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Back to the Future: Temporal Perspective in the Explanation of Events

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ABSTRACT

Prospective hindsight involves generating an explanation for a future event as if it had already happened; i.e., one goes forward in time, and then looks back. In order to examine how shifts in perspective might influence people's perceptions of events, we investigated two possible factors: temporal perspective (whether an event is set in the future or past) and uncertainty (whether the event's occurrence is certain or uncertain). In the first experiment, temporal perspective showed little influence while outcome uncertainty strongly affected the nature of explanations for events. Explanations for sure events tended to be longer, to contain a higher proportion of episodic reasons, and to be expressed in past tense. Evidence from the second experiment supports the view that uncertainty mediates not the amount of time spent explaining, but rather subjects' choice of explanation type. The implications of these findings for the use of temporal perspective in decision aiding are discussed.

KEY WORDS Causal explanation Prospective hindsight Scenarios Temporal perspective Uncertainty

People make sense of their environment by observing what happens and then reasoning about why things happen as they do. Using such causal reasoning, individuals act as amateur scientists who seek to explain what they perceive (Ross, 1977). There is great variation in the nature of these explanations. Much depends on what observers know of an event's circumstances, their explanatory skills, and how complete an explanation is desired.

In many situations substantial inference is required. These inferences about an event are crucially affected by its context. An event can be defined in terms of who is involved, what factors or actions are relevant, where it takes place, and *when* — a factor we call *temporal perspective.* Events may vary in temporal relation to observers, specifically in the difference between the time of a target event and the

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present. When people consider an event that has not yet occurred, they adopt a *forward perspective*. If they look back in time to a concluded event, they adopt a *backward perspective*.

It is natural that past and future events are usually treated differently. Normally people *explain* the past and *predict* the future. Looking back at events that have already occurred, the critical question is '*why*.' Looking forward into the future, the question is more often '*what* (will happen).' The two questions are related. One generally hopes to learn from explaining the past and to apply this knowledge to predicting the future. It is clear that the better one can anticipate future events, the more successful decisions and actions can be.

Although only the backward perspective is normally associated with explanation, suppose that people shifted their perspective on future events to think about them as if they had already occurred. Why might they do this? People can make better decisions about a future course of action if they fully understand all that is required to make it happen, including the perhaps-not-so-obvious. Weick (1979), Hogarth (1983) and others have suggested that traveling forward in time to look backward on a future event might improve decision making, by helping people see more of these necessary ingredients.

This belief, though never directly tested, stems in part from studies showing that temporal perspective can influence the way people perceive and evaluate events. How subjects described past and future events differed in terms of amout of detail, causal complexity (as measured by description length), and level of abstraction (Bavelas, 1973; Sevon, 1984). In these studies, subjects described past events in more details and at greater length than they did future events.

Explaining future events as past (i.e., prospective hindsight) might well improve decision making if people do 'see' more when they look backward. Given this potential value, prospective hindsight deserves further investigation. However, to understand this phenomenon it is important to control for a natural confounding factor, uncertainty of outcome.

Uncertainty and explanation

In previous temporal perspective studies, future events were always presented to subjects as uncertain, and past events always had sure outcomes. For instance, Sevon (1984) concluded that decision makers' conceptions of past events were more causally complex then their conceptions of identical future events. However, her experimental task compared explanations for Sweden's past high inflation/unemployment with explanations for possible but uncertain high inflation/unemployment in a future period. Although such a comparison legitimately reflects real world conditions, it is not possible to know whether the observed effects were due to differences in temporal perspective or to the accompanying differences in uncertainty. Other studies also suggest that uncertainty contributes to the inferences people make about events. For example, in the 'sealed-fate effect' subjects bet less when dice are thrown but not yet revealed, than when dice are thrown after bets are placed (Strickland, Lewicki, and Katz, 1966; Rothbart and Snyder, 1970).

This leads us to ask: What is the role of uncertainty in accounting for the differences in explaining events, that have heretofore been attributed to temporal perspective? The most extreme hypothesis is that the entire effect of temporal perspective is due to uncertainty. It is uncertainty that is 'driving' the observed differences in explanation, and the natural confounding between these two contextual factors has led to a misattribution of these effects to temporal perspective. At the least, it would be useful to disentangle the two factors and assess the independent impact of each.

If certainty of outcome does influence how subjects perform an explanation task, how might this happen? Subjects might work at explaining an event either longer (an effort hypothesis) or differently (a processing hypothesis). The effort hypothesis presumes that subjects devote more time and, thereby, explain more thoroughly a sure event than an uncertain one. Possibly people feel more obligated to explain a known outcome than to waste time constructing an explanation for an outcome that may or may not occur. In contrast, the processing hypothesis asserts that uncertainty influences the cognitive strategies subjects use to explain events. Subjects may view explanation under uncertain conditions as a different kind of task needing a different kind of explanation than under certainty. Or different kinds of explanations may have different ecological values in uncertain and sure task environments. The effort hypothesis predicts that people work longer, the processing hypothesis claims that they work differently.

Experimental rationale

Our initial interest was to examine and test the claims offered by prospective hindsight as a decision aid. Can it help people 'see' more? Paramount in understanding and evaluating any potential benefits of shifts in temporal perspective are assessing whether particular context variables influence explanation, how they might do so, and the specific nature of their effects.

Our primary goal is to disentangle the separate effects of temporal perspective and outcome uncertainty on the explanation of events. In our experiments temporal perspective is manipulated by asking subjects to explain events that differ in whether they occur in the past or the future. Uncertainty is independently manipulated by specific instructions about the level of certainty to be assumed.

Second, we wish to determine whether systematic differences in explanations occur because subjects work longer or think differently. Explanations of future and past events might differ in length alone or in more qualitative ways (abstract vs. concrete terms; past, present, or future tense). If different contexts produce only differences in time invested, explanations are more likely to vary in length then quality, whereas if different event contexts elicit different cognitive processes, qualitative as well as quantitative differences are likely.

In the two experiments reported here, subjects were asked to explain the occurrence of an *outcome event* in terms of underlying causes. Each such event was the consequence of some activity and could be classified as either a success or failure. For example, playing tennis could result in winning or losing and a sales presentation could result in a sale or no sale. Each event was set in either the past or the future and its occurrence was depicted as either sure or uncertain. These events provided a rich causal environment for explanation, permitting variability in the length and content of subjects' explanations.

The aspects of subjects' explanations that were analyzed included length, content, and verb tense. Because length (or complexity) has often been measured by the number of causes or attributions provided for an event (Ward, Hastie, and Taylor, 1978; Sevon, 1984), we asked subjects to list as many reasons as they could for each outcome. For content of explanations we developed a measure based on differences in level of abstraction. This content measure was derived from the results of pilot work and current conceptions of how events and knowledge about events are mentally represented (e.g., Abbott, Black and Smith, 1985; Abelson, 1981; Bower, Black and Turner, 1979; Galambos and Rips, 1982). In pilot work we observed that subjects' explanations differed as to whether they explained an event in terms of *actions consistent with* the outcome (a style we refer to as *episodic*) or in terms of a listing of *factors contributing to* the outcome (a style we call *abstract*).

Episodic or action-based explanation is characterized by listing of actions. These are often stereotypic and consistent with a specific instantiation of a script (Abelson, 1981), although temporal ordering of events need not be preserved. Examples of episodic reasons for a party's success are:

> She greeted the guests with a smile.
> Everyone will dance until the wee hours.
> The food was served on time.
> The band will play great music.

Abstract or factor-based explanations contain lists of underlying factors, like fixed parameters or enduring propositions. Such factors are similar to the devices that imbue scripts with predictive generality. Examples of abstract reasons for a party's success are:

She is friendly.
The guests are reasonable people.
She is a good cook.
Music is an excellent mood-setter.

Reasons were also coded and analyzed by their verb tense. Tense and content are partially confounded, due to linguistic differences in the expression of abstract and episodic reasons. Because abstract reasons often concern enduring propositions that remain true over time, they are stated in the neutral present tense. Episodic reasons represent specific instances or actions and occur at some point in time; that point may be expressed in the past, present, or future tense. Fischhoff (1976a) found that subjects often (mistakenly) used future tense when describing past events of which they are uncertain, responding as if they are predicting future events. We analyzed the tense of each reason to discover whether subjects systematically alter tense according to temporal conditions.

A measure of effort was obtained (in the second experiment only) by recording the length of time subjects spent constructing their explanations. In addition, subjects were asked to rate the difficulty of the explanation task.

Using the dependent measures described above, we sought to determine whether previous research on the effects of temporal perspective would be replicated when temporal perspective was not confounded with certainty. In this regard the main issue centered on whether subjects generate more reasons for past events than for future ones, regardless of the certainty of the event's outcome. If qualitative differences in explanations also appear, such differences might provide information regarding whether subjects work longer, differently, or both, and would be useful in addressing the issue of *quality* of explanation.

EXPERIMENT ONE

Method

Materials

Four scenarios were developed, depicting two professional and two personal situations. Eight versions of each scenario varied only in outcome: either future or past, e.g., an executive will complete a report by the deadline versus the executive completed the report by the deadline; sure or uncertain, e.g., the executive completed the report by the deadline or may have completed it; and a success or a failure, e.g., he completed the report by the deadline versus he did not. Appendix A presents one scenario with its eight possible outcomes.

Temporal perspective and certainty level were between-subject factors; the four scenarios and valence of outcome were within-subject factors. The experimental materials were distributed as booklets. Each booklet contained four scenarios, two positive and two negative, all with the same level of certainty and temporal perspective.

Subjects

Subjects were 114 unpaid University of Chicago MBA students enrolled in an introductory decision making course. Random assignment to the four experimental conditions (past certain, past uncertain, future certain, future uncertain) yielded approximately 28 subjects in each.

Procedure

Subjects were told that they would be given information about situations and then asked to answer questions about the material. For each of the four scenarios subjects began with the background information, and then generated as many plausible reasons as they could think of for the outcome in question. Finally, they provided a subjective probability for the outcome's occurrence. This served as a manipulation check to establish that subjective uncertainty corresponded to the intended uncertainty level. Subjects spent as much time as they wished, up to thirty minutes in total on the four scenarios. Times spent working were not recorded.

Results

Subjective probabilities

The subjective probabilities were used to check that subjects assumed the intended level of certainty. Within the two sure conditions, only two subjects assumed less than absolute certainty; they were dropped from further analysis. All subjects in the uncertain conditions assumed less than absolute certainty. The mean subjective probability across uncertain conditions was .54. Within the two uncertain conditions, the future subjects assumed greater uncertainty (M = .50) than did the past subjects (M = .57). This difference is marginally reliable, $t = 1.28, p < .10$.

Number of reasons

Our measure of length of subjects' explanations was the number of different reasons listed for a particular scenario. In cases where reasons were either numbered or presented in an ordered list, counting reasons was straightforward. In cases where the explanation was expressed as a paragraph, each complete sentence was counted as a reason. (There were very few such cases, and in all of them each individual sentence was judged to convey a separate idea.) Numbers of reasons were analyzed in a 2 (future/past) × 2 (certain/uncertain) × 2 (professional/personal scenario type) × 2 (positive/negative outcome) mixed-model ANOVA. Exhibit 1 displays the means for temporal perspective by certainty.

There was no reliable difference in the number of reasons generated for future and past events, $F(1,108) = 1.49$; but subjects did generate more reasons for sure outcomes than for uncertain ones, $F(1,108) = 19.79$, $p < .001$. There was a marginally significant certainty × temporal perspective interaction, $F(1,108) = 3.04$, $p < .09$. This was manifested as a negligible difference in the number of reasons generated for future sure and past sure events, but a more substantial difference in the number for future and past uncertain ones. There was no reliable difference in the number of reasons generated for positive and negative outcomes, or for professional and personal scenarios (both Fs less than 1).

Experiment 1

	Certain	*Uncertain*	*Combined*
Past	4.43	3.72	4.08
Future	4.57	2.94	3.76
Combined	4.50	3.30	

Experiment 2

	Certain	*Uncertain*	*Combined*
Past	5.17	3.06	4.12
Future	4.41	3.38	3.90
Combined	4.79	3.23	

Exhibit 1. Mean number of reasons generated per scenario by level of certainty and temporal persective

Experiment 1

	Certain	*Uncertain*	*Combined*
Past	.51	.31	.41
Future	.49	.23	.36
Combined	.50	.27	

Experiment 2

	Certain	*Uncertain*	*Combined*
Past	.71	.31	.57
Future	.75	.42	.59
Combined	.73	.37	

Exhibit 2. Mean proportion of episodic reasons by level of certainty and temporal perspective

Type of reasons

Each generated reason was coded as episodic (action-based) or abstract (factor-based). For each scenario, we computed the proportion of reasons that were episodic. This measure was subjected to an arcsin transform and then analyzed in the same 2 × 2× 2 × 2 mixed-model ANOVA. Exhibit 2 displays the relevant proportions.

Again, there was no reliable difference between past and future outcomes, but there was a significant effect of certainty. More episodic reasons were generated for sure outcomes (.50) than for uncertain outcomes (.27), $F(1,108) = 21.41, p < .001$. A greater proportion of episodic reasons was also generated for personal scenarios (.41) than for professional ones (.36), $F(1,108) = 5.73$, $p < .02$. There was no difference for positive and negative outcomes (F less than 1).

Tense of reasons

A final measure was the linguistic tense of each reason. A crossover in tense was defined to be either a reason in the past tense for a future outcome, or a future tense reason for a past outcome. The proportion of tense crossovers was negligible in all but the sure future condition, where a third of all reasons generated was expressed in the past tense (see Exhibit 3). In general, subjects showed a tendency to use past tense when generating reasons for sure outcomes, regardless of the temporal perspective of the outcomes.

	Experiment 1		**Experiment 2**	
	Certain	*Uncertain*	*Certain*	*Uncertain*
Past	.00	.00	.00	.00
Future	.33	.02	.38	.02

Exhibit 3. Mean proportion of total reasons that are tense crossovers

Discussion

In Experiment 1, subjects reacted indifferently to changes in temporal perspective but exhibited substantial effects of certainty-of-outcome. Sure outcomes yielded more reasons, and a higher proportion of episodic reasons. In addition, subjects frequently expressed reasons for such outcomes in the past tense, even when the outcomes were depicted as future. These results indicate that previous findings attributed to temporal perspective may be due almost solely to the level of certainty. In other words, in the natural confounding of certainty and temporal perspective in the real world, it is certainty that is the more fundamental factor and that is driving the observed effects on explanation.

In addition, the results of Experiment 1 are consistent with a cognitive processing hypothesis, the idea that subjects may think differently about sure events than about uncertain ones. The explanations generated for these events differed in content as well as length, even though the information available to the subject (the outcome's antecedents) was held constant. There is no a priori reason for this to occur. In our task the set of possible explanations for an outcome should not change due to level of certainty about the outcome. The reasons for the outcome are equally uncertain in both sure and uncertain cases. If subjects used the same strategy to explain both types of outcomes, but spent more time generating reasons for sure ones (the effort hypothesis), only differences in the length of explanations would be seen. However, our findings show both length and qualitative differences.

EXPERIMENT TWO

Experiment 1 supports the cognitive processing hypothesis that subjects think differently about sure and uncertain events. To further investigate whether subjects work differently or merely longer when explaining sure outcomes, we conducted a second experiment in which we collected two additional measures. First, time spent working on the entire exercise was recorded for a subset of subjects. Second, for each scenario all subjects rated the difficulty of generating an explanation on a seven-point scale (7 signifying very difficult). This measure reveals whether subjects view the task of explaining sure and uncertain outcomes as unequal.

Experiment 2 also attempts to replicate the findings of Experiment 1, while removing a possible artifact. The source of outcome information in Experiment 1 differed between sure and uncertain conditions. In uncertain conditions outcomes were suggested by scenario actors, while in sure conditions subjects were told by the experimenter that an outcome was sure. Thus, the certainty effect found in Experiment 1 could have been a source effect. To control for this, all outcomes in Experiment 2 were suggested by the experimenter (see Appendix B for examples of this rephrasing).

An additional change was suggested by the work of Koriat, Lichtenstein, and Fischhoff (1980) and Hoch (1984) which shows that subjective probabilities reported after reason generation may be biased by differential availability of evidence. Thus, the subjective probabilities reported in Experiment 1 may not be representative of subjects' initial levels of uncertainty before they generated reasons. To remove this potential artifact, subjects in Experiment 2 provided subjective probabilities before they generated reasons instead of afterward.

Method

Materials

Two scenarios similar to those of Experiment 1 were used. However, all outcomes were suggested 'anonymously'; unlike the stimuli used in Experiment 1, no outcomes were depicted as being suggested by scenario characters. As before, eight versions of each scenario were written in which only the outcome statement was varied. Outcomes were either future or past, sure or uncertain, professional or personal, and positive or negative, using the same design as Experiment 1. One scenario with its eight possible outcomes is presented in Appendix B.

Subjects

Subjects were composed of two groups. The first group consisted of 76 University of Chicago MBA students enrolled in an introductory marketing course, who performed the experimental task as part of an in-class assignment. The second group was composed of 32 respondents to an ad for paid participants. This groups consisted of undergraduate and graduate University of Chicago students, who performed the task individually. It was this latter group for whom we unobtrusively recorded the time spent on the entire task. Subjects in both groups were randomly assigned to the four experimental conditions, yielding a total of approximately 27 subjects in each.

Procedure

The experimental procedure was identical to Experiment 1 except for the following. First, subjects read and responded to two scenarios instead of four. Second, subjective probabilities were assessed before generation of reasons instead of afterward. Lastly, subjects rated the difficulty of explanation, on a seven-point scale, each time they completed an explanation.

Results

An initial analysis of the paid and unpaid subjects' data showed no significant differences on any dependent measure. Consequently, all analyses are reported for the combined group. The one exception is the time measure, which was collected only for the 32 paid subjects.

Subjective probabilities

Within the two sure conditions, only one subject assumed less than absolute certainty; that subjects was dropped from further analysis. Subjects in uncertain conditions assigned an average probability of .46; there was no reliable difference between the two uncertain conditions in the mean subjective probability assigned (M = .46 for the past condition and M = .45 for the future).

Number of reasons

This measure was analyzed as before. The results replicated Experiment 1 (see Exhibit 1). Subjects generated more reasons for sure outcomes than for uncertain ones, $F(1,99) = 19.92, p < .001$; and there was no reliable difference between past and future outcomes (F less than 1). Additionally, the marginally significant certainty × temporal perspective interaction of Experiment 1 disappeared. Thus, temporal perspective showed no influence at all on the number of reasons generated. One finding which differed between experiments was the effect of scenario type: a greater number of reasons was generated for outcomes related to the personal scenario than for the professional one (M = 4.35 and M = 3.68, respectively), $F(1,99) = 13.71, p < .001$. There was no reliable difference between positive and negative outcomes (F less than 1).

Type of reasons

Content of reasons, episodic versus abstract, was analyzed as in Experiment 1. The general pattern of results in Experiment 1 was repeated (see Exhibit 2). The proportion of episodic reasons was greater for sure outcomes (.73) than for uncertain ones (.37), $F(1,99) = 26.63, p < .001$. No other reliable differences were found (all Fs less than 1).

Tense of reasons
Again subjects showed a tendency to use the past tense when generating reasons for sure outcomes, regardless of the temporal perspective of these outcomes (see Exhibit 3). The proportion of tense crossovers was negligible in all but the sure future condition, where it was .38.

Difficulty of explanation
Subjects found if more difficult to generate explanations for uncertain outcomes than for sure ones, (M = 3.79, and M = 3.00, respectively), $F(1,99) = 13.49, p < .001$. No other reliable differences in difficulty were found (Fs less than 1).

Time spent working
No reliable differences were found in time spent working across the experimental conditions (Fs less than 1). Notably, M = 18.3 minutes and M = 20.9 minutes for the certain and uncertain conditions respectively. The direction of this difference is contrary to the prediction of the effort hypothesis.

Discussion
Experiment 2 verified the results of Experiment 1, removing any reservations due to artifacts. Indeed, any reliable effect of temporal perspective completely disappeared, while the effect of certainty was somewhat larger.

Experiment 2 also supports the hypothesis that subjects work differently, rather than just longer, when explaining sure outcomes. We found no differences in the amount of time subjects spent explaining, yet 4.60 reasons were generated per sure outcome and only 3.28 per uncertain one. This suggests that different, more efficient reason generation strategies were used when the outcomes of an event was sure. At least this is the case when the task is to generate as many reasons as possible ignoring their content. A difference in the efficiency of sure and uncertain strategies is supported by subjects reporting greater difficulty explaining uncertain outcomes. In sum, the results of Experiment 2 point to different strategies being employed as certainty changes, not the same strategies being pursued longer.

Strategies for explaining sure versus uncertain outcomes
This finding naturally leads to futher questions about what specific processing strategies might be adopted in sure and uncertain environments. Because our experiments were not designed to identify the strategies used, the hypotheses we can offer are necessarily *post hoc*. In considering plausible processing hypotheses, we assume several things about the information available to subjects and the strategies they adopted.

First, we assume that all subjects have conceptual knowledge concering an event, including standard roles played by people (say, the host and guests at a party), typical props, objects and locations involved (e.g., a party's location, refreshments and activities), a standard set of scenes and actions (planning the party, inviting the guests, greeting them, eating, participating in activities, leaving, cleaning up, etc.), and some normal consequences of a successful (or unsuccessful) completion of the event. Presuming this knowledge seems reasonable for the common 'scripted' events used in our experiments. Second, we assume that all subjects have particular episodic knowledge from instances of the described events personally experienced or learned about. Third, we assume that subjects used information presented in the stimulus scenario in combination with conceptual knowledge and specific experience to construct a mental representation of the particular event and outcome.

Given these assumptions, we offer three possible cognitive strategies for constructing explanations. They correspond to the locus of the difference between the way sure and uncertain events are tested: different knowledge retrieved, hierarchially 'deeper' use of knowledge, or different inference processes.

1. *Retrieving different knowledge, abstract versus episodic*
For sure outcomes subjects may retrieve episodic instances from personal experience and use them to construct event-based reasons. When an outcome is uncertain, conceptual knowledge regarding which key variables influence outcomes for the generic event under consideration may be retrieved instead. Here an explanation would consist of a list of factors thought to affect an outcome's likelihood.

2. *Processing retrieved knowledge to a deeper, episodic level*
According to this hypothesis, for both sure and uncertain outcomes the knowledge domain activated is the same: information hierarchially organized with abstract variable information at a higher level and episodic action-based information at a lower level (Abelson 1976). Explanations for sure outcomes may involve a deeper level of processing within the knowledge hierarchy.

3. *Reporting retrieved knowledge or engaging in inference*
This final hypothesis suggests that the same knowledge is retrieved for both sure and uncertain outcomes, specifically abstract factor-based knowledge. For uncertain outcomes, key factors may be selected and listed without further inference. In the case of sure outcomes, such information may be used to construct a mental model of the situation, enabling simulations to be run (Holland, Holyoak, Nisbett, and Thagard, 1986). Here, events seen to lead to the outcome in the simulations would comprise an explanation for its occurrence.

Our data do not permit any conclusions about which of these classes of strategies is responsible for the observed effects. That identification remains a task for future research.

GENERAL DISCUSSION

We set out to understand the role of temporal perspective in explaining events in two ways. First, we tested whether the effects of temporal perspective are due to the level of outcome certainty which is usually confounded with it. Second, we asked whether the observed differences in the number and kind of reasons generated follow from different processing strategies or merely working longer in one condition.

The answer to the first question is remarkably clear: most, if not all, of the effect of temporal perspective is caused by the level of outcome certainty. Previous studies could not reveal this mechanism because they preserved the natural confounding between temporal perspective and certainty — future outcomes are always uncertain, past are usually sure. The answer to the second question also seems clear, though the evidence is not definitive. The number and type of reasons generated, the time spent on the task and the rated difficulty all point to a strategy difference and not an effort difference.

Our data support the idea that cognitive differences affect explanation, but do not address *why* such differences arise. The reason may be based in part on natural differences in the knowledge available for the explanation. First, we note that people often refrain from thinking about events in abstract terms, if they believe that concrete (event-based) reasoning is possible (Abelson, 1976; Nisbett, Borgida, Crandall, and Reed, 1976). In day-to-day experience, the key abstract factors pertaining to an outcome's occurrence are available for both past and future events. However, only for a past outcome can one also draw on the specific, antecedent events that led to its occurrence. Such events are not available, except through simulation, for uncertain future outcomes. Thus, in our natural ecology reasoning about sure outcomes is most likely to be concrete, while reasoning about uncertain outcomes is abstract.

As an example, consider predicting the winner of the first basketball game of a championship series. Before the game predicting the winner is based on general factors: match-ups between key players, team strengths and weaknesses, etc. Even past games are used to identify factors relevant to the imminent contest. After the game it's a different story. The defeat of one team is explained both by these general factors and by specific events like Player A's early foul trouble Player B's 'off night', too much inactivity since the team won its previous series, etc. Such events are too numerous to anticipate beforehand and to relevant to ignore afterward.

Aiding decisions

Our initial interest in temporal perspective was prompted by claims made for the prospective hindsight technique. Can people 'see' better by taking a backward perspective on a future event? The present findings reveal that although prospective hindsight produces more reasons for an event, these reasons are typically episodic in nature. This is 'seeing' more, which is not necessarily the same as 'seeing' better. The value of a greater number of reasons must be qualified by such factors as the worth of an episodic reason versus an abstract one. Since we cannot judge the value of each reason, it cannot be concluded that prospective hindsight generates superior explanations. It depends on whether longer episodic reasons for an event are more valuable than shorter abstract ones.

At the same time that our findings qualify the value of the prospective hindsight technique, they highlight the potential benefit of manipulating outcome uncertainty. For instance, prospective hindsight would seem to be valuable whenever one wishes to facilitate the construction of events chains for an outcome. We can also create the natural complement to prospective hindsight, 'historical foresight', which turns sure outcomes into uncertain ones. It might make sense to adopt historical foresight in situations where the discovery and investigation of key underlying factors are desirable. For example, learning from experience is based on the premise that history repeats itself. Unfortunately, learning may be hampered because people tend to focus on specific details of antecedent events to explain a past (sure) outcome.

If a new product fails, even though test markets had returned favorable results, the manufacturer naturally wants to know what happened. The manufacturer would gain most from discovering the key variables that influence such failures (e.g., a geographically limited appeal). Unfortunately, often the producer will seek the specific actions that caused the product failure *in this particular case* (like the Monday morning quarterback who concentrates mainly on Sunday's events). Using historical foresight, i.e., generating abstract reasons for a past outcome, might be more suitable than letting episodic reasoning dominate. This logic underlies the traditional case study approach, wherein students are asked to analyze a past event without knowledge of its actual outcome. In this way, learning may be enhanced.

Prospective hindsight may help in intuitive forecasting by utilizing people's natural facility to generate event chains for sure outcomes. Decision makers can generate explanations to support many alternative solutions or outcomes. In this way they can increase realistic awareness of uncertainty present in a future situation, including the range of potential outcomes (Koriat *et al.*, 1980; Hoch, 1984; Hogarth, 1983; Weick, 1979). And the more concrete the explanation, the more likely the debiasing effect (Fischhoff, 1980; Kahneman and Tversky, 1979).

Relatedly, the construction of scenarios (i.e., descriptions of alternative hypothetical futures) is one method of assessing potential long-range social, economic, and technical developments (Jungermann, 1985). There are different categories or types of scenarios one can generate. For example, a distinction can be made between 'exploratory' and 'anticipatory' scenarios (Jungermann and Thuring, 1987). The former begin with a known or assumed concrete event and proceed forward. Anticipatory scenarios start from some future outcome and ask for possible events which could produce this outcome. The methodology of scenario generation is concerned with issues such as what kinds of scenarios results from differences in instructions or technique used, and whether higher quality scenarios can be obtained. From a methodological point of view, event chains are likely to be more elaborated and detailed when people are asked to generate anticipatory scenarios for future, certain outcomes than for others. In terms of quality differences, the question of whether longer event chains result in better forecasting remains open.

There are other closely related problems where imagining outcome certainty may help. In fault tree analysis we try to anticipate the cause of disastrous outcomes like a nuclear plant malfunction. The hidden causes include both general factors like corrosion of cooling pipes and specific events like the unorthodox testing that led to the Chernobyl disaster. In situations where one wants to reveal obscure or rare causes of a possible outcome, it should prove useful to assume that the outcome has already occurred and then work backward to its possible causes. The same procedure can usefully be repeated to identify causal events earlier in the sequence. If a nuclear disaster can be caused by an unorthodox experiment (that deliberately disables key safety systems), we can ask what events would prompt the perceived need for such an experiment. At a more mundane level the same strategy of assuming an outcome with certainty and then seeking its causes can be used to anticipate what can go wrong with a European vacation or a move of one's laboratory to a new building. A backward perspective on the outcome to convey its certainty should generate more insight into events that might, in fact lead to it.

In sum, one does not have to be a mad scientist to travel in time. By simulating different situational perspectives, decision makers may gain new insights about the causes of events in their environment.

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APPENDIX A

Example scenario for experiment 1

Basic scenario

Robert H. is an entry-level assistant with a limited business background. Hired for his potential, he is hard-working and shows great willingness to learn. However, to date his boss has been unimpressed with his performance. Robert has been assigned a new project, unrelated to anything he has done previously. If performed well and completed by the deadline, it will provide a valuable opportunity for him to show his ability to his superiors.

Outcome versions

Past certain: As it turned out, the project (was/was not) finished by the deadline. Please list as many reasons as you can think of why the project (was/was not) finished by the deadline.

Past uncertain: The morning after the deadline had passed, the gossip around the office was that the project probably (had/had not) been finished by the deadline. Please list as many reasons as you can think of why the project may (have/have not) been finished by the deadline.

Future certain: As it will turn out, the project (will/will not) be finished by the deadline. Please list as many reasons as you can think of why the project (will/will not) be finished by the deadline.

Future uncertain: The gossip around the office is that the project will (probably/probably not) be finished by the deadline. Please list as many reasons as you can think of why the project (may/may not) be finished by the deadline.

APPENDIX B

Example scenario for experiment 2

Basic scenario

Imagine that you work at a major consumer products firm. A good friend of yours, Heather, has been employed for eight months as a brand assistant. Single and in her mid-twenties, she is determined to combine both a successful career and a satisfying social life. Recently, for professional and social reasons she has decided to give a large dinner party. She has spared no expense to make the party a huge success.

Outcome Versions

Past certain: As it turned out, the party was a (great success/terrible failure). Please list as many reasons as you can think of why the party was a (great succes/terrible failure).

Past uncertain: Please list as many reasons as you can think of why the party may have been a (great success/terrible failure).

Future certain: As it will turn out, the party will be a (great success/terrible failure). Please list as many reasons as you can think of why the party will be a (great success/terrible failure).

Future uncertain: Please list as many reasons as you can think of why the party may be a (great success/terrible failure).

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