiar both to common wisdom and in reasoning about historical research, the first experimental demonstration of hindsight bias was performed by Fischhoff (1975).

Fischhoff presented different groups of subjects with descriptions of historical events. One group, the "before" condition, was presented with four possible outcomes of the described events and asked to estimate the probability of each outcome. Four "after" conditions were presented with the same event descriptions, and in addition, in each "after" group one of the possible outcomes was (fictitiously) presented as the actual outcome of the events. The subjects were then asked to assess the ex-ante probabilities of each possible outcome. "After" group subjects attached significantly higher ex-ante probabilities to events they believed actually occurred relative to subjects who did not possess outcome information. These results held even when subjects were explicitly instructed to answer as they would have answered had they not known the actual outcome, and when asked to answer as they believe similar subjects without outcome information would have answered.

This design has been replicated for event descriptions in many domains, with different types of subject groups and under various conditions, and the results have proved impressively robust (for recent overviews see Blank, Musch, and Pohl 2007 and Pezzo 2011). Fischhoff and Beyth (1975) found the bias to exist for recall of one's own prior probability estimates as well. Subjects asked to assign probabilities to possible outcomes of contemporary political events were asked after the unfolding of the actual events to recall their stated prior probabilities. Subjects believed that they had assigned significantly higher probabilities to outcomes that in fact occurred than they actually had. These results too have been replicated many times in different settings (Wood 1978; Davies 1987; Hasher, Attig, and Alba 1981; Pennington 1981; Pezzo 2003; Hölzl and Kirchler 2005). Most of the experimental research on hindsight bias since has been dominated by effects obtained in these two designs: distorted retrospective assessments of event probabilities and distorted memory for prior probability estimates (Blank, Musch, and Pohl 2007).

Much work has been done in an attempt to explain hindsight bias, and the mechanism suggested in Fischhoff's initial study (1975) seems to have the strongest support (Clarkson, Emby, and Watt 2002). According to this explanation, outcome knowledge is automatically assimilated to knowledge of antecedent events. The events are reconstructed in the observer's mind and understood in a way that highlights the salience of evidence that is consistent with the actual outcome and deemphasizes other data that without hindsight would have made the situation seem more confusing and uncertain. In this way people construct a coherent narrative that causally links outcomes to their antecedents and makes them seem inevitable, even when there is information available that indicates that events could have turned out otherwise. Fischhoff (1975) terms this process "creeping determinism", because while people may not in principle believe that history is deterministic, when encountering a specific case the mind automatically creates a deterministic causal account of its unfolding. This account can be very powerful: as with optical illusions, it is impossible to "unsee" the causal links once they are established, even when one is aware that they are illusory; and so warnings and instructions to ignore outcome information are ineffective in mitigating the hindsight bias (Fischhoff 1975).

Motivational explanations have also been suggested, such as the need to present and perceive one's self positively, or the desire for the control implied by predictability (Campbell and Tesser 1983; Louie 1999). However, as noted by Hölzl and Kirchler (2005), the empirical support for such explanations appears rather weak. The "desire for control" explanation, often termed "the defensive attribution thesis" has fared especially poorly in empirical research (Peffley 1984). It should be considered, though, that empirical studies are mostly carried out in psychology labs, where motivational concerns are generally rather marginal. As discussed extensively by Tetlock (1985), most real-world decisions are made in dynamic environments under various accountability regimes. Under these conditions, the nature of people as approval and status seekers is more apparent. If the motivation to present one's self positively has even a secondary role in the hindsight bias, there is reason to fear that the bias would be amplified under natural circumstances.

To assess the importance of hindsight bias in the real world, it is important to regard not only the consistency of its appearance across various settings, but also the size of its effect. A meta-analysis of experimental studies by Christensen-Szalanski and Willham (1991) suggests that the effect is rather small, though persistent. A later meta-analysis found a larger effect,

though one still considered ‘small’ to ‘medium’ (Guilbault et al. 2004). Nevertheless, Christensen-Szalanski and Willham’s analysis shows that given a decision threshold in probability terms, the hindsight bias might cause a change in a person’s decision in a substantial percentage of cases. If, as argued above, the effect is stronger in the field, this is probably an underestimation of the influence of hindsight bias in the real world.

Furthermore, the size of the hindsight effect is not uniform across the different settings in which it occurs. The experimental literature has identified conditions under which the effect of hindsight bias is especially strong. Identifying these conditions is important in order to demarcate the circumstances that are most prone to biased judgment; these would be the circumstances that most warrant intervention.

There is some support for the idea that hindsight bias is stronger when outcome information disconfirms expectations (Fischhoff 1977; Wood 1978; Arkes et al. 1981; Schkade and Kilbourne 1991; Reimers and Butler 1992). This may be due to a ceiling effect, as expected results leave little room for the "sense making" that causes hindsight bias (Buchman 1985; Pezzo 2003). Some have argued that very surprising outcomes may cause an opposite effect, termed "reverse hindsight bias" (see Verplanken and Pieters 1988; Mazursky and Ofir 1990). If the feeling of surprise associated with a disconfirming outcome is strong enough, people may believe that they "never would have known it", and estimate the outcome's prior probability as lower than observers without outcome information. However, evidence for the existence of this effect remains controversial (Pezzo 2003).

Hindsight bias was also found to be stronger when outcomes are negative than when they are positive (Mitchell and Kalb 1981; Schkade and Kilbourne 1991; Anderson et al. 1997; Casper, Benedict, and Perry 1989). This result is consistent with the negativity bias (Rozin and Royzman 2001), according to which people are predisposed to overweigh negative entities while processing information (see also Kahneman and Tversky 1979 on loss aversion). Positive outcome information might not always be salient enough to cause a strong hindsight bias response (Anderson et al. 1997). It should be noted that the effect of negativity seems to flip when the situation is self-relevant (i.e. when the negative outcome of the situation pertains to one’s self, as when estimating the foreseeability of being fired, see Mark and Mellor 1991). In self-relevant situations, a smaller hindsight bias is exhibited for negative relative to positive outcomes, probably because people engage in defensive processing, denying culpability by

denying foreseeability (Pezzo and Beckstead 2008; Pezzo and Pezzo 2007). In this case, motivational factors counter the cognitive effect of hindsight.

We believe the finding that surprising negative outcomes cause an especially strong hindsight effect should be disturbing, since examination of surprising negative outcomes is perhaps the real-world setting in which ex-post evaluation of judgment is most common, and most consequential. Furthermore, the fact that events that are the least predictable in foresight cause the strongest hindsight effect implies that even actors making very reasonable decisions under conditions of extreme uncertainty risk being judged harshly in retrospect. Furthermore, the fact that negativity operates differently for self-relevant events indicates that there is less of a problem of unnecessary self-berating for negative outcomes of one's own decisions than that of unfair judgment of others' mistakes and overconfidence regarding responsibility for one's own positive outcomes.

After summarizing the experimental literature on the conditions that give rise to hindsight bias and arguing that hindsight bias is important in the real world, in the next chapter we go on to examine in more detail, though still on a theoretical level, the ways in which this bias is damaging to overall decision making quality. That discussion will prepare the ground for examining the detrimental effect of hindsight bias on specific decisions that are made in social institutions.

Chapter 3: Negative consequences of hindsight bias

As nearly four decades of research into hindsight bias have found it to be ubiquitous across diverse domains and extremely difficult to overcome, concern has arisen as to the negative consequences it might have in applied settings. This concern has focused on two types of consequences: unfair evaluations of past decisions, and deficient learning from experience (Blank, Musch, and Pohl 2007).

In this chapter we discuss the theoretical basis and empirical evidence that point to the existence of these consequences. This will be of use in the next chapter, when we explore the specific situations in which hindsight bias has negative consequences for the functioning of social institutions. This discussion will also assist us in chapter 5, when we analyze measures for coping with hindsight bias. Understanding which type of consequence we are attempting to avoid in each situation will prove useful in determining what coping measures would be appropriate.

In addition, this chapter develops a distinction between fields where events are regular and fields where they are irregular, suggesting that learning from experience is more problematic for the latter, and that choice of appropriate measures for dealing with hindsight bias should take this distinction into account.

3.1 Consequences for evaluation of past decision making

Hindsight bias affects our evaluation of the appropriateness of past judgment and results in unfair blame attributions. If in retrospect an outcome seems to flow inevitably from what was known at the time of decision, it would seem to a hindsighted judge that it should have been predicted and prepared for. If caught unprepared, an accountable actor will be held responsible and judged harshly for negative outcomes that might have occurred purely by chance, to the detriment of that actor's professional reputation or worse.

These conditions may also lead to harmful incentives, for example by encouraging overly conservative behavior, as indicated by a recent study into the behavior of actors expecting to be judged in hindsight (Livnat 2010). Such behavior may result in forgoing the advantages of taking reasonable risks, and in the wasted cost of excessive precaution. Conversely, a belief that one stands to be judged harshly regardless of the quality of one's decision may result in

recklessness and excessive risk taking, due to a breakdown in the legitimacy of accountability structures (Margulies 2010).

Similar processes occur in credit attribution. In hindsight, positive results will seem to have stemmed deterministically from a decision maker's choices even when they were not predicted or planned for. Therefore, decision makers will receive undue credit for chance results.

The research on the effect of hindsight on responsibility judgments has been plentiful (Blank, Musch, and Pohl 2007), though it has focused almost entirely on the effect of negative outcomes. In fact, the effect of negative outcome information on evaluation of past behavior has been studied separately from the hindsight bias and termed 'the outcome effect'. While the hindsight bias refers to the effect of outcome information on the perceived predictability of events, the outcome effect refers to the direct effect of outcome information on "individuals' evaluation of the skill and/or competence of a judge who did not foresee that outcome prior to its occurrence" (Clarkson, Emby, and Watt 2002, 7).

While we discuss outcome bias as a consequence of hindsight bias, the relationship between the two seems to be more complicated. It has been demonstrated that outcome influences evaluation of responsibility directly as well as through biased retrospective likelihood assessments (Baron and Hershey 1988). The outcome effect has been observed both together with hindsight bias (Brown and Solomon 1987; LaBine and LaBine 1996; Mitchell and Kalb 1981; Carli 1999) and alone (Clarkson, Emby, and Watt 2002; Caplan, Posner, and Cheney 1991; Baron and Hershey 1988). Interestingly, while Carli (1999) found, as expected, that outcome bias is mediated by hindsight bias, other studies either did not, or did not report on results for a mediation relationship (as noted by Pezzo 2011).

It is therefore likely that the outcome effect involves further factors not present in hindsight bias. Because it relates to evaluations of people, rather than just estimation of probabilities, it may be more influenced by strategic or motivational factors than hindsight bias is (Clarkson, Emby, and Watt 2002). For example, evaluators may feel a need to identify guilty parties for bad outcomes in order for restitution and retribution to take place (Shaver 1970).

While we accept the distinction between outcome bias and hindsight bias, in this work we nevertheless analyze the effect of outcome information on decision evaluation as a consequence of hindsight bias. This is because the focus of this work is on hindsight bias and the scope of this work does not allow devoting significant attentions to the additional factors operating in outcome

bias. We assume that the hindsight bias drives at least part of the outcome effect and focus on contexts where the relevance of event likelihood assessments to the judgment context is relatively clear.

3.2 Consequences for learning from past events

In addition to its effect on the fairness of responsibility judgments, it has been argued that hindsight bias hinders people's ability to learn from past events, though surprisingly little empirical work has been done to examine this suggestion (Blank, Musch, and Pohl 2007), and it remains somewhat controversial.

Some scholars (Hawkins and Hastie 1990; Hoffrage, Hertwig, and Gigerenzer 2000) argue that hindsight bias is a generally harmless byproduct of an adaptive process of automatic and unconscious knowledge updating. "Rewriting history", so to speak, allows us to improve our inferences over time by using outcome information to strengthen connections between antecedents and events that follow them. This warps the perception of what one had known and what others could have known in the past, but this is of little concern for learning because "remembering the real state of affairs (e.g., whether something is true or really happened) is generally more important than remembering what one thought about it before learning the truth" (Hoffrage, Hertwig, and Gigerenzer 2000, 579).

According to this view, the difference between the predictions of subjects with and without outcome knowledge is a result of the rational updating of causal structures upon receiving new information. The probabilities supplied by those who received outcome information are therefore assumed to be closer to the "true" probabilities than those supplied in foresight (assuming that the outcomes provided are not bogus, which they are in most experimental designs). To take a simple example, if we tossed a coin a dozen times and always received tails, it would be rational to update our assumptions regarding the fairness of the coin. This would (correctly) affect both our expectation for the next toss and our perception of the ex-ante probabilities for the outcome of the first toss. Even for more complex problems, in a world with limited information, outcome is a relevant if imperfect indicator of actual ex-ante probabilities.

In contrast, Fischhoff and Beyth (1975) hold both that the perceived ex-ante probabilities for an outcome that occurred are in fact warped because of hindsight bias, and that in many real-world situations unconscious ‘learning from feedback’ processes are not sufficient for effective learning, and conscious reflection on where one had gone wrong is necessary.

The basis for this argument is the “sense making” mechanism which was proposed by Fischhoff (1975) as an explanation for hindsight bias and which was discussed in chapter 2. This mechanism suggests that the mind is predisposed to make associative inferences even in cases in which they are not warranted, “learning” causal links that do not exist and which would therefore be of no use in improving future predictions. The historical case studies used in Fischhoff’s (1975) study included facts that could have supported any of the possible outcomes. The initial conditions were very uncertain, and while it is impossible to say for certain, the outcome that actually occurred probably was a result of the conditions as well as a large random factor. However, in hindsight the facts in the event description that support the outcome that occurred become much more salient than the others; they seem to indicate the actual outcome unequivocally, and the initial uncertainty is forgotten. As a result, the facts that support the outcome are perceived as much better predictors of the outcome than they actually are and the role of chance is underestimated.

The pseudo-power of ex-post explanations is related to overfitting in statistical analysis. To quote Fischhoff (1982a, 345), “given a set of events and a sufficiently large or rich set of possible explanatory factors, one can always derive postdictions or explanations to any desired degree of tightness... The price one pays for overfitting is, of course, shrinkage, failure of the derived rule to work on a new sample of cases. The frequency and vehemence of methodological warnings against overfitting suggest that correlational overkill is a bias that is quite resistant to even extended professional training”. Even in the coin toss example mentioned above people over-infer: we are much too quick to abandon the assumption of randomness and assume that most sequences of coin tosses are less likely to be the result of random tosses than they actually are (Gilovich, Vallone, and Tversky 1985). The “sense making” mechanism that explains hindsight bias is therefore consistent with much else that we know about the way people reason about probabilities.

According to this argument, the problem hindsight bias causes for learning is overlearning, i.e. overestimating the importance of observed explanatory factors and

underestimating the role of randomness. This also results in overconfidence regarding one's predictive abilities.

An interesting formalizations of this intuition is provided by a model developed by Biais and Weber (2009). According to this model, when people update their knowledge upon receiving outcome information, they average the actual outcome with their expectations (of course, they could also be performing some other function of the two; the point is that prior knowledge is adjusted, not replaced). Biased memory for prior expectations means the average will be biased as well; the new information is essentially over-weighted. The results of this model predict an underestimation of future volatility, and indeed, the authors found, using a sample of investment bankers, that a larger hindsight bias was correlated with reduced expectation of volatility and reduced investment performance.

A negative result of overestimating the importance of an outcome's perceived causes is wasting resources by taking measures to counter what "caused" a random undesirable outcome. A severe outcome often causes an entire system to be redesigned around a chance failure, which may have minute probability of repeating itself (consider the practice of inspecting shoes at airports following the 'shoe bomber' in 2001). Besides the wasted resources, this behavior is dangerous because focusing on conditions that proved dangerous in the past leaves us unprepared for the next crisis, which is likely to originate elsewhere. In the words of the common adage, 'the generals are always preparing to fight the last war'.

Up to this point we have focused on learning as the identification of causal relationships, but in environments where causal relationships are complicated and uncertainty is prevalent, an important type of learning is developing skills and systems for making decisions under uncertainty. Fischhoff and Beyth (1975) argue that hindsight bias disrupts this type of learning by causing false complacency regarding the degree of preparedness necessary for events with a certain perceived probability. According to this argument, people and organizations choose to take action only when the perceived likelihood of an event exceeds a certain threshold. Actors who experienced being caught unprepared for a certain occurrence will learn from this that they must be prepared for events of that occurrence's likelihood, *as it is perceived in hindsight*. Since the predictability of the occurrence is exaggerated in hindsight, the actors will continue to be unprepared for events whose likelihood is similar to the occurrence's *actual* ex-ante perceived likelihood.

Similarly, people studying past events in attempt to learn for the future may learn to (correctly) associate a particular set of indicators with a certain outcome, but when they have to make decisions in future conditions, they will encounter not just these clear-cut indicators but a much more confusing set of evidence, which they may have been better prepared to handle if in learning from experience they had been able to properly reconstruct the original uncertainty of events.

Hindsight bias may also discourage developing better prediction mechanisms and better processes for dealing with uncertainty. Because ‘creeping determinism’ usually makes it easy to find an explanation for events within the information available, without conscious recognition that their prediction mechanisms have failed, organizations may not be inclined to improve them, for example by monitoring more information or analyzing it better. In addition, as we will discuss below, in some cases events are so different from one another that it is almost impossible to improve predictions for the future by making causal inferences from past events. In these cases, a more effective approach to learning from experience would be improving mechanisms for coping with or preparing for unexpected events without trying to predict them (Fischhoff and Beyth 1975; Fischhoff 1982a; Taleb 2008). The overconfidence in the ‘order’ of history and the possibility of prediction, which is part of hindsight bias, makes this approach less attractive than it should be.

As mentioned above, studies have found hindsight bias to be ubiquitous across many different fields – from historical case studies (Fischhoff 1975) and current events (Fischhoff and Beyth 1975; Hölzl and Kirchler 2005) to decision making in business (Bukzar and Connolly 1988) and medicine (Arkes et al. 1981; Caplan, Posner, and Cheney 1991; Arkes et al. 1988; Detmer, Fryback, and Gassner 1978) and interpretations of scientific experiments (Slovic and Fischhoff 1977). Nevertheless, we would like to argue that the implications for learning differ across fields. While in all fields a tendency to overlearn from event outcomes exists, fields differ in the amount of information that is actually contained in event outcomes. Some fields are governed by a fairly strict regularity. In these fields, outcomes provide a rather strong signal regarding what that regularity is, though it may only become apparent when the outcomes of many events are studied in aggregate (recall the coin toss example). Scientific fields, such as medicine and weather forecasting belong to this category. While uncertainty exists in these fields, prediction is still possible, though with rather large error margins. However, in other fields

events are either governed by processes which are overwhelmingly random, or are too different from each other to be compared in a way that allows extracting regularities and making meaningful predictions. Historical and political events belong to this category. Since most historical events are essentially unique, it is usually not possible to learn from them by examining a large sample of similar events; such samples rarely exist. In such cases, in-depth analyses of single cases are often the only way to learn. The information produced in this way is very limited, because it is impossible to separate the random factors from the causal ones, and because the future events one is learning for are not expected to be sufficiently similar to the past one is studying. In this type of fields improving predictions by drawing causal inferences from past occurrences is essentially impossible.

A good indicator for distinguishing between fields where outcomes provide useful information for improving predictions and those that do not is the quality of expert judgment in that field. As Tetlock (2006) famously showed, political experts do very poorly at predicting future political events, essentially doing no better than chance. Most studies have received similar results regarding the predictions of stock market analysts (Kahneman 2011). While stock performance information seems less unique than historical events, and indeed statistical analysis can be and is routinely applied to it, it seems to be governed by essentially random processes, with past stock performance containing little or no information relevant for future performance (Fischhoff 1982a).

The distinction between these types of fields is not meant to imply that hindsight bias is a problem for one but not the other. Even when regularities exist, people's tendency is to exaggerate them, with harmful consequences, as discussed above. However, we do suggest that in fields with regularity, *overall* learning from experience is at least potentially not as problematic as in fields with unique or irregular events. This is because those operating in these fields often encounter many similar cases and receive feedback regarding their outcomes; improper learning may thus be corrected and refined by future similar events with different results. No such moderating mechanism exists for unique or irregular events.

It remains an open question to what extent this in fact happens automatically. It is possible that without formal learning procedures that aggregate the data, intuitive learning is dominated by in-depth examinations of an unrepresentative sample of events (such as those in

which outcomes are extreme), with actors always focusing primarily on the lessons from the last memorable event, despite being exposed to a more diverse set of events.

Whether the nature of a field (regular/irregular events) affects hindsight bias and the quality of learning from past events is an important question that remains to be further examined in future research. For the purposes of this work it is important to note that even if hindsight bias is disruptive in both cases, the distinction is still important for devising appropriate coping measures. Measures that focus on bringing forward more information to improve causal inferences and future predictions will be relevant for fields with regular events only. In fields with irregular events, a more productive approach to dealing with hindsight bias will be concentrating attention on the difficulty of prediction and the need to accept uncertainty as an inherent part of the decision making process.

In the next chapter, we will detail how the detrimental consequences of hindsight bias discussed in this chapter play out in different situations in the real world. After that, we will go on to discuss ways of coping with these effects.

Chapter 4: A map of real-world contexts affected by hindsight bias

In this chapter we move from theory to practice and identify the social institutions in which hindsight bias is expected to have a detrimental effect on optimal functioning. We will discuss three domains: the legal domain, the domain of politics and government and the domain of organizations and management. For each domain, we will catalogue relevant specific contexts. This discussion is not meant to provide an in-depth exploration of each identified context nor to be an exhaustive list of all situations relevant to hindsight bias; it is meant to be an introductory map of the sort of situations where hindsight bias might be relevant and consequential in the social world. We expect this map to assist our own discussion of the real-world relevance of various coping mechanisms, and hope it will inspire future studies on hindsight bias in under-explored contexts.

In principle, any setting in which actors make decisions under uncertainty and are held accountable for the way things turn out should be of interest, and so should all institutional mechanisms for drawing lessons from past events. In practice, most of the concern focuses on the aftermath of negative outcomes, especially severe negative outcomes. This is because negative outcomes are so much more obtrusive than benign outcomes, and because they are the ones that mostly inspire retrospective analysis.

The contexts we discuss differ across a number of dimensions. We would like to single out a few dimensions which we believe are relevant for analyzing how promising each of the coping measures we discuss in chapter 5 is for each category of hindsight decision.

First, we distinguish between formal and informal contexts. We define formal contexts to be cases in which a person, in her professional capacity as decision maker, is presented with a task of hindsight judgment which is highly susceptible to bias, in accordance with the studies discussed in chapter 2. The task is clearly delineated and the decision, once made, is presented straightforwardly. Informal contexts are cases in which hindsight judgment is not explicitly required by the system, but for which we argue that hindsight bias is expected to influence actors' behavior indirectly.

This distinction is important for our discussion of coping mechanisms. In formal contexts it is possible to incorporate debiasing measures in the requirements of the decision making process or to redesign the system in a way that such biased decisions are either avoided as much

as possible or recalibrated (see chapter 5). Informal contexts are more difficult to cope with because it is often harder to pinpoint the actual decision. In addition, many informal contexts are not often identified as relevant to the research on hindsight bias, and there has therefore been little discussion of the need to cope with its effects.

The contexts discussed are further differentiated according to which of the two detrimental effects of hindsight bias discussed in chapter 3 – impaired learning or unfair responsibility judgment – occur. This is important because in the real world improving retrospective probability assessment in and of itself is not usually very important. What is important is that learning or responsibility judgments based on this type of assessment are adequate. And this goal can be achieved directly, without improving probability assessments but by working with or around them, as we will see in chapter 5. In order to address the consequence of hindsight bias directly, we have to know which consequence it is we are addressing.

Table A (p. 36) provides a list of the types of situations included in the analysis, ordered by domain and accompanied by examples and by their values with regard to these two dimensions (formal/informal, effect on learning/fairness of judgment). The distinction we developed in chapter 3, between fields in which events have regularity and fields where they are essentially unique, will also be of use in analyzing the appropriateness of coping measures for different decisions (in chapter 5), and will arise a number of time in the discussion of specific decision making situations as well (in this chapter). However, this dimension is not included in the table because it cuts across the categories of decisions we discuss.²

4.1 The legal domain

The prime, and most formal, institution through which society investigates past events and assigns blame is the justice system. Indeed, hindsight bias is relevant to a variety of judgment tasks that are undertaken by the courts. These situations are relatively easy to identify because assessment of prior probabilities is often explicitly required by law. These judgments have also been widely researched as instances of hindsight bias, and this research has originated a number of interesting coping mechanisms which will be discussed in chapter 5.

² For example, we defined “negligence judgment” as one category (section 4.1.1), though negligence judgments exist both for fields where events are regular and fields where they are irregular.

Of the two main concerns with the implications of hindsight bias that were discussed in chapter 3 – learning and responsibility judgments – in the legal domain the foremost concern is with unfair allocation of blame and punishment (and in rarer cases, credit). The justice system is not designed to deduce lessons for the future from the events it judges, and its current design is extremely ill-suited to facilitate learning by the sides engaged in legal action (for reasons discussed by Poythress, Wiener, and Schumacher 1992).

Most of this section will deal with the specific types of legal judgments in which the law requires the courts to undertake judgments that are subject to hindsight bias. At the end of the section we will turn to discuss how other actors in the legal domain may be affected by hindsight bias, thus indirectly influencing the fairness of the justice system.

4.1.1 Negligence

The judicial task most commonly discussed in the context of hindsight bias is the judgment of negligence. The idea of negligence is that people should exercise reasonable care when they act by taking into account any harm their actions might foreseeably cause other people (Feinman 2010). In the words of the California Bar Association jury instructions, the judgment of negligence entails deciding whether "a person of ordinary prudence ... in the same situation and possessed of the same knowledge... would have foreseen or anticipated that someone might have been injured by... his action or inaction" (as quoted by Rachlinski 1998). The estimation of *what others could have known in foresight* is exactly the type of thinking for which outcome information causes distortions.

Judgment of negligence is a key aspect of most liability suits. Potentially, this may include liability for medical malpractice, manufacturers' liability for damage caused by products, auditors' liability towards third parties relying on their reports, investment funds' and corporate managers' liability to investors, liability for damage incurred in traffic and work accidents or any other personal injury for which a tortfeasor can be found. In practice, the details of the law depend on the context in which the damage occurs, and liability is often limited. The specifics of the law in each field may, among other goals, represent different attitudes towards dealing with the hindsight bias (Rachlinski 2000), and are probably influenced by the specific properties of each field.

4.1.2 Intentional misrepresentation

The judgment of negligence requires the justice system to reconstruct what a defendant could and should have known and taken into account in her decision making, under the assumption that any causal relationship between the defendant's actions and damages incurred by the plaintiff was unintentional. Rachlinski (1998) suggests that hindsight bias may also affect judgment of what a defendant actually knew, and therefore might be relevant for claims of intentional misdeeds as well. If an outcome seems obvious, it would be easier to conclude that the defendant must have known and expected it. This has been discussed mostly in the context of liability for securities fraud, in cases where corporate officials are accused of knowingly making false statements to investors regarding the prospects of their businesses (see Rachlinski 1998; Gulati, Rachlinski, and Langevoort 2004).

In such cases, direct evidence regarding intent, such as written notes or witness testimony is often available, which may diminish the effect of outcome information. Of course, hindsight might color the interpretation of such evidence as it does the evidence regarding what outcome should have been predicted and prepared for; but it seems likely that such evidence would be less prone to misinterpretation (see discussion by Rachlinski 1998; though we are not aware of any empirical investigation of this question).

4.1.3 Probable cause

A different type of judgment for which hindsight bias is relevant, still within the context of liability law, arises in some types of intentional torts. In such cases individuals sue the state for damages caused by violations committed by law enforcement officials that are claimed to be unwarranted by the circumstances. Examples include false arrest and detention or unreasonable search and seizure.

In these cases the legal judgment that is subject to hindsight bias is that of probable cause. The appropriateness of the official's behavior should depend on whether the information available at the time of the decision constituted probable cause for the violation. However, the results of the official's action (for example, evidence uncovered during a search), or unrelated

future developments (introduction of other evidence) may retrospectively confirm or repudiate the official's cause for action. When judged in hindsight, these developments will seem inevitable, and color the perception of the reasonableness of the official's action. For example, whether an act of search and seizure yields evidence of criminal behavior should not normatively affect the judgment of its legality, but Casper, Benedict, and Perry (1989) found that mock jurors presented with such evidence were less likely to judge police forces to be liable for damages caused by the search relative to subjects who received no outcome information or received information indicating that the plaintiff was not connected to any criminal activity.

Judgment of probable cause is relevant for procedural law as well. Evidence obtained via a search conducted without probable cause is inadmissible in court. In an experiment with judges as subjects, Rachlinski, Guthrie, and Wistrich (2011) did not find an effect of hindsight on judges' ruling of search legality. Possible reasons for this will be discussed in chapter 5 (section 5.2.1.1). It should be noted that judges have been shown empirically to be susceptible to hindsight bias in other contexts (Anderson et al. 1997; Jennings, Lowe, and Reckers 1998; Guthrie, Rachlinski, and Wistrich 2000; Guthrie, Rachlinski, and Wistrich 2009).

Probable cause is different from the legal determinations discussed above (negligence and intentional misrepresentation), because it does not belong to the schema of determining responsibility for negative consequences. While the judgment of probable cause does reflect on the appropriateness of an officer's behavior, the question being asked is not whether she properly foresaw the negative consequences of her actions but whether she correctly expected the damage she caused to be justified. Contrary to negligence cases, in this case hindsight bias can work either for or against the defendant depending on what the outcome turned out to be. Rather than too harsh judgment, in this case hindsight bias might result in judgment that is too lenient, resulting in future unjustified violations of citizens' rights.

4.1.4 Patent non-obviousness

The last type of legal determination included in this discussion does not involve judging the appropriateness of behavior, but more directly whether a result was obvious in advance or predictable: this is the case of patent law. The core requirement for obtaining a patent is that the invention was not obvious at the time it was invented (Mandel 2006). Judging if this requirement

is met is a task performed in hindsight: after knowing the details of the invention, it must be decided if it is an obvious extension of what was known prior to the invention. The hindsight bias presents a problem then, both for the decisions made by Patent and Trademark Office (PTO) examiners, and for the judgment of court cases in which patents are contested.

The negative implication of this is an unfair denial of credit to inventors who created patentable inventions. Interestingly, in this case hindsight bias results in an effect opposite than usual: hindsight bias is usually expected to cause attribution of responsibility (either blame or credit) in excess of what is warranted, because outcomes are perceived to be more strongly tied to behavior than they really are; in this case, hindsight bias causes credit to be denied.

4.1.5 Expert testimony

The previous sections discuss legal determinations made by judges or juries, but in some cases judges rely almost entirely on expert testimony. This typically applies to negligence cases in complex professional fields such as medicine, where judges are aware that they lack the professional expertise to determine what actions would have been appropriate (Hugh and Dekker 2009). While in theory expert testimony is only supposed to help determine the facts of the case or establish professional norms, leaving it to the judge to deduce negligence, in practice experts offer their own verdict of whether an action was negligent or not (Hugh and Dekker 2009). Even when they do not, the way experts interpret and present the facts of the case is likely to be affected by hindsight bias. Knowing the outcome, their presentation of the case is likely to make the connections between behavior and outcome seem stronger than they actually were.

In addition to its influence on judges, expert opinion is also the yardstick by which claim handlers, defendant lawyers and defense organizations make decisions about whether to defend a claim of negligence or negotiate a settlement (Hugh and Dekker 2009). Studies have shown that experts are subject to hindsight bias (see section 5.1.2.3). This indicates that hindsight bias affects determination of negligence in the legal system through the role of experts as well as judges.

4.1.6 Other actors in the litigation process

The types of decision making situations outlined so far have been limited to trial cases, and specifically to the formal legal decisions made by judges or juries, with a short mention of expert witnesses as well. This is consistent with the focus of most of the research on hindsight bias in the legal system. However, as noted by Hugh and Dekker (2009), the biasing effect of hindsight is relevant also to other actors in the litigation process and may affect final rulings indirectly by affecting such actors as plaintiff and defendant lawyers, insurance claim handlers, coroners, police officials, regulators and other investigative officials. The effect of hindsight bias on investigative officials has barely been examined at all, although these actors often make judgment calls that are similar to those ultimately made by judges at court, although in a less formal manner.

This is especially important because a large majority of cases, especially in civil law, which is most relevant to the issue at hand, are settled out-of-court and never reach a judicial decision (Hugh and Dekker 2009). In these cases, the influence of hindsight on other legal actors seems even more important for the outcome of the case. To the extent that corrective mechanisms aimed at judges and juries are effective, they would probably be reflected in out-of-court negotiated settlements, due to their effect on the parties' expectations of trial outcome. However, targeting other actors and stages of the legal process directly may be necessary as well.

4.2 The domain of politics and government

In discussing the domain of politics and government we will concern ourselves mostly with the effects of hindsight bias on reactions to high-profile events that have political significance, and on public judgment of politicians and high ranking government officials. While extreme cases of misconduct by politicians or civil servants may be judged in court, in general the political domain has its own mechanisms for dealing with the aftermath of consequential events, and in contrast to the formal rule of law, they tend to be more flexible, developing on a per-case basis.

However, hindsight bias is also important for the role of government as regulator. In this context the requirement of hindsight judgment is more formal and events are generally less high-

profile. This type of decision making is closely related to what occurs in the legal domain, and we will discuss it briefly before moving on to other, more distinctively political, contexts.

4.2.1 Regulation

Regulatory agencies are mostly concerned with devising rules and enforcing them, and are not generally in a position to evaluate the appropriateness of behavior ex-post. However, when regulations are violated, the regulatory agency typically has the authority to pursue legal action. This often includes the authority to impose certain sanctions through administrative rather than legal proceedings. In this way the regulator acts as investigator and judge, and is subject to hindsight bias to the extent that the judgments undertaken require relying on outcome information.

In most cases what counts as a violation is clear enough by judging the behavior itself, but in cases where the application of the regulations is not clear cut, outcome information can influence the judgment of whether a violation had occurred or not. In addition, sometimes the regulator is called to investigate only following a negative outcome. For example, accounting firms are often investigated for failing to warn of an audited company's impending failure. The knowledge that the company did in fact fail is expected to affect the regulator's belief that the auditor should have been able to predict this. An indication that this in fact occurs, can be found in Buchman (1985)'s analysis of the Securities and Exchange Commission (SEC)'s censure of Arthur Andersen & Co.'s auditing procedure in the case of a financial statement that had turned out to be false. This analysis found evidence for hindsight bias in the language of the SEC decision. Decisions to revoke professional licenses following professional mistakes that had resulted in adverse outcomes (such as injuries to medical patients) also seem likely candidates to suffer from hindsight bias.

These types of regulatory decisions are related to the decisions discussed in the section on the legal domain. First, because they often end up being adjudicated in court, and second, because they are made based on formal administrative rules and through an adversarial process, much like court decisions. Therefore, regulatory decision making may benefit from methods of coping with hindsight bias in the legal system.

In addition, hindsight bias has consequences for regulation in the domain of learning. Negative outcomes often trigger the institution of new regulations. This reaction is probably excessive, for reasons discussed in section 3.2. This type of decision (as distinct from regulatory judgment) can be seen as an instance of policy learning, and as such will be discussed further in section 4.2.4.

4.2.2 Commissions of inquiry

Perhaps the most formal mechanism of retrospective judgment used in the political domain is the appointment of commissions of inquiry. These are ad hoc bodies of investigation appointed by the government to investigate a particular occurrence, typically a large scale adverse event which had caused public outrage. Common objects of such investigations include disasters, accidents, prominent policy failures and scandals (Sulitzeanu-Kenan 2006). The operation of the commission of inquiry is generally independent, though it is limited by the mandate specified by terms of reference that accompany its appointment.

Commissions of inquiry seem to represent a prototypical situation in which hindsight bias would be especially strong. First, the public salience and strong negativity of the outcomes investigated are likely to make their effect especially hard to ignore. In addition, commissions of inquiry are typically created to examine unique, even historic events for which no comparative class of events is readily available that can be used to attenuate the influence of a particular occurrence (Lieblich 1987).

For many commissions of inquiry, judging preparedness for an unexpected event is explicitly mentioned as part of the commission's task. This type of task is especially common for commissions of inquiry investigating intelligence failures or the unfolding of military events. The judgment of whether a system should have been better prepared for an event depends on the judgment of how likely that event seemed before it occurred, which is precisely the type of judgment disrupted by hindsight bias. The Kahan Commission (1983) on the Beirut massacre formulated its judgment task in exactly these terms: “[to judge] whether it was possible to predict and whether it should have been predicted that bringing the Phalangists into the camps [...] might cause a massacre, as in fact happened” (Kahan Commission report, 1983, 69). Commissions with similar tasks include the 9/11 Commission (2004) on the 9/11 terrorist

attacks, the Roberts Commission (1941) on the Japanese attack on Pearl Harbor, and the Agranat Commission (1975) on the Yom Kippur War. Similar hindsight bias issues arise regarding judging responsibility for coping with natural disasters like Hurricane Katrina (2005) and the Mount Carmel Forest Fire (2010), both of which were investigated by internal government committees.

Another common type of commission of inquiry deals with intentional misdeed or other types of misconduct not related to the assessment of risks. Examples include the Saville Inquiry on the Bloody Sunday incidents (1972), the Tower Commission on the Iran Contra affair (1986) and the Beisky Commission on the Israel bank stock crisis (1983). Though the severity of outcomes may affect responsibility judgments for intentional misconduct as well, this does not occur through an improper estimation of ex-ante probabilities, so we do not see this as an instance of hindsight bias. However, recall that commissions of inquiry are almost always authorized to investigate responsibility at the ministerial level. While the concrete error or misdeed is most often not committed by the minister herself, she may be held accountable for misconduct or failure in her office. The degree of ministerial responsibility for what occurred “under her watch” depends on how foreseeable the misconduct was, given what the minister knew and could have known, and this type of judgment is subject to hindsight bias.

That said, it should be noted that excessive responsibility attributed to high ranking officials, including ministers, may not be a major problem in investigative bodies. There is reason to believe that investigative bodies are inclined to attribute more responsibility to lower ranking officials, while being more lenient towards those at the top. Cognitively, it may be easier to attribute responsibility to individuals who are proximate in time and space to the event itself rather than to those higher up who are responsible for system factors, because the causal links to the actual event seem clearer (Einhorn and Hogarth 1986). In addition, it is not uncommon for governments to be accused of using commission of inquiry as a vehicle to protect themselves at the expense of others (Beatson 2005). If these accusations sometimes have merit, political dynamics and interests regarding the inquiry’s appointment and operation may bias its conclusion against holding ministers responsible, the hindsight bias notwithstanding.

On the other hand, our discussion of hindsight bias (and its implications for political blame attribution, discussed in the next section) indicates that the common accusation of whitewashing directed against commissions of inquiry may be to a large extent due to the

public's hindsight judgment, rather than actual excess leniency. Inquiries might in fact be stricter, not more lenient than is normatively warranted. This would be the case if the process of investigation results in less (though still) biased judgment than the casual observations of the public.

Therefore, in examining the merit of using commission of inquiry, one should consider its susceptibility to hindsight bias not only absolutely, but relative to other forums. Despite its limitations, a commission of inquiry might actually have a relative advantage in coping with hindsight bias when compared to other political and public forums. Because it is a formal and contained forum of investigation, it would probably be much easier to incorporate debiasing mechanisms in a commission's work than in less formal public forums.

While our discussion of commissions of inquiry up until this stage focused on the problems the hindsight bias causes for responsibility judgments, the implications for learning are relevant as well. This aspect is especially important in commissions of inquiry, because contrary to legal judgments, learning from experience for the purpose of drawing lessons for the future is considered one of the most important functions of commissions of inquiry (PASC 2005). In many cases, commissions of inquiry choose to limit their mandate in making responsibility judgments, and define their main purpose as learning organizational and procedural lessons for improvement of systems and decision making processes (see for example the report of the Kahan commission, 1983).

The cases for which commission of inquiry are appointed belong exactly to the class of cases discussed in chapter 3 for which learning in hindsight is expected to be especially problematic – extreme, unrepeatable events, which cannot be viewed within the context of a comparable class of events. When there is no relevant class of events to compare to, there is no way to separate the role of chance from that of behavior. As discussed above, this may lead to overlearning, and cause governments to implement major changes in policies and organizations which would not in fact prevent future failures.

4.2.3 Political assignment of blame

Politicians are subject to public scrutiny: their performance is constantly evaluated by the media, by opponents and allies within the political system, and by the public at large. These

evaluations affect a politician's career, especially one who has to be voted into office. Hindsight bias is a factor in these evaluations, especially when a politician is in a position to be associated with a particular well-defined occurrence. In such cases, public blame manifests itself in attitudes that are expressed in opinion polls, media criticisms, public protests, calls for the resignation of officials or for the appointment of a commission of inquiry, etc.

There has been much research on the dynamics of blame attribution in politics (see for example Hood 2010), but the role of hindsight bias is not usually discussed in this context. While hindsight bias may not affect the direction of blame, it is certainly expected to affect its strength. A necessary condition for blame is the perception of avoidable harm (Hood 2010). Hindsight bias implies that too much blame will be attributed to a targeted party because the degree to which damage is perceived to have been avoidable is exaggerated in hindsight.

The harm caused by this manifestation of hindsight bias is the unfairness of politicians being judged unfairly and the incentives that are created for blame avoidance behavior (see chapter 2). However, this harm should be weighed against the importance of accountability of political officials and the desire for strong deterrence against myopic behavior and disregard for decision outcomes. While maintaining this balance is important for all judgment contexts (consider medical malpractice for example), it seems especially strong in the case of politicians because the political system seems to offer especially strong incentives for myopic behavior (Margulies 2010). This is an important point to note when considering action to counter the effect of hindsight bias in this context.

In addition, it should be considered that hindsight bias in the context of public blame attribution is a very informal instance of hindsight bias; individuals are generally not formally required to engage in retrospective probability analysis, but they are likely to be doing so of their own accord. Furthermore, hindsight bias is only one of many factors, both motivational and cognitive, in the "messy" process of blame attribution. This makes it difficult to isolate the exact point where a biased decision is being made and corrective measures can be incorporated. These conditions, in addition to the importance of freedom of information in democratic societies and the fact that judgment is diffused across many individuals, make it difficult to imagine the incorporation of systematic debiasing measures that target individual judges. Therefore, in this

context the literature on debiasing hindsight bias will probably be of more use for informing the efforts of individual politicians attempting to deflect blame in the wake of negative outcomes.³

4.2.4 Policy learning

While the traditional approach to political science assumes that government policy is driven by conflicts of power, in recent decades learning theories of government have gained in prominence. These theories give more attention to the ways governments learn from their experiences and how policies are often influenced by actors' interpretation of how previous policies have fared, either their own policies or those observed elsewhere (Grin and Loeber 2006). Hindsight bias has an effect on policy learning both with regard to the interpretation of positive and negative outcomes of policy, and with regard to which policies are adopted from other places or domains.

Following negative events, blame and learning in hindsight often occur together. Trying to recover from a negative outcome, governments often institute large policy changes addressing what is perceived in hindsight to have caused the failure. As discussed in chapter 3, this is often an overreaction, because in hindsight one can always identify aspects of the policy to hold responsible for whatever the outcome happened to be. Action taken to address these 'learned' causes is wrongly assumed to be sufficient in preventing future negative results, while other weaknesses are ignored. Conversely, when outcomes are generally positive, hindsight bias strengthens the perceived causal links between policy and outcomes, thus making government overoptimistic regarding policy effectiveness, leading to over-investment in ineffective policies (see more on this in section 4.3.4).

Similar processes occur when attempting to learn from results achieved by others. When looking for a policy solution, policy makers search for successful outcomes elsewhere and then work backwards, identifying policy features which in hindsight seem responsible for the successful outcome. Since these cases are examined because of their success and not at random,

³ Markman and Tetlock (2000) show that people in accountable positions tend to point out their inability to foresee outcomes as a debiasing attempt against those they are being held accountable to. However, it is not clear how useful such strategies are. As discussed in chapter 5, merely drawing attention to the existence of hindsight bias is a very poor debiasing measure, and such claims by politicians are likely to be regarded as mere excuses. More useful strategies may be developed by examining what debiasing measures are most effective and appropriate for use as personal presentation strategies, an issue we return to in chapter 5.

and are rarely compared with unsuccessful cases, there is reason to expect that at least some of the success stories are due to chance or external factors; however, reasoning in hindsight, it is easy to devise plausible explanations that link policy features to successful outcomes.

The proper approach to counteracting hindsight bias and improving policy learning depends on the characteristics of the policy field, as discussed in chapter 3. In fields where regularity is expected, coping measures can focus on bringing forward more information to improve causal inferences and future predictions. In fields with irregular events, attempting to improve causal inferences will be more difficult, and a more productive approach to dealing with hindsight bias will be concentrating attention on the difficulty of prediction and the need to prepare for the occasional occurrence of unexpected events.

4.3 The domain of organizations and management

In this section we discuss the implications of hindsight bias for the functioning of organizations. As a government is one type of organization, there are clear parallels between the contexts described here and those described in section 4.2. The government is unique in the involvement of the entire citizenry in its workings, in the typically large scale of the events it deals with, and in its broad authorities. The organizations discussed in this section typically deal with smaller scale and more routine events for which statistics may be available, such as surgery outcomes in a healthcare organization. Accordingly, the fields dealt with often (though not always) belong more to the category of fields where events are fairly regular and predictable.

4.3.1 Internal investigations

Similar to the way commissions of inquiry are established to investigate government failures, organizations sometimes conduct internal investigations to inquire into things that have gone wrong. Most such investigations are initiated with the express purpose of providing lessons that can be implemented to prevent future similar occurrences.

Internal investigations of adverse events are often routine in organizations where safety is a main concern and accidents are perceived as an integral (if regrettable) part of the organization's activity. Medical service providers are an example of such organizations in which

the use of retrospective investigation techniques is especially common (Henriksen and Kaplan 2003).

In terms of learning, these investigations can be divided into those seeking to improve future judgment of individual professionals by learning from the experience of others, and those seeking to identify failures in system designs. Morbidity and mortality conferences, which are common in most hospital wards, are an example of the former. In these conferences recent cases of medical errors resulting in patient injury or death are presented and discussed, focusing on the physicians' judgment regarding diagnosis or choice of treatment. In the conference, the discussants work backwards from the outcome to identify what seem, in hindsight, to be clear indications for the correct course of action (Henriksen and Kaplan 2003). In retrospect, counter-indicative evidence that existed at the time of the decision seems a lot less prominent. As a result, participants may judge the presenting physician too harshly for not foreseeing the correct course of action. In addition, their learning from the incident will be limited because they will attach excessive predictive power to the causes identified, and still be unprepared to deal with the much more confusing set of evidence (indicative and counter-indicative) that is typical of real medical decision contexts.

Note that the focus on a physician's decision in these conferences exposes the assumption that the final outcome could have been deduced from the information available at the time of the decision, and so does not encourage improving implementation processes, gathering better information etc. This is why techniques for identifying system failures following accidents, such as 'root cause analysis' (RCA), are preferred by many safety experts, who claim that a vast majority of failures (in medicine and other industries) can be traced to systems factors rather than judgment failures (see for example the report of the Committee on Quality of Healthcare in America 1999). However, inasmuch as they are always performed in retrospect following specific incidents, hindsight bias causes trouble for these types of techniques as well. A severe outcome may cause an entire system to be redesigned around the specific factors identified as its cause, although it was in fact due mostly to chance, or to a unique mix of factors that is unlikely to occur again in exactly the same way.

An important feature of such investigations is their relative regularity. The ability to gather aggregate data regarding adverse events and learn from the systematic patterns that characterize them offers potential for curbing the overlearning typical of independent

investigations into particular events. Apart from healthcare, these considerations are relevant to other fields where safety is a concern, such as manufacturing, nuclear energy and aviation.

4.3.2 Disciplinary procedures

In most organizations disciplinary procedures take place following clear breaches of acceptable conduct, and are not directly related to outcomes. Nevertheless, under certain circumstances disciplinary measures may be imposed following judgment of responsibility for adverse outcomes. This is most likely to occur for professionals in disciplines that are outcome-focused and in which it is easy to identify a particular individual at the “sharp end” of an unexpected outcome. Lawyers, accountants and doctors are such professional. An example of a disciplinary procedure that can be affected by hindsight bias is the practice, customary in some healthcare organizations, of temporarily suspending the attending physician pending investigation after a patient suffers an adverse outcome that is perceived to be avoidable.

4.3.3 Performance evaluation

Organizations often evaluate their performance based on outcomes. They do this to decide if their policies are successful and whether they should be continued or terminated. In addition, in some organizations employees are evaluated and even compensated according to outcomes. We refer here to general performance evaluation, rather than judgment of responsibility for negative events, as are those that are investigated in internal investigations which were discussed above.

While in the context of evaluating politicians we were more concerned with unfair blame for negative events, here we are mostly concerned with mistaken credit attribution (or more often, credit appropriation). This is because performance evaluation contexts are very often self-relevant; even when the performance being evaluated is that of an employee, the manager is usually also considered indirectly responsible for outcomes. As discussed in chapter 2, in self-relevant situations the effect of negativity on hindsight bias is flipped, with positive outcomes causing more hindsight bias than negative ones. This is attributed to the self-serving bias, according to which positive outcomes are attributed to skill while negative outcomes are

attributed to bad luck (Blank, Musch, and Pohl 2007). As a result, in many cases, organizations become overconfident that their policies yield success and do not learn enough from their mistakes.

A striking example of clearly non-normative performance evaluation can be found in the field of investment management. Many years of research have shown that successful trading in the stock market has little to do with skill and a lot to do with luck. The year-to-year correlation between the outcomes of mutual funds is virtually zero. The same is true for personal investment advisors. Nevertheless, this is a field which routinely compensates for performance, awarding large bonuses for essentially random results that seem meaningful in hindsight (Kahneman 2011). Investment management is an easy target, because learning is not possible at all if there is no regularity to results. But overconfidence in attributing responsibility for positive outcomes is similarly relevant to fields in which outcomes have some regularity, though probably less than it seems.

Another factor may be that in these contexts the proximity of actions and outcomes is generally rather low. People are very sensitive to temporal and physical proximity, and are very likely to consider it causal (Einhorn and Hogarth 1986). When it is harder to find a proximate cause to the outcome, the self-serving bias may overcome hindsight bias in interpreting negative results, and people will favor random bad luck to deterministic explanations. The performance of a stock portfolio is very distant from the actions of the investor, while the results of a surgery very proximate to a surgeon's; it would therefore be harder to deny the feeling of inevitability regarding the outcome of surgery. In contrast, when results are positive, the self-serving bias and hindsight bias work in the same direction to award behavior undue credit for positive outcomes, even when the distance between behavior and outcomes is rather large.

Table A

Domain		Category	Examples	Learning	Responsibility judgment
Legal	Formal	Judge and jury decisions	Negligence	-	+
			Intentional misrepresentation	-	+
			Probable cause	-	+
			Patent non-obviousness	-	+
	Informal	Expert testimony	Negligence in medical malpractice suits, contested patents	-	+
		Other actors	Investigating officials deciding whether to pursue legal action, lawyers negotiating a settlement in cases where court decisions are subject to hindsight bias	-	+
Politics and government	Formal	Regulation	Censure of auditing procedures ex-post, revocation of professional licenses	-	+

		Commissions of inquiry	Inquiry into intelligence failures, large scale accidents, unpreparedness for natural disasters, ministerial responsibility for officials' misconduct	+	+
	Informal	Political blame	Protest against unforeseeable negative outcomes	-	+
		Policy learning	Overreaction to negative outcomes, over-optimism regarding policy effectiveness and the effectiveness of policy transfers	+	-
Organizations and management	Formal	Internal investigations	Morbidity and mortality conferences, retrospective failure analysis techniques	+	+
		Disciplinary procedures	Physicians suspended after an adverse outcome	-	+
	Informal	Performance evaluation	Misperception of successful prediction by investment managers	+	+

Chapter 5: Coping with hindsight bias

The extensive research on the prevalence of hindsight bias has encouraged attempts to discover mechanisms that will eliminate or at least reduce its effect. These can be divided into two different approaches: a general approach and a context specific approach. The general approach focuses on devising interventions to improve individual judgment across different domains. This is usually done in the lab, using variations on Fischhoff's (1975) experiments. For the most part, such interventions have been notoriously unsuccessful, serving mostly to demonstrate the robustness of the effect (see Fischhoff 1982b, who analyzes the debiasing literature from this perspective). In addition to debiasing measures developed in the lab, we include in the general approach also a discussion of the role of different attributes of the decision maker that may make her less prone to hindsight bias.

In contrast to the general approach, the context specific approach seeks remedial measures for specific fields where hindsight judgment is required. While most of the attempts in the general approach are executed by psychologists, and thus have a more theoretical than practical bend, this work is often done by experts within a specific field, like legal scholars or management experts. These researchers sometimes make use of general measures, suggesting adaptations of lab "cures" for the field. However, more often they follow a different path, targeting the system rather than the individual judge, for example by designing it to bypass or recalibrate faulty judgment, thus improving the output of the system regardless of individual judgmental abilities (cf. the distinction made by Jolls and Sunstein 2005 between insulating and debiasing measures, and the debiasing framework suggested by Fischhoff 1982b).

An apparent drawback of this approach is its narrowness in tackling hindsight bias one context at a time. However, we believe this relative disadvantage is an illusion. The premise of this analysis is that context specific characteristics are very important when deciding whether and how to correct for hindsight bias. Hindsight bias is a basic facet of human cognition, so it does not seem likely that a one-size-fits-all fix will be found to correct for it. Therefore, even general debiasing mechanisms must expect to be tailored to specific contexts. Indeed, general attempts that show relative success in the lab sometimes fail in specific domains, as will be discussed below. Furthermore, when solutions are developed within a certain system, this does not mean that their application is limited to that system. In trying to cope with hindsight bias in a

specific context, the pool of coping mechanisms to be considered should include both general measures and domain specific measures within other fields.

In this chapter we attempt to provide such a pool by surveying the coping measures that have been developed by research in both approaches. We also attempt to point out further avenues for debiasing that we believe have not yet been sufficiently explored, drawing from strategies that have proven useful in addressing other biases and from the theoretical literature on the operation mechanisms of hindsight bias. For each measure which shows some promise, we will attempt to characterize the types of contexts for which it is likely to be most useful. The measures discussed in this chapter are summarized in Table B (p. 68), which includes a short description of each measure, an estimation of its effectiveness, and a characterization of the domains for which it might be useful.

5.1 General coping measures

In this section we organize debiasing measures according to their locus of action. First we discuss measures that intervene with the judgment task, adding elements that attempt to direct the decision maker to better judgment. Then we discuss measures that attempt to change the decision maker, making her better able to handle hindsight tasks more generally.

5.1.1 Measures that focus on the task

5.1.1.1 Motivational measures

Motivational measures attempt to improve performance by increasing subjects' motivation to perform well, and ensuring that what they want to do well is indeed what the task requires (i.e. people should be motivated to accurately assess prior knowledge, rather than appear smart in hindsight). Motivational measures are expected to improve judgment when the source of the bias is lack of sufficient effort (Arkes 1991; Larrick 2004). Such measures have absolutely no effect on hindsight bias. Attempts include providing monetary incentives (Hell et al. 1988; Camerer, Loewenstein, and Weber 1989), prompting subjects to try harder (Fischhoff 1977), and informing subjects that they will be held accountable for their performance (Kennedy 1995). The

failure of these measures is not surprising, as the source of hindsight bias is primarily cognitive, not motivational (see chapter 2).⁴ We therefore expect measures that involve changing the cognitive strategies with which people approach the judgment task to be somewhat more fruitful.

5.1.1.2 Clarifying the task and raising awareness

Manipulating instructions in an attempt to clarify the judgment task is completely ineffective in mitigating hindsight bias. Such attempts include asking subjects to answer as they would have answered had they not known the actual outcome, and asking them to answer as they believe similar subjects without outcome information would have answered (Wood 1978; Fischhoff 1975). Providing warnings and detailed information regarding hindsight bias is similarly ineffective (Sharpe and Adair 1993; Pohl and Hell 1996). This indicates that people lack the ability to judge correctly in hindsight even when they understand what they are expected to do and are consciously trying to avoid hindsight bias.

5.1.1.3 Calling attention to alternative outcomes

The cognitive measure that has been most consistently successful in reducing, though not eliminating, hindsight bias is increasing subjects' attention to counterfactual outcomes by asking them to list possible alternatives to the outcome reported or to generate reasons for alternative outcomes (Arkes et al. 1988; Lowe and Reckers 1994; Slovic and Fischhoff 1977; Sanna, Schwarz, and Stocker 2002). For this technique to work, list generation is necessary: simply asking subjects to consider alternative outcomes before making judgment is ineffective (Kamin and Rachlinski 1995).

It should be noted that this technique can backfire when thinking of alternative histories is experienced as too difficult (Sanna, Schwarz, and Stocker 2002). These authors found that listing a small number of hypothetical histories attenuates hindsight bias while listing a large number exacerbates it, probably because the difficulty of thinking of many alternatives makes

⁴ Motivational factors do affect hindsight bias when the situation is self-relevant, as discussed above. However, this is not because the mechanism of hindsight bias itself is motivational, but because motivational factors cause a self-serving bias that can either counter hindsight bias (in negative self-relevant situations) or amplify it (in positive self-relevant situations).

the possibility that events would have turned out otherwise seem less likely. Another interesting caveat is that this technique did not appear to be effective when subjects were professional judges evaluating auditors (Anderson et al. 1997). The authors speculate that perhaps their experience in ex-post reasoning makes judges unwilling to consider hypothetical alternatives. We will return to the theoretical implications of this issue in section 5.1.1.4. In practical terms, this puts in question the usefulness of this measure in contexts where judges are the evaluators, though further research is necessary to validate this single experimental finding.

The advantage of this measure is that it is very simple, and its costs are very low. It is most appropriate for use in formal contexts where it can be incorporated as part of the task. In the legal context, it could be very useful for juries and experts who can be clearly instructed by judges before decision making. Since judges function both as case managers and case deciders, they cannot not be instructed, and their adoption of this measure would have to be through the change of legal doctrine to require them to list in their decisions the alternative eventualities they considered. This change is a little farther from the way this measure was tested in experiments than jury instruction, and so its effectiveness requires separate study.

This measure can also be fairly easily incorporated in formal judgment contexts within organizations. Furthermore, if such methods are used regularly within a particular organizational context until they become part of the organizational culture, better judgment may be induced by habit. The effect of training and practice with this measure should also be further studied, to see if people who learn how to use it tend to adopt it also when they are not required to.

In more informal contexts, this measure can be used by politicians facing public blame, as a defensive strategy. They can urge the public to use this method, or call the public's attention to alternative outcomes that seemed likely at the time of the decision.⁵

5.1.1.4 Analytical techniques

Analytical techniques belong to what Larrick (2004) calls technological debiasing measures. The idea behind technological measures is that while human judgment may be flawed, tools and procedures can be developed which will provide the correct judgment when properly

⁵ While we believe this is an idea worth developing, we note that the effectiveness of using debiasing measures as rhetorical strategies requires separate study and connects to the literature on the effectiveness of communication strategies in general, a topic which cannot be addressed within the limited scope of this work.

applied to a task. For some types of judgment tasks, such tools can entirely replace human judgment: if the task can be completely mechanized, there will be no room for fallible judgment.⁶ However, in the case of hindsight bias there are no formal rules for arriving at a correct solution, and it is not even clear that there is one correct answer to what the ex-ante probability of an event was. Therefore, purely mechanical methods are impossible. However, it might be possible to develop judgment aids which provide a formal structure for approaching the task, mechanizing it only in part. We refer to these judgment aids as analytical techniques (following Larrick 2004) because they rest on decomposition: the judgment task is decomposed into elements, and each element is considered separately. This might work because though judgment of each element may still be biased, the decomposition process calls attention to elements that are intuitively ignored, and moderates the effect of elements that are not formally included (such as outcome information).

This direction has not been much explored in the context of hindsight bias and such methods have not yet been developed specifically with hindsight in mind, though there is much interest in such decision aids in the context of making predictions and choosing optimal courses of action.

One such analytical method, in which people can be trained to improve judgment in hindsight, can be developed based on Kahneman and Tversky's (1982) corrective procedure for improving intuitive predictions. Kahneman and Tversky argue that people often fail at predictions because they overuse singular information relative to distributional information. People predict based on their understanding of the unique event under consideration, and fail to take into account the distribution of outcomes for similar events. When considering an event in isolation, it is impossible to take into account all the random or unknown factors that will affect its outcome, and so people discount such factors and predict based only on the properties of the specific event. However, the distribution of similar events incorporates this information, and so holds valuable information that should be taken into account. The procedure they suggest for doing this is as follows: define a class of events comparable to the event in question; estimate the average distribution for that reference class; make an intuitive prediction based on impression; assess the predictive value of one's impressions based on past experience; and adjust the intuitive

⁶ A good example for this is accounting procedures (Arkes 1991). Accountants are able to avoid the sunk cost effect (at least when they are analyzing the books) because there is no place for them in standard accounting procedures.

judgment accordingly, making it closer to the average distribution. This procedure is implemented in many policy contexts and is known as reference class forecasting (Flyvbjerg 2006).

The relevance to hindsight bias is based on the fact that the cognitive mechanism at play is the same: people prefer narrative thinking and tend to discount random factors. When judging in hindsight, this implies creeping determinism. Once the outcome is known, it is incorporated into a coherent account of events, rendering it difficult to think of all the other potential outcomes, and those that might have occurred in similar cases. By exposing evaluators to distributional data when estimating the predictability of a known outcome, it may be possible to moderate the narrative effect. Of course, hindsight might affect aspects of this analytical process as well – for example, to which class of events the event in question is deemed comparable, or how good predictions are expected to be in general. But this method would still call attention to relevant information that is usually ignored, and to alternative ways that similar events have turned out.

Obviously, this method cannot be employed indiscriminately. Not all events can be assigned meaningful reference classes. Some events are essentially unique. For example, attempting to compose a reference class for the war between the Gurkas and the British (the case studies used in Fischhoff's original experiments) would be absurd. However, for some events, such as medical outcomes, it seems a plausible idea. For this method to be useful, the environment must be structured in a way that provides the necessary distributional data. This requires composing records that can be subjected to systematic statistical analysis and making predictions that can be evaluated so that the predictability of outcomes in certain fields can be calculated (as suggested by Fischhoff 1982a).

While more research is needed, it seems likely that this method would benefit formal judgment contexts in fields where events are regular. For this measure to be applicable, it is also necessary that the relevant decision makers be trained in carrying out the procedure. Therefore, the prime candidates for benefiting from this measure are internal investigations and judgment procedures in organizations that regularly moderate outcomes. Most of the cases of legal determinations discussed in chapter 4 might also potentially benefit from this method, especially determinations of liability. However, it might be more difficult to train judges in this technique,

because they do not possess subject matter expertise which might be necessary for analyzing a case in comparison to its reference class.

Decision analysis is another analytical procedure that can be adopted for hindsight bias (see for example Bursztajn et al. 1984). There are many different variations on decision analysis, but the basic idea is to decompose and analyze decision alternatives in a way that will identify the alternative which maximizes expected utility. In hindsight, this may work by recreating the original decision environment, calling attention to other choices that were available and their relative expected utility. This might highlight the uncertainty of the original decision environment, making the final outcome seem less necessary. In addition, if the expected utility of alternative courses of action is low, this will make the actual decision seem better in comparison (cf. section 5.2.1.2).

However, we are skeptical regarding the expected effectiveness of this procedure. This is because the reasoning behind reference class forecasting implies that a deep knowledge of the details of a case may in fact be a *disadvantage* for reasoning in hindsight. The more one knows of a case, the stronger its narrative coherence, and the more difficult it is to discount singular information and see the relevance of distributive information (Kahneman and Tversky 1982; Slovic, Fischhoff, and Lichtenstein 1977). When judging in hindsight, this means that there are more factors which can be enlisted as support for the outcome that actually occurred. Indeed, Pennington (1981) found that a longer event description produced a stronger hindsight bias effect than a short description. It is true that written descriptions are necessarily more coherent than knowledge gleaned from real involvement, but the mechanism behind hindsight bias suggests that people are prone to construct such coherent accounts from the information available to them.

In the case of decision analysis, we believe analysts are unlikely to come up with alternatives and assessments that make the actual outcome seem less likely, unless they are explicitly instructed to. It is more likely that because of hindsight bias, they will use the details uncovered for the analysis to strengthen support for the inevitability of the outcome that actually occurred. Nevertheless, the effectiveness of this measure is an empirical question that remains open. If it does turn out to be effective, this type of analysis carries a certain advantage, because contrary to the reference class forecasting method, it can be used for formal judgment contexts even in cases where distributive information is not available.

5.1.2 Measures that focus on the decision maker

Lab interventions that focus on the judge rather than the task are rare and generally ineffective. In this section we will first shortly discuss such attempted interventions (sections 5.1.2.1 and 5.1.2.2) and then go on to discuss the role that more general characteristics of the judge, such as different types of experience and expertise, may play in mitigating hindsight bias. Due to the paucity of empirical evidence, the latter discussion will be mostly theoretical.

5.1.2.1 Group deliberation

It would have been fortuitous if groups were less susceptible to hindsight bias than individuals, because many of the judgments in the domains discussed in this work are made in small groups rather than by individuals. Unfortunately, despite some speculation regarding the advantage of juries (Wistrich, Guthrie, and Rachlinski 2005), group deliberation (i.e. relegating the hindsight task to a group and requiring discussion until a unanimous decision is reached), seems to have no effect on hindsight bias (Bukzar and Connolly 1988; Stahlberg et al. 1995).

5.1.2.2 Feedback and retesting

Two experimental studies attempted to debias hindsight bias by providing subjects with feedback for their performance and then repeating the task (Pohl and Hell 1996; Camerer, Loewenstein, and Weber 1989). In these experiments, subjects performed tasks of judgment in hindsight (recalling their own prior estimations in Pohl and Hell 1996, and guessing those of others without outcome information in Camerer, Loewenstein, and Weber 1989). They then received feedback regarding the actual original estimates relative to their own estimations, and performed more judgment tasks of the same kind. This procedure did not affect hindsight bias.

5.1.2.3 Subject matter experience or expertise

Results are somewhat less clear regarding the effect of expertise, or experience with the type of decision that is being judged (as distinct from experience with judgment in hindsight,

which will be considered in section 5.1.2.4). Theoretically, experience with the decision context being judged should nuance hindsight judges' perception of what could have been known in advance relative to other subjects, and so attenuate the bias. If this is true, it implies that it is preferable to recruit experts when judgment in hindsight is necessary.

Nevertheless, many studies have found hindsight effects in samples of subjects with experience or expertise in different fields such as finance (Bukzar and Connolly 1988; Biais and Weber 2009), accounting (Anderson, Lowe, and Reckers 1993) and medicine (Arkes et al. 1981; Caplan, Posner, and Cheney 1991; Arkes et al. 1988; Detmer, Fryback, and Gassner 1978), and Kennedy (1995) found no effect of experience on hindsight bias within her sample. However, a meta-analysis of hindsight bias studies found the effect to be somewhat smaller among subjects familiar with the subject material (Christensen-Szalanski and Willham 1991), though that study's definition of familiarity did not distinguish between expertise and first-hand experience of the particular outcome⁷, which seem to be two quite different constructs. So it seems that while the hindsight bias definitely exists for experts, it might be somewhat mitigated.

It may also be useful to make a distinction between different types of expertise, according to the quality of expertise and overall predictability of events within a given field (see discussion in chapter 3). The fields where predictions improve with experience are those in which practitioners regularly receive accurate and timely feedbacks on their predictions – this is a condition for developing useful intuitions (Hogarth 2001). Experts who regularly receive such feedback may become more sensitive to the difficulties of prediction, while those who do not probably misremember their own predictions because of hindsight bias, and will consequently believe that making predictions is easier than it in fact is.

5.1.2.4 Experience with judging in hindsight

Section 5.1.2.3 discussed experience in making decisions in foresight within a particular professional field. This section considers the effect of experience in making assessments in hindsight. The work of judges and historians is based entirely on making retrospective judgments and assessments, and so these professional can be said to have experience in it. Since these professionals are responsible for a large portion of consequential hindsight judgments made

⁷ For example, watching a team lose a basketball game as opposed to being told the game's result.

overall, if this experience mitigates hindsight bias, it would provide a reassuring message regarding the effect of hindsight bias on society in general.

Experience with a task is usually expected to improve performance; given many attempts, people figure out how to deal with a difficult task. However, the mechanism for improving with experience relies on feedback – in order to learn by trial and error one must know when one is in error. However, historians and judges rarely if ever receive feedback regarding the accuracy of their retrospective judgments. Generally, such feedback is not even possible, because the true ex-ante probabilities of an outcome are unknown. Even if it were practically possible to devise and provide feedback for the types of tasks these professionals perform, it probably would not help, because hindsight bias seems immune to training with feedback, at least in the simple experimental settings described in section 5.1.2.2.

Also bearing on this issue is the finding that calling attention to alternative outcomes was an ineffective debiasing method with judges, though it shows fairly consistent success otherwise (Anderson et al. 1997, see section 5.1.1.3). The authors speculate that perhaps their experience in ex-post reasoning makes judges unwilling to consider hypothetical alternatives. This interesting conjecture leads us to speculate that experience in ex-post reasoning might actually make hindsight bias worse. While experts within a specific domain have experience with making decisions under uncertainty and experiencing their outcomes, judges are used to reasoning retrospectively after all the information is at hand and a coherent narrative has emerged. Consequently, judges might find it more difficult than others to recreate the original uncertainty of the environment in which the decision maker was acting. They would thus be more vulnerable to the creeping determinism which drives hindsight bias, and may suffer more from overconfidence in their professional abilities.

Contrary to these conjectures, Fischhoff (1982b) actually suggests that historians may be more immune than others to hindsight bias; but not due to experience per se. Judges and historians differ from others not only in their experience but in the special training they receive. At least with regard to historians, Fischhoff (1982b) suggests that their training contains elements that prepare them for retrospective reasoning. We discuss this possibility in the next section.

To substantiate this speculative discussion, it would be interesting to see if these professionals indeed differ from laymen with regard to hindsight bias. We know that judges do

exhibit hindsight bias (Anderson et al. 1997; Rachlinski, Guthrie, and Wistrich 2011; Jennings, Lowe, and Reckers 1998; Guthrie, Rachlinski, and Wistrich 2007; Anderson, Lowe, and Reckers 1993; Guthrie, Rachlinski, and Wistrich 2009), though we do not yet know if they fare better or worse compared to non-judges, and we know nothing regarding the quality of retrospective judgments of historians.

5.1.2.5 Professional training: analysis of primary sources

While merely increasing awareness of the bias and training by retesting are ineffective, as noted above, professional training may have a different effect. This is especially true to the extent that training incorporates methods that can be used in overcoming the bias.

Fischhoff (1982b) suggests that historians' training might be useful in overcoming hindsight bias because of its focus on primary sources, such as historical documents containing first-hand accounts of how the past was perceived. To the best of our knowledge it has not been tested whether reliance on such primary sources attenuates hindsight bias. It would be very useful to know this because many acts of judging in hindsight do in fact rely on examining primary information on what people thought in the past, rather than just basing judgment on event descriptions as typically occurs in experimental studies.

Davies (1987) and Hoffrage, Hertwig, and Gigerenzer (2000) have conducted research that provides some indication that this approach might be fruitful. These studies use a memory design, testing people's recall for their own probability estimates after receiving outcome information, and show that when subjects are provided with the notes they took in the foresight prediction phase, they show less hindsight bias in recalling their predictions. Of course, in this case the notes may serve simply as a memory cue, so it still has to be tested whether providing notes is an effective debiasing technique when estimating what others could have predicted. This method may work in a similar way to asking subjects to consider alternative outcomes, because primary material would probably include unconsidered reasons for the likelihood of alternatives.

On the other hand, historical methodology also includes gathering a wealth of data on individual events. As discussed above, an abundance of details may serve to exacerbate hindsight bias, because people focus on the extra details that support the actual outcome, discounting contradictory information. More supportive factors mean stronger narrative coherence, and a

stronger feeling of creeping determinism. Even concrete evidence on what was thought before events may be filtered in this way, with only evidence supportive of the actual outcome seeming consequential. According to this reasoning, historical methodology may actually contribute to hindsight bias. Indeed, historians are probably the profession most often accused of being wise in hindsight.

However, we nevertheless hold that some types of information lend themselves more easily to creative interpretation in hindsight than others. Rigorous adherence to primary documents (as opposed to ex-post interviews, for example) may check, at least to a certain extent, the story-telling tendencies of historical analysis. In disciplines such as history where events are unique and trading depth of analysis for information on the frequency of similar events is not an option, it would certainly be worth exploring how effective this methodology in fact is in coping with hindsight bias.

Like historians, judges too rely on primary evidence when making judgment, but it is not clear to us to what extent their training includes analysis methods similar to that of historians. Another question is whether, assuming the analysis of primary sources does attenuate hindsight bias, training and experience in this method will improve judgment even when the method itself cannot be employed, i.e. because primary sources are not available. If this method is indeed effective, another consequence is the importance of structuring the environment in a way that makes it possible, i.e. by keeping records of deliberations and information available at the time of decision making (as suggested by Fischhoff 1982a).

5.1.2.6 Distance from events

Our analysis regarding the effect of abundant information on hindsight bias implies that in some cases a deep familiarity with the details of a case may in fact be a *disadvantage* for reasoning in hindsight. The more one knows of a case, the stronger its narrative coherence, and the more difficult it is to discount singular information and see the relevance of distributive information (Kahneman and Tversky 1982; Slovic, Fischhoff, and Lichtenstein 1977). Therefore, in cases when distributive data is available, it may be preferable when judging in hindsight to

conduct an independent inquiry by a neutral analyst rather than an internal investigation by someone deeply involved in the details of an event.⁸

5.1.3. Interim conclusion

To sum up so far, we reiterate the position of many previous researchers of hindsight bias, concluding that it is extremely difficult to eliminate and even mitigate hindsight bias. Part of this is due to the fact that in contrast to many biases of intuitive judgment, there is no known formal solution to the problem, so debiasing is not just a matter of inducing people to work with system 2 rather than system 1, to use Kahneman's (2011) famous terms. There is no systematic way to make predictions under unique circumstances based on ambiguous and partial information. This is a task that must be performed using intuition. Therefore, when this task must be repeated once outcome is known, it will also be done in intuition, and it would seem hard to obtain an intuitive judgment which disregards outcome information.

The measures we discussed for which there is some evidence (theoretical or empirical) of being effective all work by *focusing attention on relevant information other than outcome*, and more specifically on information regarding the possibility that things would have turned out otherwise. These include listing reasons for alternative outcomes, requiring the use of distributive information on the way similar events turned out, and considering evidence from pre-outcome decision making processes on how people actually believed things would turn out.

The problem with hindsight bias is that people are naturally disinclined to consider such information, even when they are aware of the effect of hindsight. Therefore, it seems that general training in such methods (i.e as part of a critical thinking skills education program) would be ineffective. They have to be included within the framework of performing a specific task (though they *might* be effective as part of a training program for performing specific tasks). For this reasons, these measures are only relevant for formal judgment contexts, where they can be formally incorporated. In these contexts too they are expected to be only partly effective.

⁸ This analysis demonstrates the problem with Christensen-Szalanski and Willham's (1991) conflation of subject matter expertise and personal involvement into one construct they call *familiarity*, which reduces susceptibility to hindsight bias (as discussed earlier in this chapter). According to our analysis, subject matter expertise may reduce hindsight bias because experts have experience with the uncertainty of their domain of expertise, while deep familiarity with a *specific* case might exacerbate hindsight bias by providing more context specific detail which makes events seem deterministic.

In addition, we speculated on types of experience and training that may affect hindsight bias. This issue is relevant for deciding which individuals should be preferred for performing hindsight tasks, and what type of training is relevant for those expected to be in a position to regularly perform such tasks. This discussion leaves many open questions which warrant further research, including the effect of subject matter expertise and retrospective decision making experience on hindsight bias. Further important open questions are whether excessive exposure to the details of a case indeed exacerbates hindsight bias in real-world contexts as we theorized, and whether distributive data has an attenuating effect.

In the next section, for the most part we discuss ways to design systems to work around hindsight bias, rather than attempts to mitigate it directly. These measures are generally more effective than those detailed in this last section, but they also often incur heavier costs.

5.2 Context specific coping measures

Most of the coping mechanisms discussed in this section were developed for the legal arena. Courtrooms are fora in which the formal requirement to reassess what could have been known is most common (as argued by Wistrich, Guthrie, and Rachlinski 2005, see also chapter 4). As a result, most proposals for context specific coping mechanism have arisen out of concern for the fairness of this system. Furthermore, it has been argued that over many years of judging in hindsight, courts have evolved ways of maintaining fair judgment despite hindsight bias, using specific features of different judgment contexts (Rachlinski 1998).

Relying loosely on Fischhoff (1982b), we will arrange the measures to be discussed according to the following categories, from the least to most extreme: restructuring the hindsight task; correcting for judgment in hindsight; and eliminating hindsight judgment from the system entirely.

5.2.1 Measures that restructure the judgment task

By restructuring the task we mean constructing it in such a way that reduces the effect of outcome information by requiring decision makers to focus on other aspects of the judgment task. This is somewhat related to the task-focused measures discussed above which work by

calling attention to aspects other than outcome that are relevant for estimating ex-ante probabilities. However, in this section the judgment task is considered within its wider context, and this allows more possibilities for focusing attention away from outcome information. As discussed above, in most real-world contexts retrospective reassessment of probabilities is not interesting in and of itself but as an indicator of something else, such as behavior appropriateness; therefore, measures in this category can call attention to elements in the decision environment that are relevant to this judgment task directly, even if irrelevant to judging the predictability of events.

5.2.1.1 Ex-ante tests

One way to restructure a hindsight judgment task is to provide proxies for the ex-ante probabilities being estimated, so that decision makers do not have to assess them directly. Rachlinski (1998) describes how under certain circumstances, courts have adopted tests of compliance with ex-ante norms as a supplement for direct assessment of decision reasonableness in negligence judgments. Professional custom and government regulations are examples of such ex-ante norms. Admittedly, it is not always clear what the professional custom is, and how certain norms apply to specific actions, and outcome information may affect these determinations as well. This mechanism will be better, the more comprehensive and clear cut are the ex-ante norms, and the more information is available regarding compliance with them.

It should be noted that for the most part courts do not currently utilize this mechanism to its full extent. Proof of compliance with custom or regulation constitutes evidence of non-negligent behavior, but not conclusive evidence, and the court reserves the right and duty to determine directly what constitutes reasonable care (a construct still anchored on the foreseeability of harm).⁹

Deference to professional custom is rather common in cases of medical malpractice, perhaps because judges recognize the great degree of expertise medical practice requires (Rachlinski 1998). However, determining what constitutes customary medical care is not a simple task. In the medical profession especially the application of protocols and guidelines in

⁹ Some liability regimes do completely substitute negligence judgments with proof of compliance with laws or regulation; these are “no liability” systems that attempt to eliminate hindsight judgment entirely, and which will be discussed in section 5.2.3.1.

retrospect is difficult. Comprehensive up to date guidelines are only available for a small minority of conditions, and even then they very rarely fit the particular case exactly. Decisions regarding medical treatment are made on a case by case basis, and such decisions cannot usually be wholly guided by definitive rules (Hugh and Dekker 2009). When judges defer to medical custom, they must judge based on expert testimony, and they are sometimes required to choose between the views of conflicting experts (Hugh and Dekker 2009). Furthermore, expert testimony is also subject to hindsight bias, as discussed in chapter 4. Therefore, when using ex-ante norms as a way to avoid hindsight bias, it is essential not only that a strong professional culture exist, but also that the application of professional norms is straightforward.

Proxies for retrospective probability estimations need not be only norms. In the case of patent law, courts have increasingly supplemented the test of obviousness, which induces hindsight bias (as discussed in chapter 4), with secondary tests, such as whether the invention fulfilled a long felt need, or the commercial success of an invention (Rachlinski 1998).

There may be other proxies used by judges that have not yet been codified. An example for this may be found in determining probable cause when deciding whether evidence obtained without a warrant is admissible in court. In a study by Rachlinski, Guthrie, and Wistrich (2011), judges made similar probable cause judgments regarding the legality of a police search, whether or not they received information regarding the outcome of the search. At the same time, the judges did exhibit hindsight bias when estimating the probability that the search would yield evidence of criminal activity. This is surprising because the legal definition for probable cause includes a requirement that the ex-ante likelihood that criminal activity took place should exceed a certain threshold (Taslitz 2010). Therefore, we would expect a biased estimation of ex-ante probability to result in a biased judgment of probable cause. In a preliminary study with similar findings, the authors suggest that perhaps despite the legal definition, judges do not rely chiefly on estimations of prior probability when ruling on probable cause, but rather use rules of thumb that address common situations – for example certain types of claims by police officers (i.e. vague assertions regarding the smell of drugs) may or may not be conceived as reflecting probable cause (Wistrich, Guthrie, and Rachlinski 2005).

An important characteristic of this judgment context is that judges are required at different times to judge probable cause both before an outcome is known (when granting a warrant) and afterwards (when operational urgency prevents obtaining a warrant in advance).

Therefore, judges have an opportunity to generalize across these two types of judgment, obtaining non-biased rules of thumb. In many other contexts, where judges make decisions in hindsight only, rules of thumb that develop may be too stringent.

This is in line with our previously stated argument according to which experience in reasoning under uncertainty within a particular domain may attenuate hindsight bias. Other ex-ante tests as well should, and generally are, developed by individuals who have experience making decisions in the relevant domain and experiencing both positive and negative outcomes.

To conclude, despite their limitations, ex-ante tests seem appropriate debiasing mechanisms for situations that are regular enough to allow reliable tests that can be applied in a straightforward manner. For more unique situations, such tests may not be available, while in highly complex situations, the ruling on such tests in hindsight may be severely biased as well. A further point worth noting is that this measure is only relevant for situations where the purpose is to evaluate behavior, and not when the purpose is learning from experience. Learning from experience contexts generally require the reexamination of ex-ante tests in light of outcomes.

5.2.1.2 Drawing attention to alternative stakeholders

Another way to restructure the task is to redefine the context of the decision being judged so that other factors are taken into account besides responsibility for outcome. Using a debiasing method of this type, Anderson et al. (1997) managed to eliminate the outcome bias¹⁰ entirely among judges evaluating the appropriateness of an audit decision. The context of the decision was a case where an acquiring company is suing for damages for an auditor's failure to correctly predict the acquired company's prospects. The authors asked the judges to list all the stakeholders who would have been harmed had the auditor made an alternative assessment that would have turned out wrong. By "redefining (clarifying) the auditors' responsibility as one that includes a responsibility to a variety of stakeholders" (Anderson et al. 1997, 24), this measure may make the decision seem reasonable even if the probability of the outcome that in fact occurred is still perceived as higher than it actually was.

¹⁰ It should be recalled that the outcome bias refers to the effect of outcome information on evaluation, while hindsight bias to the effect of outcome information on probability estimations.

Alternatively, this mechanism may improve judgment on probability assessments directly. As noted by the authors, making judges think about how alternative courses of action could have turned out badly as well calls attention to the ex-ante state of uncertainty, essentially recreating the decision maker's dilemma. Requiring judges to consider alternative courses of action that may have resulted in negative outcomes may make the advantages of the chosen course of action seem more dominant in comparison and its (realized) negative outcome less likely in foresight.¹¹ Unfortunately, the authors did not ask the subjects for probability assessments, so we do not know which explanation is more likely. A replication of this study with probability assessments would be necessary to better understand the mechanism which drives this measure. If this measure improves probability assessments as well as responsibility judgment, it would be more accurately characterized as a general debiasing measure (as those discussed in section 5.1). In addition, this would mean that it might be an effective measure for contexts where the purpose is learning from the past, as well as evaluation of behavior.

In any case, the success of this rather simple debiasing measure is promising, and it would be interesting to see whether it would work in other fields, and in cases where the negative consequences of alternative courses of action would have pertained to the same stakeholder. For example, in the field of medical malpractice, would it help reduce biased judgment to call attention to what might have been the consequences to the patient had the physician made a different diagnosis and been wrong?

Because it requires instructions, the usefulness of this measure is limited to formal contexts, as well as to informing defensive strategies for those being judged in informal contexts (similar to the "listing alternatives" measure, see discussion in section 5.1.1.3).

¹¹ This measure brings to mind the 'listing alternative outcomes' measure discussed in section 5.1.1.3, because both involve drawing attention to hypothetical scenarios of how things could have turned out otherwise – alternative outcomes of the actual decision, or possible outcomes of alternative decisions. A comparative advantage of this measure in the context of judging responsibility for negative outcomes ex-post is that the alternative scenarios are also negative. Because people react more strongly to negative information (as discussed in chapter 2), the alternative positive outcomes that would be raised in the 'listing alternative outcomes' measure may not be dominant enough to draw attention away from an actual negative outcome.

5.2.1.3 *Calling attention to consequences of judgment (rebiasing)*

Clarkson, Emby, and Watt (2002) managed to effectively eliminate the outcome effect in the context of an auditor negligence trial as well. They did this with jury instructions that stressed the negative consequences (professional and financial) to the defendant of being found responsible for not foreseeing a client's failure.

This mechanism may seem completely unrelated to hindsight bias itself – in the sense that it is just adding another bias to the system, but this time one that works for the defendant. This setup supposedly creates a situation where the biases cancel each other out, resulting in improved judgment. Indeed, the authors use a “fight fire with fire” metaphor to describe their debiasing measure, and mean it to be used mostly as a defense argument by a defendant's advocate, not as an element of the justice system.

It should be noted that this type of manipulation can serve both sides of the case. In situations where the plaintiff naturally commands more sympathy, such as most cases of personal injury, it would probably be a lot less effective as a balancing force to hindsight bias. In those cases, the plaintiff's side can retaliate with the exact same type of fire, and stronger.

Nonetheless, in principle we should not be above using people's biases to design our systems to improve judgment. As argued by Thaler and Sunstein (2008), the environment in which peoples make decisions is never neutral and always biased in one way or another, so we may as well arrange it to optimize judgment. Creating a system where biases cancel each other out is not necessarily a bad option when care is taken that the result is in fact balanced, or at least more balanced than the alternative. If negligence trials are biased in favor of the plaintiff,¹² it may make sense to incorporate rebiasing mechanisms in the justice system. In any case, it seems worthwhile to pursue further research on what type of biases, cognitive or otherwise, may work consistently and proportionately to the advantage of defendants (or those being judged in non-legal settings) in contexts where they are disadvantaged by hindsight bias.

¹² It should be noted that the mere existence of hindsight bias does not prove that they are, because other aspects of the system might favor the defendant (see Peters 1999 for a discussion).

5.2.2 Measures that correct for biased judgment

These measures aim to improve the overall output of the system by correcting for biased judgment, rather than attempting to improve or avoid it.

5.2.2.1 Changing the evidentiary standard

The main tools for regulating the severity of judgment in the legal system are the standards of proof (to what degree of certainty must a case be proven) and the burden of persuasion (which side is required to prove the case). In tort cases the burden of persuasion is generally on the plaintiff, who is also usually the side benefiting from hindsight bias. On the other hand, the standard of proof is usually defined as “preponderance of evidence” which means that to prove the case it is necessary to prove only that the evidence is stronger for one side than the other, even by the smallest margin. Given hindsight bias, this low standard of proof probably makes the case too easy for the plaintiff to prove. In order to correct for over-demanding hindsight judgment, the standard of proof could be changed to “clear and convincing case”, which means the case must be proved to a higher degree of certainty (usually perceived to be about 70%, see Jolls, Sunstein, and Thaler 1998). Changing the evidentiary standard is rarely done but is possible when there is a good public policy reason to make claims difficult to prove, or a serious risk of deception (Rachlinski 1998). In the context of hindsight bias, this measure is suggested by Rachlinski (1998) and Jolls, Sunstein, and Thaler (1998).

A higher evidentiary standard may work as a buffer protecting a defendant from hindsight bias. If hindsight bias causes judges to think that a case against a defendant is about 20% stronger than it actually is, this mechanism would correct for the bias. However, there is no clear data on the exact size of the hindsight effect, and it stands to reason that it will differ across different types of cases. It would therefore be difficult to know if this mechanism adequately balances the hindsight bias, or perhaps under or overcompensates for it. This is important because there are social costs to making judgment too lenient as well. Conversely, there is some evidence that despite their legal importance, evidentiary standards have no effect on court decisions, at least in cases tried by jury (Kagehiro and Clark 1985). So it is not clear how effective this mechanism is within the legal system.

Extrapolating from this formal legal measure to non-legal contexts yields a rather general directive that those being judged in hindsight should be treated leniently, or with the benefit of the doubt. The Winograd Commission Report (2008) imposed such a measure on itself, claiming that it in order to counter hindsight bias it had “avoided passing judgment where the fault was not clear and evident from the facts” (p. 62) – in essence, setting a higher bar for actions worthy of censure. While it is hard to know how such spontaneously expressed declarations of intended leniency affect the final judgment, it seems likely that if the declaration is sincere, the inclination towards leniency will indeed be expressed in the final judgment.

However, it would probably be more difficult to correct for hindsight bias this way with an external directive to evaluators who do not independently see reason to be lenient. Such a directive would have to be accompanied by a rather convincing argument as to why lenience is required. It is not clear if simply citing hindsight bias as an argument for leniency would be sufficient: merely raising awareness to hindsight bias is ineffective in prompting less biased judgment, as discussed above

The debiasing measure developed by Clarkson, Emby, and Watt (2002), discussed in the previous section, may in fact have operated in this way, essentially prompting jurors to judge leniently by engaging their sympathy. In this study the authors also had success mitigating the outcome bias with jury instructions that stressed the *unfairness* of taking outcome information into account when judging appropriateness of behavior.

Another direction for making such directives more effective is to have them ingrained in an organization’s culture. When injunctions gain prominence within an organization and reach a status of organizational maxims or mottos they may have an effect on workers’ behavior, especially when they are phrased in a catchy way or refer to a vivid case in the organization’s history where the bias had a deleterious effect (see Heath, Larrick, and Klayman 1998 on how such cultural norms within organizations may operate as cognitive repairs). On a larger scale, perhaps a society can become by education more forgiving towards past decision making (as recommended by Fischhoff 1982a). This type of awareness is not expected to change the ability to make proper retrospective probability judgments, only the degree of confidence at which censure for bad decisions is perceived as appropriate.

5.2.2.2 Incorporating more incidents in the analysis

Another way to correct for hindsight judgment is to decrease the weight given to it by incorporating similar incidents with different outcomes in the analysis. Since the problem of hindsight bias is overlearning from a single incident, enlarging the pool of cases investigated may provide more information that can serve to cancel out the spurious connections deduced from a single dramatic event. March, Sproull, and Tamuz (1991) discuss ways to enlarge the amount of data used when attempting to learn from a single event. Some of their suggestions would seem to exacerbate hindsight bias. For example, experiencing single events more richly would probably just uncover more spurious causes for the outcome, as discussed above. Other suggestions are more promising, such as composing ‘near histories’ or ‘hypothetical histories’ for inclusion in the analysis. This means learning from events that did not happen but could have. In organizations where safety is a main concern this is often done by the investigation of ‘near misses’ – incidents in which accidents almost occurred.

The investigation of near misses follows a logic which is opposite to that of the hindsight bias: the event is analyzed as if it were an accident, i.e. the benign outcome is not perceived as inevitable but considered to be due merely to good luck. In most organizations there are many more near misses than actual adverse events (Barach and Small 2000), and so learning from near misses provides significantly more data from which dangerous properties of the system can be deduced, and may reduce the influence of chance aspects of an actual adverse outcome. In the literature on safety in organizations this is considered good practice and has been found to increase safety significantly, as long as it is executed by an effective system for reporting and analyzing such incidents (see discussion by Barach and Small 2000).¹³

Cognitively, the most effective type of events for combatting hindsight bias are events that ‘almost happened’ and not just ‘could have happened’ (a distinction developed by Kahneman and Varey 1990), though both fit the common definition of ‘near misses’ (used for example by Barach and Small 2000). Events that almost happened are those where clear aspects of the event point to the proximity of a negative outcome (i.e. safety measures are neglected in a hospital and a patient falls but is not injured), while those that could have happened are events

¹³ Of course, most of this effect is probably the result of more data in and of itself, not of correcting for what is (over)learned from actual adverse events. We still consider this a corrective mechanism because it reduces the relative importance of biased judgment in the overall learning of an organization.

where it is discovered that dangerous conditions that could have led to bad outcomes prevailed without occurrence (i.e. safety measures were neglected but nothing happened). While the former encourages counterfactual thinking on what could have happened, the latter induces hindsight bias – the benign outcome seems inevitable, performance is judged as adequate and as a result overall risk is perceived as lower (see an experimental investigation of this idea at Dillon and Tinsley 2008).

It would be interesting to know if it is possible to shift an organization's perception of what is an 'almost happened' event and what is just a 'could have happened' event. This would be useful for increasing the pool of events to be learned from and allowing the organization to identify recurring weaknesses without resorting to overlearning from single incidents. Certainly organizations advocating 'safety culture' attempt to do this by instituting strict norms regarding safety measures and formal reporting and investigation systems for even seemingly trivial safety lapses.

While analyzing near misses increases the number of events that can be compared to the event judged in hindsight, this mechanism is still useful only for contexts in which events are fairly regular. For more unique or historical events, it would be difficult to compose convincing hypothetical histories, and these would surely be less compelling than the vividness of actual events. Even in realms where this mechanism can be implemented, it is difficult to counter the strong emotional effect of outcomes that did occur (March, Sproull, and Tamuz 1991), and some overlearning will probably still occur.

Beyth-Marom and Zakay (1987) suggest using such a measure in the context of commissions of inquiry. They recommend conducting routine investigations at a similar scale for a larger class of cases, including positive events. However, this seems impractical because of the high profile of investigations conducted by commissions of inquiry, and in any case, it is only relevant when a comparable class of events exists, which may be true for accidents or natural disaster but not for most cases investigated by commissions of inquiry. Therefore the relevance of this measure is limited mostly to learning in organizations.

As an aside it is worth noting that though the idea of this mechanism is to improve learning in the system overall after resigning to the fact that the learning possible from event outcomes is limited and biased, it seems theoretically possible that such practice with alternative

histories would also serve to reduce the hindsight bias directly. Research on this question would be of much interest.

Another suggestion of March, Sproull, and Tamuz (1991) for increasing the data used when learning from single events is to collect diverse interpretation of the same occurrence. This resonates with Fishhoff's advice not to restrict oneself to one method of inquiry and to seek several independent interpretations of history because "several imperfect readings of history are better than none at all" (Fishhoff 1982a, 351). Though "wisdom of the crowds" is a popular idea, it is of limited value in cases such as this when people tend to be biased in the same direction (Surowiecki 2005). And indeed, group deliberation is ineffective in countering hindsight bias (see section 5.1.2.1). Nevertheless, it should be kept in mind that while the events in an experiment are usually clear cut, in real life the nature of outcomes is often a source of debate – it is not always clear what occurred and whether it is positive or negative. Therefore, diversity of opinion regarding the nature of the outcome may provide more information for improving learning. This would seem to be especially true for complex large scale unique events for which the nature of outcomes is most likely to be contested. Interpretations of the nature of outcomes affect also the assignment of blame, so this measure is relevant also for judgment contexts. Especially, it points towards the advantage of holding an open public debate with regard to political blame (contrast this to the discussion in 4.2.2 which suggests that public fora are more sensitive to hindsight bias than commissions of inquiry).

A limitation of this idea is that the purpose of retrospective judgment in most real-world contexts is to reach a coherent unified account of past events which allows taking action (March, Sproull, and Tamuz 1991). So it is not clear how to make this mechanism useful. Perhaps diverse interpretations can be cultivated at an earlier stage in the judgment process, creating a wider basis for drawing conclusions, similar to the role of dialectical inquiry and devil's advocacy in avoiding groupthink in strategic decision making (see Schweiger, Sandberg, and Ragan 1986).

5.2.3 Measures that eliminate the judgment task

5.2.3.1 Abstaining from judgment

The most extreme method available for coping with hindsight bias is simply abstaining from all evaluation of decisions made in the past. Some liability regimes take this approach, in either of two opposite ways. Absolute or strict liability regimes eliminate hindsight judgment by making actors liable for the outcomes of their behavior without requiring proof of fault. Conversely, other liability regimes provide immunity from hindsight bias by adopting a “no liability” rule, denying injured parties the right to sue for damages (Rachlinski 1998; Arkes and Schipani 1994). A middle ground includes various types of limited liability where fault need not be proven but compensation is limited.

This undoubtedly solves the problem of hindsight bias, and such systems have other advantages, such as cutting litigation costs and expediting compensation for victims. Expanding such systems to more areas of tort law is a key element of many proposals for tort reform (see Weiler 1993 for an interesting discussion in the field of medical malpractice and O’Connell 1985 for a more general proposal).

A key issue that should be considered in deciding whether one of these liability regimes should be implemented is their implications for accountability. A fault system has the advantage of clearly assigning blame to those at fault, which serves a normative function. This function is lost when switching to a no-fault system of whatever type. While the literature on hindsight bias indicates that such blame is often assigned unfairly, a no-fault system means that also those who deserve censure will not be held accountable. Therefore, the social importance of accountability should be taken into account when designing a liability system for a particular field, as in when considering abstaining from hindsight judgment in other contexts. Excessive censure may be a fair price for demanding accountability of those actually at fault. The resolution of this dilemma also depends on the expected size of the hindsight effect in a particular context and on the availability of less drastic debiasing measures.

This measure is also relevant for situations where the purpose of judging in hindsight is learning. Some human factors experts hold that learning should be proactive and not reactive, and stem from identifying problems by examining operations only before things go wrong

(Gopher 2004). However, while protecting from hindsight bias, this measure may entail missing the lessons that can be legitimately deduced from experience, to the extent that such lessons exist. In addition, abstaining from judgment is not always a feasible option because the lessons are often compelling and arise spontaneously without the task of retrospective judgment being undertaken intentionally.

5.2.3.2 Suppressing biasing information

It is possible to avoid hindsight judgment without abdicating judgment altogether by limiting exposure to outcome information. If information is presented to the evaluator of a case in a way that does not expose how events turned out, hindsight judgment will be avoided and judgment will be limited to what was known at the time of the decision itself.

The formal mechanism for suppressing outcome information in the legal system is trial bifurcation. A bifurcated trial consists of two parts. In the first a legal determination is made without outcome information, and depending on this determination, the trial will either be concluded or proceed to a second part in which outcome information is introduced. For example, in the context of negligence, in the first part information will be presented regarding the decision environment, behavioral norms and the actual allegedly substandard decision. If it is determined that proper standard of care was lacking, outcome information will be introduced in the second part in order to determine causality and harm. This method has been suggested for determinations regarding the legality of a police search (Casper, Benedict, and Kelly 1988), medical malpractice (Poythress, Wiener, and Schumacher 1992) and patent validity (Mandel 2006). However, in practice, use of trial bifurcation is rare (Poythress, Wiener, and Schumacher 1992).

A major objection to this method is that the very fact that an incident is being tried at court or investigated provides information that a negative outcome has occurred, and so this method does not in fact shield from outcome information (Rachlinski 1998). However, there is some evidence that such general information is less biasing than detailed information (Arkes and Schipani 1994). Furthermore, bifurcated trials do tend to be somewhat more pro-defendant, suggesting correction for the hindsight-biased unitary trial (Poythress, Wiener, and Schumacher

1992).¹⁴ If so, this method may reduce hindsight bias but it would still seem far-fetched to say it eliminates it.

Further practical problems with the implementation of this method have also been raised, mostly with regard to the feasibility of maintaining secrecy regarding the outcome (Poythress, Wiener, and Schumacher 1992). Courts are adversarial systems, not carefully architected laboratory tests. When one of the arguing sides has a clear interest in making the adjudicator of the case aware of an outcome, even by insinuation, it would be difficult to prevent this.

Another concern we would like to raise is that even if outcome information were successfully suppressed, the presentation of the ex-ante situation would probably be influenced by hindsight bias. In retrospect, evidence consistent with the actual outcome seems more relevant and important than other evidence (Fischhoff 1975). As the presenters of the case would necessarily be aware of the outcome, we would expect their selection and presentation of the evidence to be biased (even before considering their vested interests), thus biasing the adjudicator of the case's perception of events even without outcome information.

Jolls, Sunstein, and Thaler (1998) have an interesting suggestion for preventing the assumption that an outcome had occurred as a result of the defendant's actions simply because a case is being tried. They propose that when possible, information regarding the action chosen by the decision maker should be denied as well. This is relevant for situations in which the structure of the original decision was a choice between two options, each of which carried a risk of harm. Both of these options would be presented in court, but not the actual choice. The adjudicators of the case may assume that an adverse outcome occurred, but they would not know as a result of which option.

Unfortunately, this proposal would probably be feasible only under very special circumstances. While in theory any decision that entails tradeoffs between different risks seems to follow such a structure (examples for this are many medical decisions, or the use of technologies that carry a risk but prevent another risk), in practice, the universe of choices is rarely if ever delineated so clearly as in the authors' proposal. One possible way to overcome this problem is by considering only options explicitly considered by the decision maker, but this does not allow for detecting negligence by failure to consider better options. On the other hand,

¹⁴ While the results of actual bifurcated trials provide limited information because trials are not bifurcated at random, experimental evidence supports this idea as well (see discussion at Poythress, Wiener, and Schumacher 1992).

deciding which options should have been considered by the decision maker is a task done in hindsight and subject to bias.

Another issue that should be addressed regarding suppression of evidence methods is that they require a clear separation of functions between the decider of a case and its manager. The latter holds all the information and is responsible for manipulating the decision environment and the information available to ensure the former is able to make a fair judgment. In practice, this means that in the legal system, such debiasing methods are only available for trials by jury, which in most countries compromise a relatively small proportion of tried cases, especially in civil law, for which this discussion is most relevant. An interesting option to consider is dividing these functions between two judges, but we are not aware of any legal system that allow for this, and we find it hard to believe judges would be receptive to it.

Shielding expert witnesses from outcome information may be more feasible, and since in many cases professional norms as judged by experts are an important benchmark for appropriate behavior, it may be no less important (see chapter 4). This idea has received surprisingly little attention in the literature (though see Hugh and Tracy 2002). As with judges and juries, though outcome information can be suppressed when soliciting an expert report, it is difficult to hide the fact that a case is being tried, which indicates that a bad outcome had occurred. We believe this can be solved more simply than with adjudicators of the case, at least for experts being nominated by the court rather than commissioned by the litigants. We propose a mechanism similar to a police lineup, according to which a witness will be presented with a few different cases of professional decisions in the relevant field, and will then have to determine if any of them were negligent. Even with this mechanism, experts would probably still be more likely to criticize the decision being judged than if the case were just introduced as part of their workload; they would know that one of the cases presented had resulted in a bad outcome and they would be looking for possible causes for that result. However, if the case is indeed non-negligent and the set of cases presented is chosen properly, the likelihood that the expert witness would find fault specifically with the scenario being tried is smaller than if it were presented alone.

The cases to be presented should be very well developed and detailed to be comparable to the actual case of concern, and they must be non-negligent but still present a non-trivial professional dilemma. Developing such cases is not a simple task, but it can be done as a one-time project (or at least one in need of only occasional updates), after which a large pool of cases

will be available for use in future lawsuits within each field. Since the police or a similar enforcement agency are not involved in the execution of tort law, the task of developing and presenting the alternative cases will have to be undertaken by the courts themselves, through the appointment of relevant professionals. This is similar to the way courts today order independent investigations or expert assessments. We believe the legal system will be receptive to such an idea because it is based on the familiar concept of the police lineup, the necessity of which is widely recognized. Furthermore, the wide coverage that problems with eye witness reliability has gotten in the past few decades (following the work of Elizabeth Loftus in the 1970s) has made the courts much more aware and willing to take action with regard to the cognitive limitations of witnesses (Harley 2007). This does not yet seem to be the case regarding the cognitive limitations of the adjudicators of the case themselves.

The possibility of suppressing outcome information should be considered for non-legal contexts as well. This method is far more appropriate for formal contexts than informal contexts because of the necessity of separating between the person investigating the case and the person making the judgment. The person making the judgment must be an outsider, who was not involved in the case and who has no prior knowledge of its outcome.

Another factor to consider is the feasibility of hiding the outcome. In investigations of high-profile events where the outcome is well known, this would be impossible. On the other hand, in organizations where routine investigations of employee behavior and system operations are performed even without special occurrences, this would be much easier.

While it seems at a first glance to be only relevant for judgment of responsibility, this measure can be relevant for improving learning as well. It can be useful to allow investigators to try to find aspects of behavior that were problematic without knowing exactly how a negative result was achieved, and this is expected to help separate random bad outcomes from those actually stemming from things that should be changed in the organization.

5.2.4 Interim conclusion

To conclude, we have not been able to identify a silver bullet that effectively eliminates hindsight bias in all situations. Even within particular contexts, the coping mechanisms that have

been devised come with costs as well as benefits, and these must be weighed carefully one against the other when attempting to cope within a certain context.

Legal scholars in particular have been prolific in devising methods for coping with hindsight bias. The most effective methods which are also most widespread within the legal system are abstaining from judgment through a no-fault liability system and reliance on ex-ante tests as proxies for retrospective probabilities. These methods work by minimizing the use of retrospective probability assessment. Their main cost is minimizing the ability to judge and learn when it *is* appropriate. This cost is large for no-fault systems and for cases where ex-ante criteria are crude, but depends also on the social importance of accountability in different domains.

Manipulations of the information presented to the judge can also be effective. The main problem with this type of method is low feasibility. Most real life contexts are not so contrived as to allow for easy manipulation. An exception to this is expert testimony, which we suggested could be rather effectively shielded from outcome information.

In terms of improving learning, an important lesson from this analysis is the importance of extending learning processes to include as much information which is not based on hindsight as possible. This can be done by conducting hypothetical histories of how things *could* have turned out and including them in the analysis, and examining work processes proactively to identify problems before their outcomes are known. In domains where activities are fairly regular and events comparable to each other, it is also important to keep complete records of the outcomes of as many events as possible and analyze them in the aggregate, to moderate the effect on learning of any particular outcome. Nonetheless, these measures will not be able to counter the strong effect of outcome information on lessons learned, though they may mitigate its relative effect somewhat.

Table B

Measure	Effectiveness	Relevant domains	Sources
Monetary incentives	Ineffective		Hell et al. (1988); Camerer, Loewenstein, and Weber (1989)
Prompting to try harder	Ineffective		Fischhoff (1977)
Accountability	Ineffective		Kennedy (1995)
Manipulating instructions to clarify the task	Ineffective		Wood (1978); Fischhoff (1975)
Warnings and detailed information on hindsight bias	Ineffective		Sharpe and Adair (1993); Pohl and Hell (1996)
Listing alternative outcomes/possible reasons for alternative outcomes	Consistently reduces, but does not eliminate, hindsight bias in the lab (thought one study did not find it effective with judges)	Formal judgment in law and organizations, can be used to inform defensive strategies by those being judged in informal contexts	Arkes et al. (1988); Lowe and Reckers (1994); Slovic and Fischhoff (1977); Sanna, Schwarz, and Stocker (2002)
Analytical methods – based on reference class forecasting [requires training]	Speculative	Formal contexts, subject matter with regular events for which distributive data is available	Based on Kahneman and Tversky (1982)
Analytical methods – decision analytics [requires training]	Speculative, has been suggested but does not seem promising	Formal judgment contexts	Bursztajn et al. (1984)
Group deliberation	Ineffective		Bukszar and Connolly (1988); Stahlberg et al. (1995)

Training through feedback and retesting	Ineffective		Pohl and Hell (1996); Camerer, Loewenstein, and Weber (1989)
Subject matter expertise/experience with the type of decision being judged [implies that in these contexts it is preferable to choose experts as judges]	Not clear, hindsight effects exist for experts but perhaps somewhat mitigated	Domains in which expertise is relevant and of high quality	Christensen-Szalanski and Willham (1991); Kennedy (1995)
Experience in retrospective judgment: judges, historians	Speculative, probably ineffective and may even make things worse		
Professional training in analysis of primary sources with evidence of past thought processes [implies the need to train relevant position holders or to choose those with experience/training in these methods]	Speculative	Unique events, events for which records of pre-outcome deliberations are available	Fischhoff (1982b)
Preferring a neutral analyst, preferring an independent investigation by someone not involved	Speculative	Domains with distributive data	

Replacing retrospective probability assessment with judgment of compliance with ex-ante norms and other secondary tests or rules of thumb	Not clear – hindsight may affect these assessments as well	Domains where there are clear cut norms (domains that are regular and not highly complex), when enough evidence on ex-ante conditions is available, not relevant when the purpose is learning from experience	Rachlinski (1998)
Drawing attention to alternative stakeholders who would have been harmed by alternative assessments that would have turned out wrong, considering the (negative) consequences of alternative decisions	Probably effective (strong theoretical basis but only one empirical study)	Formal contexts for evaluation of (and possibly also learning from) decisions with negative consequences, informing defensive strategies for those being judged in informal contexts	Anderson et al. (1997)
Calling attention to consequences of judgment – stressing the negative consequences to the person being judged from being judged unfairly	Probably effective, but seems very sensitive to specific conditions	Contexts where it is easy to raise sympathy for the one being judged, formal contexts for evaluating behavior, informing defensive strategies for those being judged in informal contexts	Clarkson, Emby, and Watt (2002)
Changing the evidentiary standard, “judging leniently”	Not clear	Judgment of responsibility contexts	Rachlinski (1998); Jolls, Sunstein, and Thaler (1998)

Incorporating more incidents in the analysis: including near misses/hypothetical histories	Probably effective in improving overall learning, not clear if effective in improving learning in specific cases	Learning in domains with regularity (formal and informal contexts)	March, Sproull, and Tamuz (1991)
Incorporating more incidents in the analysis: diverse interpretations of the same incident	Not clear	Large scale unique events (learning and judgment, formal and informal contexts)	March, Sproull, and Tamuz (1991); Fischhoff (1982a)
Deferring judgment	Effective	Formal judgment and learning contexts	Rachlinski (1998); Arkes and Schipani (1994)
Suppressing outcome information/decision information	If complete suppression is possible (which it usually is not), probably effective	Only very formal context where the informational environment is highly contrived, when there is a clear separation of functions between the decider of a case and its manager, when the outcome is not well known (when investigations are routine and the outcome is not drastic)	Casper, Benedict, and Kelly (1988); Poythress, Wiener, and Schumacher (1992); Mandel (2006)

Chapter 6: General conclusions

The most important lesson of this work is that the specific characteristics of the contexts in which hindsight decisions are made are important for judging the effectiveness and applicability of measures for coping with hindsight bias. In this work we focused on three of the dimensions across which judgment contexts differ (formal/informal, impaired learning/impaired responsibility judgment, fields with regular/irregular events), and made passing reference to a few others (positive/negative outcomes, self-relevant/non-self-relevant situations). However, we do not presume that these are the only relevant parameters and invite research on the importance of others. For example, whether the judgment is made in a group or by an individual may be a relevant parameter. Group deliberation in and of itself does not correct for hindsight bias (see section 5.1.2.1), but the special dynamics of small group decision making may make some coping measures more effective than others.

Our focus on judgment contexts has allowed us to identify new directions for debiasing that have not been sufficiently explored. The distinction between fields with regular and irregular events called attention to the idea that encouraging the use of frequency information holds promise for coping with hindsight bias, in a way similar to that in which it can improve predictions in foresight, for example through Kahneman and Tversky's (1982) reference class forecasting technique. This is an avenue that has not been explored empirically and would benefit from more research.

This analysis also served to identify types of contexts for which previous research on debiasing has been for the most part irrelevant, and which require more creative thinking. Almost none of the measures that have been suggested so far in the literature are appropriate for use in informal contexts, i.e. situations in which judgment and lessons for the future arise spontaneously. This may call to attention the advantage of instituting formal systems for learning and judgment where they do not now exist (though of course informal contexts will always exist and be influential). A good example is performance evaluation in organizations and policy learning, where learning can in many cases be more formalized. However, before such a project is undertaken it should be noted that formal institutions for learning and judgment carry a much greater authority than informal ones, and if we do not succeed in improving hindsight judgment

by a large amount in formal situations, expanding them will just be giving greater weight to biased judgment.

While debiasing measures cannot be incorporated into informal contexts as such, they can be used to inform what an individual facing unfair blame in hindsight can do to deflect blame, i.e. what type of “excuses” would be most effective. While simply pointing out the unfairness of judgment in hindsight is ineffective, a few simple measures (discussed in sections 5.1.1.3, 5.2.1.2 and 5.2.1.3) give an indication of how calling attention to non-outcome information that is relevant to the judgment decision can help counter the strong effect of hindsight bias. An individual being judged in hindsight in a political or organizational context can try to focus attention on this type of information, or urge her judges to use these debiasing techniques.

Another conclusion from this work regards the need for further research on the effect of special training on coping with hindsight bias. Measures that improve hindsight judgment by calling attention to the relevance of non-outcome information have enjoyed relative success. It would be interesting to know whether training in these debiasing techniques will improve hindsight judgment in cases that are not presented complete with debiasing instructions. We are unoptimistic regarding the effectiveness of general training in such methods (i.e. as part of a critical thinking education program, meant to be effective for a variety of contexts), because we believe people will not be good at identifying the situations in which they need to use them. However, training in their use within particular contexts seems more promising. In addition, further research is required to substantiate our speculations on the effect of different types of experience and professional training on hindsight bias (see section 5.1.3 for a summary of the questions left open in this regard).

Coping with hindsight bias by circumventing it, rather than trying to overcome it is an approach that has been tried mostly in the legal system. We found it more difficult than we expected to extend measures developed in this approach to other domains. Avoiding outcome information is probably the most effective of these measures, though its feasibility is limited to cases when outcome information can be effectively suppressed. Beyond the legal domain, we expect this measure to be somewhat useful for routine investigations in organizations. Avoiding judgment altogether or focusing on ex-ante tests rather than responsibility for outcomes may also be effective but these measures have serious costs in terms of reduced ability to judge and learn

from experience. Changing the evidentiary standard is a method that is useful for the legal domain and we suggested extending it to other contexts by encouraging a political (or organizational) climate in which lenient judgment for past decisions is the norm. However, it is not exactly clear how to bring about such a climate.

Our last general conclusion pertains to the benefit of external rather than internal investigations. Coping measures that work by manipulating information call attention to the advantage of using as a judge someone not involved in the details of the case, to whom only the information needed for appropriate judgment can be presented. An outside-judge may have an advantage for other reasons as well. Too much familiarity with case details may induce more bias, as discussed in section 5.1.2.6 (though this idea needs to be backed by further research). In addition, it is easier to impose debiasing mechanisms on others than on one's self because it is easier to see the behavior of others as biased (Rachlinski 2000), so separating between the presenter of the case and its decider may make the incorporation of debiasing measures easier.

To conclude, hindsight bias is a ubiquitous and consequential phenomenon, and so finding measures that attenuate its effect is a worthwhile project that should be continued. However, future work should devote more attention to the ways the decision making environment is structured, and focus on measures that are appropriate for these structures. Alternatively, research can inform how decision making environments can be restructured in order to lend themselves more easily to effective coping with hindsight bias.

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