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# The Alternative-Outcomes Effect

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Distributions of possible scenario outcomes were manipulated without changing the probabilities of focal outcomes (e.g., you hold 3 raffle tickets and 7 other people each hold 1 vs. you hold 3 and another person holds 7). Participants' probability estimates confirmed that beliefs about the objective likelihood of the focal outcomes were largely unaffected by the manipulations. As expected, however, nonnumeric certainty estimates (Studies 1–3), feelings of concern (Study 4), and choice behaviors (Study 5) revealed that the manipulations did affect subjective certainty. The consistent direction of this *alternative-outcomes effect* and findings from Study 6 suggest that comparisons between the focal outcome and the strongest alternative have an important influence on subjective certainty. A potential function for these comparison processes is described, and their similarities with social comparison and social judgment processes are discussed.

Imagine two situations involving a 10-ticket raffle. In which situation would you feel more optimistic about winning the raffle?

> Situation A: You hold 3 tickets and seven other people each hold 1.
>
> Situation B: You hold 3 tickets and one other person holds 7.

According to normative rules of probability, your chance of winning is identical across the two situations. Nevertheless, perhaps you would feel more optimistic in Situation B, where you are competing against only one other person. Then again, you might feel more optimistic in Situation A, where you hold more tickets than any individual competitor.

In this article we introduce a phenomenon that we call the *alternative-outcomes effect:* People's certainty about whether a focal outcome will occur (e.g., your winning) changes as a function of how alternative outcomes are distributed, even when the summed probability of the alternative outcomes is held constant. Our interpretation of the alternative-outcomes effect is based on a distinction between deliberate, rule-based information processing and automatic, associative information processing. In the following sections, we describe this distinction and present support for the idea that the alternative-outcomes effect is a product of associative processing. We suggest that the associative processing that mediates the alternative-outcomes effect involves comparison reasoning, and we discuss some similarities between comparisons that underlie the alternative-outcomes effect and comparisons that are typically studied in social comparison and social judgment research.

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## Two Ways of Processing Uncertainty Information

Recent research has explored factors that influence people's feelings of uncertainty about an event, even when the objective probabilities for the event are easily known by the perceivers (Kirkpatrick & Epstein, 1992; Windschitl & Weber, 1998; Windschitl & Wells, 1996). For example, in demonstrating the ratio-bias phenomenon, Kirkpatrick and Epstein (1992; see also Denes-Raj, Epstein, & Cole, 1995) found that people prefer to draw a bean from a bowl containing 10 winning beans and 90 losing beans than from a bowl containing 1 winning bean and 9 losing beans. Kirkpatrick and Epstein presented convincing evidence that their participants knew the objective probability of winning was equivalent for the two bowls, yet their perceptions of uncertainty led them to prefer one bowl over the other. Windschitl and Weber (1998) demonstrated that contextual factors can affect perceptions of uncertainty about an event even when precise and credible probability forecasts are available. In one experiment, participants read about Janet, who had a blood condition that made her susceptible to certain diseases. Although a doctor had told her that her chance of contracting a mild form of malaria on her upcoming vacation was 30%, participants' uncertainty about whether she would in fact contract malaria varied as a function of her trip destination. They expressed more certainty that she would contract malaria when told the doctor's forecast was for a trip to India than they did for a trip to Hawaii. Again, the effect was exhibited despite the fact that the stated probabilities for malaria at the two trip destinations were equivalent. Several other scenarios yielded similar effects for contextual information (Windschitl & Weber, 1998).

Explaining the findings of Kirkpatrick and Epstein (1992) and Windschitl and Weber (1998) requires a novel way of thinking about people's uncertainty and the information processing that shapes it. On the one hand, people know the actual probabilities, and the probabilities are equivalent in the two versions of the problems: 1 bean in 10 is the same as 10 beans in 100, and a 30% chance of disease in India is the same as a 30% chance in Hawaii. On the other hand, feelings of uncertainty about what will happen are not the same: Optimism about drawing a winning bean is higher when one is allowed to draw from a bowl with 10 winning beans than from a bowl with 1 winning bean, and the perceived vulnerability to disease is greater in association with India than in association with Hawaii. How can this apparent dissociation between subjective probability and feelings of uncertainty be explained?

A broad theoretical distinction between two systems of information processing is helpful for addressing this question. Numerous theories within both social and cognitive psychology have proposed dichotomies in the way people process information (for a discussion see Abelson, 1994). Examples of such dichotomies are Dovidio and Fazio's (1992) *deliberate* versus *spontaneous*, Langer's (1989) *mindful* versus *mindless*, Schneider and Shiffrin's (1977) *controlled* versus *automatic*, and Zajonc's (1980) *judgmental* versus *affective* distinctions. Two recent proposals largely subsume these dichotomies and describe a distinction between two general information-processing systems, one more deliberate and analytic than the other (Epstein, 1990, 1994; Epstein, Pacini, Denes-Raj, & Heier, 1996; Sloman, 1996). Epstein (1990) labeled the two systems the *rational* and *experiential* systems, whereas Sloman (1996) labeled them the *rule-based* and *associative* systems, which are the labels we have adopted for this article.

Rule-based processing is assumed to be relatively slow and deliberate but also flexible and largely mediated by conscious appraisals. The rule-based system represents information in relatively abstract terms and operates according to formal rules of logic and evidence (Epstein, 1990, 1994; Sloman, 1996). For example, in assessing the chances of winning a product liability suit, the rule-based system might heavily weigh the fact that the base rate for winning product liability suits is low. Associative processing is relatively quick and spontaneous, but less flexible. Output from the associative system is often not mediated by conscious appraisals; it is often an automatic product that can be accompanied by an intuitive or gut-level sense. Associative processing represents information in more concrete terms and operates according to principles of similarity and contiguity. In assessing the chances for a product liability suit, the associative system might be heavily influenced by the similarity between the focal suit and a recently successful suit.

A key assumption within this framework is that the two modes of processing are semi-independent (Epstein, 1990, 1994; Sloman, 1996). Rule-based and associative processing can produce different or even contradictory responses to the same set of information (see Sloman, 1996, for examples). A logical consequence of this assumption is that the factors affecting rule-based processing are somewhat different from factors driving associative processing. Kirkpatrick and Epstein (1992) and Windschitl and Weber (1998) presented arguments and evidence that the factors manipulated in their experiments influenced associative processing while leaving rule-based processing relatively unaffected. The main dependent measures that they used were designed to be sensitive to people's more associative or experiential thoughts about uncertainty rather than to their rule-based thoughts. Kirkpatrick and Epstein used preference measures, which were assumed to be directly mediated by associative–experiential impressions of uncertainty. Windschitl and Weber used verbal measures of uncertainty, which have been shown to be more sensitive to associative processing than are traditional numeric measures of subjective probability (see Windschitl & Wells, 1996).

The experiments of Kirkpatrick and Epstein (1992) and Windschitl and Weber (1998) are important in that they identified factors that influence associative impressions of uncertainty independently of rule-based assessments. Factors that differentially influence two processing systems have already been identified in other types of judgment domains. For example, attitude-persuasion researchers are well aware of several factors that differentially affect peripheral and central processing of attitude-relevant information (e.g., attractiveness of speaker, sheer number of arguments; Chaiken, 1980; Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986a, 1986b). However, within the domain of subjective uncertainty assessment, little is known about factors that influence associative processing of uncertainty information independently of rule-based processing. This dearth of knowledge is partly due to researchers' general reliance on numeric methods of measuring people's uncertainty, which tend to prompt research participants toward more rule-based analyses of uncertainty information (see Windschitl & Wells, 1996). For instance, if Kirkpatrick and Epstein (1992) had simply measured their participants' subjective numeric probabilities in the bowl-of-beans problem, the differences in how participants represented the two versions would have gone undetected. Also, the prominence of numeric conceptualizations of psychological uncertainty (e.g., as subjective probabilities) makes it difficult to anticipate or predict the effects of factors that influence associative, but not rule-based, processing.

## Associative Processing, Comparisons, and the Alternative-Outcomes Effect

The present research investigated whether the distribution of alternative outcomes influences perceptions of uncertainty through associative processing. In a series of studies, we presented people with descriptions of events that had undetermined outcomes. One of the possible outcomes was the focal outcome, about which the participants were asked, and the others were the alternative outcomes. The objective probability of the focal outcome was held constant across manipulations of the distribution of alternative outcomes (as was done in the opening example of the 10-ticket raffle). In other words, we manipulated the manner in which probabilities were distributed among alternative outcomes while holding the sum of these probabilities constant.

We did not expect these manipulations to have much effect on people's rule-based assessments of uncertainty. We assumed that a majority of the college undergraduates serving as our participants had some (albeit limited) understanding of the fundamental rules of our culturally shared numeric probability system. In accurate rule-based reasoning, which operates according to the rules of this system, the certainty of an event is determined by the chances of the focal outcome relative to the *sum* of the chances of all the possible alternative outcomes.

The associative system, however, does not operate according to the rules of a culturally shared numeric probability system. Rather, we suggest that the associative system is sensitive to relative differences between the chances for the focal outcome and the chances for other *individual* outcomes. More specifically, we argue that the associative system makes pairwise comparisons between the focal and alternative outcomes, and that the comparison between the focal outcome and the most likely alternative has critical importance.[1] The more this comparison favors the focal outcome (or the less it favors the most likely alternative), the greater the perceived likelihood for the focal outcome.

For example, the rule-based system "knows" that holding 3 of 10 tickets is the same regardless of whether the other 7 are held by one person (a *3*–7 distribution) or split among seven people (*3*–1–1–1–1–1–1–1). However, the associative system "notes" that in the *3*–1–1–1–1–1–1–1 case, the focal outcome is relatively likely compared with the most likely alternative outcome, but in the *3*–7 case, the focal outcome is relatively unlikely compared with the most likely alternative. Hence, to the associative system, the focal outcome would seem more likely in the *3*–1–1–1–1–1–1–1 case than the *3*–7 case.

The proposal that comparison processes have an important influence on perceptions of uncertainty seems quite plausible given that comparison processes are widely assumed to play key roles in a variety of human judgments. Social judgment research has shown how comparisons with other stimuli can produce assimilation and contrast effects on a variety of dimensions such as attitude favorability and friendliness (e.g., Sherif & Hovland, 1961). Psychophysics research demonstrates that specific comparison stimuli affect judgments on dimensions such as weight, brightness, and taste (e.g., Helson, 1964; Parducci, 1965). Counterfactual thinking studies illustrate how comparisons with a specific alternative that "almost happened" can influence a variety of reactions to a factual event, such as perceptions of causality and fairness (see Roese, 1997; Wells & Gavanski, 1989). Finally, social comparison theory indicates that people's interpretations of their abilities and opinions are affected by comparisons with the abilities and opinions of specific others (see Festinger, 1954; Suls & Wills, 1991).

Although it seems plausible that comparison processing might also affect uncertainty judgments, this possibility has not been previously proposed or tested. If the comparison processes that produce an alternative-outcomes effect are characteristics of an associative-processing system, then detecting an alternative-outcomes effect requires a measurement procedure that is distinct from traditional measures of subjective probability. As mentioned above, traditional measures are especially sensitive to rule-based rather than associative processing (Windschitl & Wells, 1996). The series of studies described in this article used nonnumeric uncertainty scales and other measures to test for the alternative-outcomes effect and the processes that have been hypothesized to produce it.

## Study 1: The Casino Night Study

The first study was designed to test the general hypothesis that a manipulation to the distribution of alternative outcomes can affect the perceived certainty of the focal outcome, even though the objective probability of the focal outcome is equivalent across the manipulation.

### Method

Participants read one of two versions of the following scenario. Information that was manipulated is presented within brackets.

> Imagine that you are attending a casino-style party being held for a local charity. The event organizers hid raffle ticket stubs throughout the ballroom where the party is being held. Six party guests (you, Mary, Simon, Amman, Tara, and George) are eligible to search for the raffle tickets for a $200 money prize. All of the ticket stubs are found. [You found 21 of the tickets, Mary found 14, Simon found 13, Amman found 15, Tara found 12, and George found 13 *or* You found 21 of the tickets, Mary found 52, Simon found 6, Amman found 2, Tara found 2, and George found 5.] Whoever holds the stub for the ticket that is drawn will win the $200 prize. To win, you must be present at the event.

Notice that in both versions of the scenario, the participant holds 21 tickets and the total is 88 tickets. Half of the participants read about a *21*–14–13–15–12–13 distribution of tickets across the alternative outcomes, and the other half read about a *21*–52–6–2–2–5 distribution of tickets.

After reading the scenario, all participants responded to this question: "How likely is it that you would win the prize?" Ninety-six participants provided uncertainty estimates on an 11-point verbal measure of uncertainty (see Appendix A) that was scored from 0 (*impossible*) to 10 (*certain*). We used the verbal measure because of its sensitivity to framing and contextual factors that affect uncertainty and various judgments and behaviors under uncertainty (Windschitl & Wells, 1996). A separate group of 96 participants provided uncertainty estimates on an 11-point numeric measure (see Appendix B) that was scored from 0 (*0%*) to 10 (*100%*). The numeric measure was used to assess participants' rule-based estimates regarding the probability of their winning.

### Results and Discussion

Our primary prediction was that the alternative-outcomes manipulation would have a significant effect on verbal uncertainty estimates. As predicted, analyses of the verbal estimates showed that participants who read about the *21*–14–13–15–12–13 distribution reported significantly more certainty that they would win ($M = 6.1$, $SD = 1.5$) than did those who read about the *21*–52–6–2–2–5 distribution ($M = 5.3$, $SD = 2.1$), $t(94) = 2.08$, $p < .05$, $d = 0.42$. This result is consistent with our hypothesis that people's perceptions of a focal outcome's certainty are influenced by a comparison between the chances of the focal outcome and the chances of the most likely alternative outcome. In the *21*–14–13–15–12–13 version, the focal outcome is more likely than the most likely alternative, whereas in the *21*–52–6–2–2–5 version, the focal outcome is unlikely relative to the most likely alternative. We suggest that this comparison process is a product of an associative system that is primarily sensitive to pairwise comparisons rather than the more normatively appropriate comparisons between the focal outcome and the sum of all alternative outcomes.

This interpretation for the alternative-outcomes effect could be challenged by a second explanation, which we call the *computational-error hypothesis.* This hypothesis suggests that the manipulation of alternative outcomes affected participants' mental computations of the objective likelihood of winning. The

[1] The idea that associative processing would be influenced by individual alternatives rather than their aggregate is consistent with Kirkpatrick and Epstein's (1992) proposal of a concretive principle, which suggests that the experiential–associative system encodes events in the form of concrete representations rather than abstract representations. Our proposal, however, differs from Kirkpatrick and Epstein's in that it specifies a role for comparison processes and suggests that some pairwise comparisons are more influential than others.

scenario that participants read did not explicitly mention the total number of tickets contained in the raffle; to determine this figure, participants had to use mental addition. Perhaps the sum computed or estimated by participants reading the *21–14–13–15–12–13* version was smaller than the sum computed by participants reading the *21–52–6–2–2–5* version. The computational-error interpretation treats the alternative-outcomes effect as a rule-based phenomenon. It suggests that the effect is due to a poor application of the rules one follows in calculating probability.

This issue is addressed with the data from the group of participants who provided estimates on a numeric uncertainty measure, which tends to be especially sensitive to respondents' rule-based thoughts about uncertainty (Windschitl & Wells, 1996). As expected, the uncertainty estimates of participants reading the *21–14–13–15–12–13* version ($M$ = 3.3, $SD$ = 1.9) were not significantly different from those reading the *21–52–6–2–2–5* version ($M$ = 3.1, $SD$ = 1.6), $t(94) = 0.53$, $p > .05$, $d$ = 0.11. The correct likelihood estimate would have been 23.9%, which falls between the two response options of *20%* and *30%* (scored as 2 and 3). These results suggest that although participants tended to slightly overestimate their chances of winning, their calculations or estimations of objective uncertainty were not affected by the manipulation.[2]

Although the results from the numeric measure of uncertainty do not bode well for the computational-error hypothesis, it could be argued that people make estimation errors that produce the alternative-outcomes effect only when they are asked to provide responses on a verbal scale, not on a numeric scale. We partly agree with this argument. We have previously proposed and provided evidence that soliciting numeric estimates of uncertainty from participants prompts them to process information in a relatively rule-based manner (Windschitl & Wells, 1996). Soliciting verbal estimates, on the other hand, allows participants to process information in a more associative or experiential manner. Consequently, we agree that participants might be more likely to rely on rough computational estimates (as opposed to actual computational products) when preparing to provide a verbal estimate of uncertainty than when preparing to provide a numeric estimate of uncertainty. However, this does not necessarily mean that a systematic variation in estimations caused the alternative-outcomes effect detected in the casino night study. The following study provides a more definitive answer regarding the computational-error hypothesis.

## Study 2: The Cookie Jar Study

The casino night study and the cookie jar study are similar in many respects (e.g., design and procedures). However, three important distinctions regarding their scenarios and outcome distributions should be noted. First, unlike the casino night scenario, the numerical values in the cookie jar scenario are quite simple and small in magnitude: The relevant distributions are *2–1–1–1–1–1–1–1* and *2–7*.[3] Although errors in computations or estimates regarding the total number of raffle tickets might have played a role in the casino night scenario, it seems implausible to suggest that such errors in computations or estimates could play a role in the results of the cookie jar scenario.

The second distinction involves the number of alternative outcomes. In both versions of the casino night scenario, participants were told that there were five other people with raffle tickets. Hence, there were five alternative outcomes in both versions. In the cookie jar scenario, the number of alternative outcomes varies with the manipulation. In the *2–1–1–1–1–1–1–1* version there are seven alternative outcomes; in the *2–7* version there is one alternative outcome (with seven ways to get that outcome). This manipulation resembles the manipulation described at the beginning of this article. Note that there is some rationale for expecting the perceived certainty of the focal outcome to be greater in the *2–7* version than in the *2–1–1–1–1–1–1–1* version: There are fewer competing alternatives in the *2–7* version.

The third distinction concerns the nature of the outcomes. In the casino night scenario the outcomes are people; the reader can compare his or her chances of being the winner with the chances of other people being the winner. The outcomes in the cookie jar scenario, however, are objects (i.e., types of cookies). The cookie jar scenario describes the distribution of various types of cookies in a cookie jar and asks the reader about his or her certainty that a specified type of cookie will be drawn from the jar. Therefore, readers of the cookie jar scenario do not compare their own chances with the chances of someone else. Evidence of an alternative-outcomes effect for the cookie jar scenario would suggest that the comparison processes underlying the effect are more general than comparisons between the self and others.

### *Method*

Participants in the cookie jar study read one of two versions of the following scenario. Information that was manipulated is presented within brackets.

> Katie is a young girl who likes all kinds of cookies, but her strong favorite is chocolate chip. After dinner, she asks her dad if she can have a cookie for dessert. Her dad is agreeable, and Katie trots off to the cookie jar. The long-standing rule in Katie's home is that, when you are getting a cookie, you reach into the cookie jar without looking and take the first one that you grab. [The cookie jar that Katie is reaching into has 2 chocolate-chip cookies, along with 1 oatmeal, 1 raisin, 1 butterscotch, 1 rum, 1 peanut butter, 1 pecan, and 1 sugar cookie *or* The cookie jar that Katie is reaching into has 2 chocolate-chip cookies and 7 oatmeal cookies.] Katie returns from the cookie jar eating a chocolate-chip cookie.

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[2] Readers might note apparent differences in the means between responses on the verbal and numeric scales, which were both scored from 0 to 10. We have noted elsewhere that there is no basis or necessity to assume that responses on the verbal scale map into numeric probability estimates (Windschitl & Wells, 1996). Accordingly, we do not present an analysis of the main effect differences between the two scales. For readers interested in whether the effect of the alternative-outcomes manipulation was significantly different for the verbal versus numeric scales in Study 1, the interaction term of an analysis of variance was not significant, $F(1, 188) = 1.34$, $p = .25$. The main effect for the manipulation was not significant, $F(1, 188) = 3.52$, $p = .06$.

[3] The plot of the cookie jar scenario was inspired by a scenario used by Miller, Turnbull, and McFarland (1989) in a study on mental simulation. However, the phenomenon of interest in our study is distinct from the phenomenon studied by Miller et al. and by other researchers who have used or discussed Miller et al.'s scenario (e.g., Kirkpatrick & Epstein, 1992).

Half of the participants read the 2–1–1–1–1–1–1–1 version, and half read the 2–7 version. After reading the scenario, all participants responded to this question: "Assuming that Katie followed the long-standing rule about picking a cookie without looking, how likely was it that Katie would happen to grab a chocolate-chip cookie?" Ninety-six participants responded on a verbal uncertainty scale, and 96 responded on a numeric scale. These scales were identical to those used in Study 1 (see Appendixes A and B).

### Results and Discussion

As expected, responses on the verbal uncertainty scale exhibited a robust alternative-outcomes effect. Participants reading the 2–1–1–1–1–1–1–1 version were more certain that Katie would grab a chocolate-chip cookie ($M = 4.2$, $SD = 1.8$) than were participants reading the 2–7 version ($M = 3.1$, $SD = 1.5$), $t(94) = 3.16$, $p < .01$, $d = 0.64$. In addition, as was found in the casino night study, participants who responded using the numeric measures did not exhibit an alternative-outcomes effect. The respective means for the two versions were 2.5 ($SD = 1.6$) and 2.4 ($SD = 0.6$), $t(94) < 1$.[4]

The data from the cookie jar study are important in at least three ways. First, they suggest that the computational-error hypothesis cannot account for the alternative-outcomes effect. Second, the data suggest that the manipulation of the number of types of alternative outcomes did not have a robust effect on respondents' uncertainty. It was possible that participants reading the 2–7 version could have felt more certain than those reading the other version, because in the 2–7 version the focal outcome had to "compete" with only one other possible outcome (i.e., an oatmeal cookie). If this consideration had any effect (which cannot be ruled out), it was not strong enough to reverse the direction of the alternative-outcomes effect. Third, the data indicate that the alternative-outcomes effect is not unique to situations in which comparisons are made between the self and others. This does not mean, however, that participants in the casino night scenario did not make social comparisons, nor does it mean that motivational factors (e.g., a desire by the perceiver that the focal outcome occur) cannot play a role in enhancing the alternative-outcomes effect.

## Study 3: The Classroom Cleaner Study

Some readers of this article may have noticed a particular property of the manipulations used in the first two scenarios. Specifically, the manipulations of the distributions of alternative outcomes affected the rank-order status (first or second) of the focal outcome. In one version of the scenario (e.g., 2–1–1–1–1–1–1–1) the focal outcome was more likely than any other single outcome. In another version (e.g., 2–7) one of the alternative outcomes was more likely than the focal outcome. This property of the manipulations leaves open the possibility that the alternative-outcomes effect occurs only when the rank-order status of the focal outcome is varied from first to some rank other than first. If this is true, then explanations not involving comparison processes might account for the observed effects. For example, a best guess hypothesis might suggest that an event outcome that is the most likely (i.e., one that ranks first) receives a boost in perceived certainty because it constitutes the best guess as to which outcome will actually occur. In the two scenarios presented thus far the focal outcome is the best guess for one scenario version but not the other. Data from a third scenario, however, helps to rule out the best guess hypothesis and the more general possibility that the alternative-outcomes effect occurs only when the rank-order status of the focal outcome is manipulated. This scenario and its data were briefly described in a separate publication concerning the measurement of uncertainty (Windschitl & Wells, 1996).

### Method

Participants read one of two versions of the following scenario. Information that was manipulated is presented in brackets.

> The 50 classrooms at Williams University are cleaned each week by work–study students. [Randy cleans an average of 30 per week, Amy cleans 7, Laura cleans 5, Matt cleans 5, and Sylvia cleans 3 *or* Randy cleans an average of 30 per week and Sylvia cleans an average of 20.] They continually rotate who cleans what rooms. A teacher is trying to find out who cleaned a particular lab classroom several weeks ago.

Half of the participants read the *30–7–5–5–3* version, and half read the *30–20* version. Seventy-four participants responded to the following question on a 21-point verbal uncertainty scale: "How likely is it that Randy cleaned the lab classroom in question?" Another 74 participants responded to the following question on a 21-point numeric uncertainty scale: "What is the chance that Randy cleaned the lab classroom in question?" The 21-point uncertainty scales were expanded versions of those appearing in Appendixes A and B.

### Results and Discussion

Notice that for both versions of the scenario, the focal outcome was the most likely outcome. Although rank-order status of the focal outcomes was not manipulated, a robust alternative-outcomes effect was observed for participants providing verbal responses. Participants reading the *30–7–5–5–3* version were more certain that Randy cleaned the classroom ($M = 13.9$, $SD = 2.5$) than were participants who read the *30–20* version ($M = 11.9$, $SD = 1.5$), $t(72) = 4.00$, $p < .001$, $d = 0.93$. This finding cannot be explained by the best guess hypothesis. Also, as was the case in Studies 1 and 2, participants who responded on numeric uncertainty scales did not exhibit an alternative-outcomes effect. The respective means for the numeric responses to the *30–7–5–5–3* and *30–20* versions were 12.3 ($SD = 3.0$) and 11.7 ($SD = 1.9$), $t(72) = 1.00$, $p > .05$.[5]

## Study 4: The Hurricane Study

The three studies described thus far clearly demonstrate that the distribution of alternative outcomes affects the perceived certainty of the focal outcome. However, it depends on how

[4] For readers interested in whether the effect of the alternative-outcomes manipulation was significantly different for the verbal versus numeric scales in Study 2, the interaction term of an analysis of variance was significant, $F(1, 188) = 5.25$, $p < .05$. The main effect for the manipulation was also significant, $F(1, 188) = 7.85$, $p < .01$.

[5] For readers interested in whether the effect of the alternative-outcomes manipulation was significantly different for the verbal versus numeric scales in Study 3, the interaction term of an analysis of variance was not significant, $F(1, 144) = 3.02$, $p = .08$. The main effect for the manipulation was significant, $F(1, 144) = 10.88$, $p < .01$.

uncertainty is measured. When using the numeric scale that asked for a probability, there was no alternative-outcomes effect; when using the verbal scale, there was an alternative-outcomes effect. Which level of reasoning about uncertainty—the one tapped by the numeric measure or the one tapped by the verbal measure—reflects the perceptions of uncertainty that mediate other judgments, decisions, and behaviors? Do responses on the verbal scale reflect meaningful variations in perceptions of uncertainty? The type of verbal measures used to detect the alternative-outcomes effect has been found in previous research to be highly predictive of judgments and behavioral intentions made under uncertainty. In fact, the verbal measures were shown to be more predictive of such responses than were numeric measures of uncertainty (Windschitl & Wells, 1996). This finding is consistent with the idea that associative processing, to which the verbal measures are especially sensitive, is an important mediator of many judgments, decisions, and behaviors (see Kirkpatrick & Epstein, 1992; Sloman, 1996; Windschitl & Wells, 1996). Accordingly, the alternative-outcomes effect observed with the verbal measures should also surface in other judgments, decisions, and behaviors that are mediated by uncertainty. Studies 4 and 5 directly tested whether the alternative-outcomes effect would extend to judgments and decisions that were assumed to be mediated by perceived uncertainty.

### Method

All participants in Study 4 read the following scenario about a possible hurricane strike on the Atlantic coast.

> Imagine that you live in the coastal town of Sunbury, Georgia. Off the Atlantic coast is a hurricane that is expected to strike the coast within 24 hours. The National Weather Service has been studying the hurricane and is trying to predict where it will strike along the coast. They think damage caused by the hurricane will be heavy but mostly restricted to the general point on the coast where the hurricane hits. You see the following National Weather Service map on your local television station. It shows what the chances are that the hurricane will strike at specified sections of the coast.

After reading this information, participants saw one of the two weather maps that are shown in Figure 1. Seventy-six participants saw Map A and 76 saw Map B. To test whether the alternative-outcomes effect would extend to a judgment mediated by uncertainty, we asked all participants to respond to the following question: "Given the information on this map, how concerned would you be in Sunbury, Georgia?" Participants answered on a 9-point scale of 1 (*not at all*) to 9 (*extremely*). Participants then responded to the question "Would you be inclined to flee inland, assuming you could stay at a relative's place that was an hour away?" on a 9-point scale of 1 (*definitely not*) to 9 (*definitely yes*).

### Results and Discussion

Notice that the probability of Sunbury, Georgia, being the point at which the hurricane would strike the coast is identical on the two weather maps.[6] It is also noteworthy that participants were provided with probabilities (i.e., chance estimates) rather than frequencies. Determining the probability that Sunbury, Georgia, would be the point at which the hurricane strikes the coast requires no mental computations. Nevertheless, we expected that participants who saw Map B (the 27–70–3 version) would perceive a hurricane strike as less likely than those who saw Map A (the 27–17–17–16–15–5–3 version). All paired comparisons between the focal outcome and individual alternative outcomes on Map A, but not Map B, suggest high relative vulnerability for Sunbury. Given our assumption that perceived certainty would be a primary mediator of participants' judgments of concern and inclinations to move inland, we expected that the alternative-outcomes manipulation would affect responses on these questions.

As expected, participants who saw Map B showed less concern ($M = 6.1$, $SD = 1.6$) than did those who saw Map A ($M = 7.0$, $SD = 1.6$), $t(150) = 3.35$, $p < .01$, $d = 0.57$. Contrary to our predictions, however, no alternative-outcomes effect was found for responses regarding participants' inclination to move inland: The mean for each map was 7.3. It is not clear why an alternative-outcomes effect was observed for one dependent measure but not the other. One possibility is that the mediating role of certainty is greater for judgments of concern than for inclinations to move inland.

Despite the lack of an effect for the inclination-to-move-inland question, observing an alternative-outcomes effect on the concern question is important in several ways. First, this result provides direct evidence that the alternative-outcomes effect extends beyond responses on verbal measures of uncertainty. Second, it demonstrates the role of alternative outcomes in a situation of real-world significance: This scenario was created after one of us saw a National Weather Service map accompanying a hurricane warning on television. Third, the observed effect provides additional reasons to conclude that the computational-error hypothesis cannot account for the alternative-outcomes effect. In this scenario, unlike the others, information is presented in probabilistic form rather than in frequencies, so no computation is necessary on the part of the respondent. Finally, the observed effect suggests that even clearly arbitrary groupings of alternative outcomes can influence uncertainty. Participants seeing Map A could have easily mentally reconfigured the map to have the same impact as Map B. That is, they could have added up the probabilities that were spread across the Carolinas and associated the sum with the Carolinas rather than associating smaller probabilities with various sections of the Carolinas. Despite the arbitrary nature of the divisions of coastal sections in Map A, participants' uncertainty about the focal section was affected by the provided representation of the alternative sections.

## Study 5: The Raffle Sign-Up Study

The raffle sign-up study is somewhat different from Studies 1–4, in that its main dependent measure is a choice behavior. The study was designed to test whether the alternative-outcomes effect would extend to choice behavior and to collect some qualitative data that might explain how participants' thoughts about alternative outcomes can influence their choice behavior.

### Method

Toward the end of the experimental sessions for one of our experiments (unrelated to this research), participants were told that they could

[6] Some readers might notice that 5% of the probability distribution extends into North Carolina on Map A but not Map B. This was done to ensure that the mean of the distribution on Map A lies farther away from Sunbury than does the mean of the distribution on Map B.

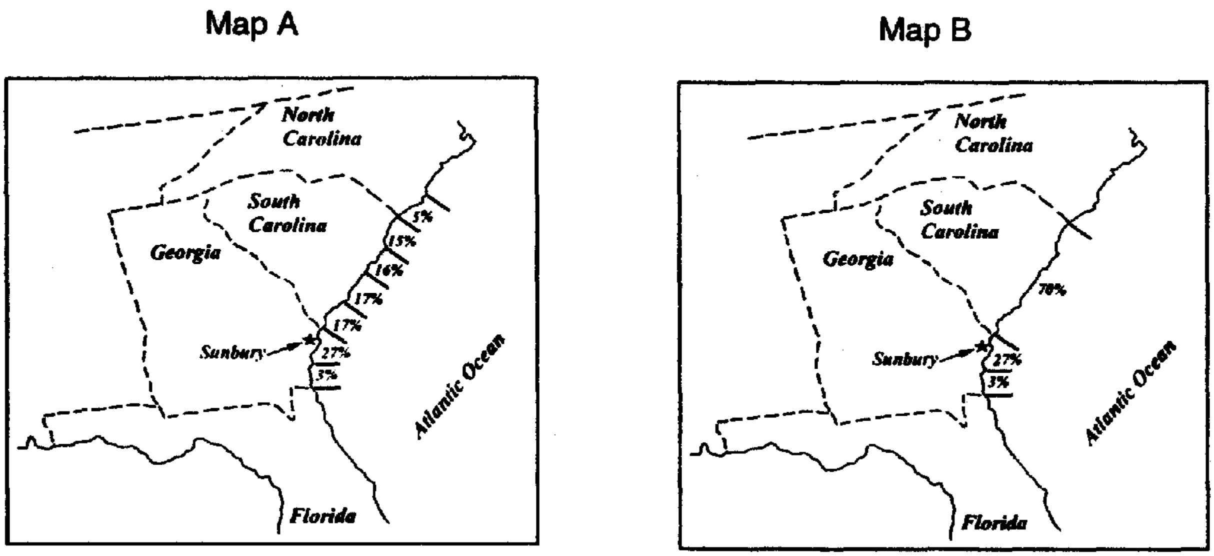


*Figure 1.* Maps A and B from Study 3. Each participant saw only one of two maps.

sign up for a chance to win prize money as extra compensation for their participation. Interested participants ($N$ = 80) were sent to a computer terminal for further information. A computer program informed them that they could choose to have a slot in one of two raffles, and that each raffle had a prize of $20. They were also told that participants from other studies were sometimes eligible to sign up for more than one slot. The program stated that each of the two raffles would have a total of 25 filled slots. The program then revealed on-screen the ostensible sign-up sheets that we constructed for the scenario. These sign-up sheets are shown in Figure 2. Notice that one name, Kirk Way, filled several slots in Raffle 1. (For counterbalancing purposes, Kirk Way sometimes filled slots in Raffle 2 rather than Raffle 1.)

After revealing the raffle sign-up sheets, the computer program prompted participants with the following question: "Would you like to sign up for Raffle 1 or Raffle 2?" After a participant selected a raffle, the computer program indicated that it had registered the participant's choice. The experimenter then gave the participant a short questionnaire, which asked, "Why did you sign up for the raffle that you did?" Responses to this question were coded by two judges to identify the presence of various types of reasons mentioned by participants. There was 83% agreement between the judges, and discrepancies were resolved through discussion.

| Raffle #1 | Raffle #2 |
|---|---|
| 1. Scott Sullivan | 1. Andy Taner |
| 2. Heidi Peterson | 2. Renee Waxton |
| 3. Ray Johnson | 3. Susan Adams |
| 4. Chantelle Becker | 4. Jenny Zhan |
| 5. Elizabeth Abbott | 5. Robert Duffe |
| 6. Kirk Way | 6. Pam Hall |
| 7. Kirk Way | 7. Bunchan Wang |
| 8. Kirk Way | 8. Tonya Larson |
| 9. Kirk Way | 9. Kristen Sparesus |
| 10. Kirk Way | 10. Mia Lenz |
| 11. Kirk Way | 11. Jim Janssen |
| 12. Kirk Way | 12. Amalin Sevant |
| 13. Sue Alexander | 13. Louise Wilkens |
| 14. Wendal Waul | 14. Ingrid Svenson |
| 15. Toni Olson | 15. Beth Jordan |

*Figure 2.* The raffle sign-up lists as they appeared to participants in Study 5.

## *Results and Discussion*

Although participants' chances of winning the two raffles were identical, significantly more participants picked the raffle in which Kirk Way did not hold slots, $\chi^2(1, N = 80) = 7.2$, $p < .05$. Specifically, 65% of the respondents selected that raffle, whereas only 35% selected the raffle in which Kirk Way held seven slots. The counterbalancing of whether the Kirk Way raffle appeared as Raffle 1 or Raffle 2 did not interact with the alternative-outcomes effect. One way of describing this finding is to say that participants avoided the raffle in which there was a clear upward comparison target—Kirk Way—and instead selected the raffle in which it appeared that all participants would have an equal chance to win the prize.

Although this description of the finding is consistent with the data and with our hypothesis, one could argue that factors other than comparison processes may have been the primary reasons why participants tended to select the raffle in which Kirk Way held no slots. For example, perhaps participants simply disliked the idea of participating in the same raffle as Kirk Way. However, participants' stated reasons for their raffle choice strongly suggest that comparison processes were the primary cause of the observed alternative-outcomes effect.

There were 52 participants who selected the raffle in which Kirk Way did not hold slots. Of those 52 participants, 12 explicitly mentioned a comparison between Kirk Way's chances of winning and their own chances of winning if they had selected the raffle in which he held slots. For example, 1 participant wrote, "Because Kirk Way had a lot of slots in Raffle 1, therefore his chances of winning were higher in that raffle—so I chose Raffle 2." Another participant wrote, "In number 1, a guy seemed to be signed up a lot, which made it seem that he would have better luck winning in that raffle." The responses from an additional 16 participants are less explicit regarding comparisons but nonetheless strongly suggest that comparison processes influenced their selections. These participants mentioned that one person held several slots in the nonselected raffle, and they expressed a feeling that their chances were better in the raffle that they selected or that someone else was likely to win the other raffle. For example, 1 participant wrote, "I chose to sign up for Raffle 1 because on Raffle 2 one person was signed up multiple times. I felt I had a better chance for Raffle 1." Another participant wrote, "The other one had a participant that would almost obviously win because he had 5 or more slots. I felt I would have a better chance when everyone was even." Hence, responses from 28 of the 52 participants who selected the predicted raffle either explicitly described comparisons or strongly suggested that comparisons influenced their decision about which raffle to select.

Alternative rationales were mentioned in much smaller frequencies. For example, one response reflected a desire to be in the raffle that was first rather than second. Notice that this strategy could not underlie the alternative-outcomes effect observed here because the positioning of the Kirk Way raffle (as Raffle 1 or 2) was counterbalanced. Other miscellaneous rationales (appearing with frequencies of 1 or 2) included a desire to sign up for the raffle that contained more female names, an intuitive feeling of being luckier in one of the raffles, and others. Five participants wrote that they had no reason. Finally, 11 participants simply mentioned a difference in the distributions of names on the two raffles. For example, 1 participant wrote, "Just because Raffle 2 had Kirk Way on there about 5 times." Such a response is clearly consistent with a comparison-process interpretation, but it is not specific enough to rule out other unstated motivations on the part of the participant.

Given that comparison processes were mentioned by participants with much greater frequency than any other type of rationale, it seems appropriate to conclude that comparison processes were the primary cause of the alternative-outcomes effect observed in participants' raffle decisions. Of course, caution must be used in drawing conclusions based on self-report data of the kind that we have presented. We asked participants to provide reasons for their own behavior—a task at which people have important limitations (Nisbett & Wilson, 1977). However, we can think of no reason why a group of participants would describe comparisons between themselves and Kirk Way if they had not already made such comparisons when deciding which raffle to select.[7]

The open-ended responses of the 28 participants who selected the raffle that did contain Kirk Way are also somewhat informative. As one would expect, comparison processes were not mentioned by these participants. Rather, the responses included several miscellaneous types of rationales, each of which did not appear with much frequency. For example, the responses of 4 participants seemed to reflect a preference to compete against fewer raffle players. For example, one participant wrote, "I figured that with the Kirk Way guy being signed up a ton of times, it would either be me or him. Even though he had more of a chance to win, I feel luckier when I am going up against fewer people."

Unlike those participants who avoided the Kirk Way raffle, numerous participants who selected the Kirk Way raffle stated that their chances were equivalent across the two raffles ($n$ = 9). This means that participants who stated that their chances were equivalent in the two raffles tended to select the raffle that contained Kirk Way. Perhaps many of these participants were initially attracted to the raffle that did not contain Kirk Way, but reacted by shying away from this preference when they realized that there was no rational basis for such a preference. The responses of a few participants seemed to reflect this hypothesis. One participant wrote, "Both raffles had the same number of people listed so I figured the chances were the same. Even though there was a person who held many of the slots in Raffle 1, it didn't matter because each slot is worth one and it doesn't change my chance of winning."

## Study 6: The Comparison Preferences Study

The results of Study 5 clearly implicate comparison processes as an important component of the alternative-outcomes effect. Thus far, we have suggested that a critical comparison for the associative system is between the chances of the focal outcome and the chance of the most likely alternative outcome. Although the pattern of results from the previous five studies is consistent with this proposal, other proposals regarding which comparisons are most important might also be consistent with the observed pattern. For example, perhaps people's certainty in the focal outcome is influenced by comparisons with alternative outcomes that are most similar to the focal outcome in their likelihood. For instance, people might first compare the focal outcome with the closest alternative that is more likely, then with the closest alternative that is less likely.

Although alternative proposals such as this one might be consistent with the observed results, we see good reasons to expect that comparisons with the most likely alternative outcome play a critical role in perceptions of certainty mediated by associative processing. The associative system is assumed to have a much longer evolutionary history than the rule-based system (Denes-Raj & Epstein, 1994; Epstein, 1994; Sloman, 1996). When the human mind was developing prior to culture and formal systems (e.g., logic, language, mathematics), the associative system dominated. Given that formal numeric systems of probability were only first introduced in the 17th century (Hacking, 1975), early humans did not have access to formal rules that informed them that the likelihood of a focal outcome should be compared with an aggregate of the likelihoods of all alternative outcomes. Without explicit knowledge of such a rule, how would a person judge the certainty of a focal outcome?[8]

Rarely would all of the alternative outcomes be explicitly

[7] The raffle sign-up displays were removed from the computer screen before participants were asked to explain their responses. Therefore, participants who mentioned names on the lists or made statements about the distributions of names must have made these observations while making their decision and prior to explaining their decision.

[8] The idea that people have an associative, nonnumeric method for processing uncertainty information is compelling in the context of the observation that it was not until the 17th century that uncertainty was treated numerically. Even then this numeric treatment was restricted to an elite segment of the population that was dealing with concrete problems such as gambling and insurance (see Zimmer, 1983). The current results support Windschitl and Wells's (1996) contention that intuitive, associative processing regarding uncertainty can be characterized as pre-Bernoullian.

defined as they were in our studies. Often the full list of alternatives would be unknown, and explicitly delineating a full list of known alternatives for conscious consideration would be too cognitively demanding. Given an ever-present need for cognitive efficiency, a mental shortcut seems useful for such situations—a shortcut in which the evidence for the focal outcome is compared with the evidence for alternative outcomes that are highly activated in memory. The alternative outcome that is likely to receive the most activation would be the alternative with the most supporting evidence. Hence, a prime comparison would be between the focal outcome and the most likely alternative (i.e., the one with the most supporting evidence).

This very crude comparison can yield a great deal of information about whether one should expect the focal outcome to occur. If the most likely alternative has far more supporting evidence than the focal outcome does, it is unwise to anticipate the focal outcome. If the most likely alternative has far less supporting evidence, then it might be wise to anticipate the focal outcome, unless there are numerous alternative outcomes. Given the utility of this shortcut, the associative system may have developed a special sensitivity to relative differences between the focal outcome and the most likely alternative.

If the associative system does have a special sensitivity to this relative difference, then we might expect people to show a consistent preference for learning about the chances of the most likely alternative before learning about the chances of other alternatives. Study 6 tested this hypothesis. Participants were asked to imagine that they held 30 tickets in a raffle drawing that had four other players. Participants were shown a rank ordering of the players according to the numbers of tickets held, but the numbers of tickets held by other players were not revealed. By looking at the rank ordering, some participants saw that they held more tickets than any of the other players, some saw that they held less than any of the other players, and some saw that they fell in the middle of the distribution. Participants were then asked to indicate which player, if any, they preferred to learn about (i.e., for which player would they like to know the number of tickets held). We expected that regardless of whether they held the most, the least, or a middle number of tickets, participants would prefer to learn about the alternative outcome that was most likely.

## *Method*

All participants in Study 6 read the same general scenario describing a raffle drawing. Manipulated between versions of this scenario was the rank ordering of players in the raffle. For all participants, the scenario started with the following introduction:

> Imagine that you own 30 tickets in a raffle. You know that the remaining tickets are held by four other people (Becky, Jane, Erica, and Pam), but you don't know how many tickets each person has. However, you do know that:

At this point, participants saw one of three different rank-order distributions: a top-rank version, a bottom-rank version, or a middle-rank version. These three versions are shown in their respective orders below.

> You have the most tickets (30 tickets), then Becky, then Jane, then Erica, then Pam, who has the fewest tickets.

> Becky has the most tickets, then Jane, then Erica, then Pam, then you, who has the fewest tickets (30 tickets).

> Becky has the most tickets, then Jane, then you (30 tickets), then Erica, then Pam, who has the fewest tickets.

After seeing one of these distributions, all participants read and responded to the following information.

> One ticket will be drawn from the raffle bin, and the winner will receive prize money. If you could find out about the number of tickets held by one other person, which of the following would you be most interested in knowing? (circle one response)
>
> 1. How many tickets Becky has.
> 2. How many tickets Jane has.
> 3. How many tickets Erica has.
> 4. How many tickets Pam has.
> 5. You would have no preference at all.

Some participants saw distributions that were different from the three listed above. For each of the three distributions listed above, we predicted that participants would show a clear tendency to prefer to learn how many tickets Becky has, because she is the most likely alternative. To ensure that such a tendency was not due to a simple liking of the name *Becky* or a meaningless propensity to circle the response option in the first position, we showed other participants three equivalent distributions in which Pam was the most likely alternative (see Appendix C). The preference question was left unchanged. The manipulation of which person (Becky or Pam) was the most likely alternative had no effect on the pattern of results and therefore rules out the potential explanation that preference trends exhibited by participants could be the result of a general liking for particular names or response positions.

## *Results and Discussion*

As predicted, participants preferred to learn about the most likely alternative, regardless of where the focal outcome (their winning) fell in the rank-order distribution. Table 1 displays the frequencies with which participants chose each option within the three conditions. Of the participants in the top-rank condition who expressed a preference, 80% (36 of 45) preferred to learn about the most likely alternative. Of those in the bottom-rank condition who expressed a preference, 95% (42 of 44) preferred the most likely alternative. Of those in the middle-rank condition

Table 1
*Frequencies for Participants' Responses to the Question of Which Other Raffle Player They Preferred to Learn About in Study 6*

| | Version (focal outcome's location in the distribution) | | |
|---|---|---|---|
| Response options | Top rank | Bottom rank | Middle rank |
| Player with the most tickets | 36 | 42 | 40 |
| Player with the second most tickets | 2 | 1 | 4 |
| Player with the third most tickets | 1 | 0 | 1 |
| Player with the least tickets | 6 | 1 | 3 |
| No preference at all | 7 | 7 | 6 |

*Note.* Participants did not see the response options as they are described in this table. Rather, they picked from an ordered list of names. To generate these frequencies we collapsed across a counterbalancing manipulation that varied the names appearing in the ordered distribution and the direction of the rank order (either least to most or most to least; see Appendix C).

who expressed a preference, 84% (40 of 48) preferred the most likely alternative.

These results appear unequivocal. There are no notable trends in any of the conditions for choosing any alternative other than the most likely alternative. One might have speculated that in the top-rank condition, participants would choose to learn about the least likely alternative, so they would know the range for the numbers of tickets held. Research on people's social comparisons between their performances and others' performances suggests that people want to know the range of performance scores within a specified sample (Wheeler, Shaver, Jones, Goethals, & Cooper, 1969). However, in the top-rank condition of the present study, only 13% (6 of 45) of the participants who expressed a preference chose to learn about the least likely alternative. One might also have expected that participants would like to learn about alternatives that are similar in likelihood, which would be another hypothesis consistent with social comparison research (e.g., Festinger, 1954; Wheeler et al., 1969). However, in the middle-rank version, only 10% (5 of 49) of the participants who expressed a preference chose to learn about either of the two alternatives that were most similar in likelihood to the focal outcome. Finally, it is worth noting that participants were free to indicate that they had no preference for which alternative outcome they would like to learn about. Despite this explicit response option, only 13% of participants expressed no preference (20 of 157).

These results clearly support our proposal that people have a preference for learning about the likelihood of the strongest alternative outcome before learning about the other alternatives. Hence, the strongest alternative outcome would be a primary reference point against which a focal outcome could be compared. This type of crude comparison likely played an essential function prior to the development of rule-based methods of representing uncertainty. It appears that it remains a built-in propensity of the associative system.

## General Discussion

The studies presented here clearly demonstrate that the perceived certainty of a focal outcome is affected by the distribution of alternative outcomes. This alternative-outcomes effect was observed across a diverse range of contexts, dependent measures, and manipulations. The consistent direction of the effects supports our contention that perceptions of certainty are influenced by pairwise comparisons between the focal and alternative outcomes, and that the comparison between the focal outcome and the most likely alternative has critical importance. The more this comparison favors the focal outcome (or the less it favors the most likely alternative), the greater the perceived likelihood of the focal outcome.

Although we have proposed that the comparison processes affecting uncertainty operate at an associative level, these processes are distinct from judgment heuristics that might also operate at this level. Consider, for example, the distinctions between the comparison processes proposed here and the availability heuristic. In an availability effect, the judged probability of an event can be influenced by the ease with which relevant instances can be recalled from memory (by its mental availability; see Tversky & Kahneman, 1973, 1974). In the present demonstrations of the alternative-outcomes effect, however, the instances are explicit and memory is not a factor. More specifically, the alternatives are explicitly described, and the perceived probability of the focal outcome is not influenced by whether it or its alternatives can be recalled.[9] Although there are surely judgment tasks in which availability processes and the proposed processes operate together, they were separated here and are distinct processes.

### Comparison Effects

We mentioned earlier that comparison processes have been proposed to account for a variety of effects within many domains. Although none of the theories from these domains have proposed a role for comparison processes in uncertainty perception, we think that research on contrast effects and social comparisons may help to provide a framework for questions and possible answers regarding the effects of comparisons on uncertainty. For instance, research on contrast effects typically focuses on how manipulations to the mean of a distribution of contextual stimuli can affect judgments of a target stimulus. For example, Higgins and Lurie (1983), in research on their change-of-standard effect, produced a context effect by having participants read about Judge Jones, who gave moderate sentences, along with several other context judges. Participants who read about relatively lenient context judges rated Judge Jones as more harsh than did participants who read about relatively harsh context judges. Like this demonstration of a contrast effect, the present demonstrations manipulated contextual stimuli and could therefore be viewed as demonstrations of contrast effects. One unique aspect of the present demonstrations is that the shape rather than the mean of the context distributions was manipulated.

Social comparison research provides numerous potential hypotheses regarding the comparisons that might be most influential for people's perceptions of certainty. For example, social comparison theory might provide predictions about people's second choices for comparison (after the most likely alternative) or about who people will spontaneously compare themselves with when the rank ordering of the alternatives' likelihoods is unknown. Perhaps in these types of situations, an individual would compare himself or herself with someone who has a similar chance of winning or is similar on relevant attributes, as social comparison theory would predict (Wheeler, Martin, & Suls, 1997; Wood, 1989).

Exploring the commonalties and differences among alterna-

[9] Some readers might wonder how phenomena related to fault trees are related to the alternative-outcomes effect (Fischhoff, Slovic, & Lichtenstein, 1978; Johnson, Rennie, & Wells, 1991; Tversky & Koehler, 1994). Research on fault trees suggests that the perceived likelihood of a focal outcome (e.g., dying from an accident) will decrease as the specific alternatives to the focal outcome are made explicit (dying from respiratory cancer, heart disease, or other natural causes) rather than left implicit (dying from natural causes). Although this effect seems to run counter to the alternative-outcomes effect, the two effects are quite different. In demonstrations of fault-tree effects, participants are not given any probability information and must generate estimates, a process influenced by the mental availability of various outcomes (and by the explicitness of possible alternative outcomes). As stated in the text, mental availability is not a factor in the alternative-outcomes effect.

tive-outcomes effects, contrast effects, and social comparison effects would likely be beneficial for the understanding of all three. This idea is consistent with recent suggestions of social comparison theorists. Kruglanski and Mayseless (1990) have suggested that social comparison processes are likely governed by comparative processes that underlie a wide range of judgments. Wills and Suls (1991) have stated that social comparison theory has failed to adequately make contact with social judgment theory and psychophysics. One major difference between the domain of social comparison and the domains investigating more traditional contrast effects is that in the former domain the relevant judgments concern the self, whereas in the latter domains the judgments are about characteristics of other people or objects. The present studies demonstrate the alternative-outcomes effect for judgments about the self as well as judgments about events that are not directly self-relevant. This suggests that differences in the self-relevance of the judgments studied in research on social comparisons and contrast effects do not necessarily preclude the study of effects that bridge those domains.

The fact that the comparison processes driving the alternative-outcomes effect appear to be automatic and spontaneous may suggest to some researchers that these processes have more in common with contrast effects than with social comparison effects. Underlying this interpretation is a common viewpoint that social comparisons are largely conscious and controlled comparisons that are motivated by needs of the self, such as self-enhancement or self-evaluation (see Wood, 1989). However, recent research provides evidence that social comparisons can be spontaneous and not directed through conscious control. Gilbert, Giesler, and Morris (1995) demonstrated that people make comparisons, which influence their perceptions of their own abilities, even when they are aware that the comparisons are completely nondiagnostic for assessing their own abilities. Such comparisons are quickly undone, assuming the necessary cognitive resources are available. As suggested by Gilbert et al., if all social comparisons were consciously directed, participants in their study would not have made the spontaneous comparisons that were later undone. We think the present research augments Gilbert et al.'s arguments that there are important components of social comparison phenomena that are spontaneous and automatic rather than deliberate and controlled.

The present research findings are also consistent with Klein's (1997) recent contention that affective and self-evaluative responses are influenced by social comparison information even when objective and unambiguous information is available. In a clever design, Klein presented participants with hypothetical information about their own chances of experiencing a negative life event (e.g., a car accident) as well as the "average person's" chances. Participants' responses on several dependent measures (e.g., their self-reported driving safety) were more affected by the relative rather than the absolute risk information. Another experiment demonstrated that comparison information about the average person influenced people's decisions even when sufficient absolute information was available. Our present findings extend those of Klein by directly demonstrating that comparison information can affect perceptions of certainty even when objective probabilities are known. Perceived certainty may have partially mediated the effects that comparisons with risk estimates from the average person had on the affective, self-evaluative, and decisional measures used by Klein.

### *The Alternative-Outcomes Effect and Real-World Uncertainty*

The present scenarios were constructed to produce unambiguous demonstrations of the alternative-outcomes effect. The objective probabilities of the focal and alternative outcomes were explicit and fixed, so that any differences in uncertainty between scenario versions could be identified as evidence of a nonnormative process. In the real world, however, objective probabilities are unknown. Therefore, we suspect that the present demonstrations underestimate the influence of alternative outcomes in unconstrained real-world situations. When objective probabilities are specified, a person's rule-based processing can keep perceptions of uncertainty somewhat in check. For example, if you learn that you hold 10 raffle tickets and five other people each hold 2, your rule-based processing will not let your perceptions of uncertainty stray too far from a 50/50 chance of winning. However, imagine a situation in which there are 10 ways (with unstated probabilities) that you can win a competition and 2 ways for each of five other people to win. For example, you have 10 pieces of artwork entered in a competition, and five other people each have 2 pieces entered. When you do not know the objective probability that each entry will win, a rule-based analysis of the evidence will not, and should not, anchor your certainty of winning at 50/50. Consequently, variations in how art entries are distributed among other competitors might have a particularly strong effect on your uncertainty.[10]

One of the possible consequences of the alternative-outcomes effect is that a mere plurality of probability for a focal outcome can be perceived as more likely than not (i.e., a majority of probability) if the alternatives each have small probabilities. In the casino night study, for instance, the participants held only 23.9% of the tickets. In the condition where this was the plurality of tickets (no one else held more than 17%), participants' average rating on the verbal uncertainty scale was well above *as likely as unlikely*. We continue to maintain that the verbal uncertainty scales should not be translated into numeric probabilities, but when an objective probability of less than 25% yields a judgment that crosses the line of *as likely as unlikely*, there are reasons to take notice. In civil tort trials, for instance, the *as likely as unlikely* criterion matches the formal criterion the courts instruct jurors to use when reaching liability verdicts.

More generally, the alternative-outcomes effect and the processes that underlie it are likely to have a variety of intriguing real-world implications. Consider the role that the alternative-outcomes effect might play in determining perceptions of guilt in criminal investigations. Imagine that investigators have a moderate amount of evidence suggesting that Suspect A commit-

[10] However, when probabilities (or other objective indicators) are not specified, testing for an alternative-outcomes effect becomes problematic. Various considerations that are unrelated to the alternative-outcomes effect might influence a respondent's uncertainty. If, in the art competition example, you were competing against five other individuals (rather than just one other individual who also had 10 entries), you could reason that the judges might be impressed by your breadth of talent and be inclined to give the award to one of your entries.

ted a particular crime. The demonstrations presented here suggest that the perceived guilt for Suspect A might be greater if there are numerous other suspects who each have a small amount of evidence against them than if there are two other suspects who each have a moderate amount of evidence against them. Also, imagine a physician who is diagnosing an illness in a patient and decides that Condition X is the most likely. Confidence that Condition X is the correct diagnosis might be greater when the doctor knows of numerous other diagnoses that each have only a small chance of being correct versus one alternative diagnosis that has a moderate chance of being correct.

Finally, we note that the effects of the comparison processes described in this article are not restricted to situations in which a full distribution of alternative outcomes is known. As we alluded to earlier, these processes might in fact have their greatest impact when a person knows that there are possible outcomes that are not explicitly defined. In such situations, a person could choose to mentally represent an ''all others'' category and use a rule-based strategy of trying to estimate how much probability space to allot this category. Although there are instances in which one might opt to use this strategy, there are numerous everyday situations for which a less demanding analysis would be required or preferred for judging the certainty of a focal outcome. A relatively effortless comparison between the focal outcome and the strongest alternative would provide a person with a quick impression of the certainty of that focal outcome.

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## Appendix A

### Verbal Uncertainty Scale as It Appeared in Studies 1 and 2

____ certain
____ extremely likely
____ quite likely
____ fairly likely
____ slightly likely
____ as likely as unlikely
____ slightly unlikely
____ fairly unlikely
____ quite unlikely
____ extremely unlikely
____ impossible

## Appendix B

### Numeric Uncertainty Scale as It Appeared in Studies 1 and 2

______ 100%
______ 90%
______ 80%
______ 70%
______ 60%
______ 50%
______ 40%
______ 30%
______ 20%
______ 10%
______ 0%

## Appendix C

### Rank-Order Distributions Seen by Some Participants in Study 6

Becky has the fewest tickets,
then Jane,
then Erica,
then Pam,
then you, who has the most tickets (30 tickets).

You have the fewest tickets (30 tickets),
then Becky,
then Jane,
then Erica,
then Pam, who has the most tickets.

Becky has the fewest tickets,
then Jane,
then you (30 tickets),
then Erica,
then Pam, who has the most tickets.

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