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Content Effects on Decision Making

David A. Rettinger

Psychology Department, Middlebury College

and

Reid Hastie

Center for Research on Judgment and Policy, Psychology Department, University of Colorado

How does the domain or subject matter of a decision problem affect the outcome of the decision? Although decision-making research typically dismisses content as merely a cover story, the present research shows that it plays a fundamental role in the decision process by influencing the information processing that underlies it. An experiment is reported in which the same basic decision problem was presented in several content domains (legal traffic tickets, academic course grades, stock investments, and casino gambling). The changes in content led to changes in both strategies and mental representations, which in turn led to changes in decision outcomes, even though measures of the subjective utilities of the options remained unchanged.

Life is a gamble. At least that is the expressed wisdom of many philosophers and behavioral scientists. This precept has led to a large literature of decision-making studies in which people are asked to make ratings and choices of monetary gambles like those they would encounter in casinos. Lopes (1983) described the simple monetary gamble as playing the same role in decision research that the fruit fly occupies in genetics. The prevailing view in the

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Address correspondence and reprint requests to David A. Rettinger, Psychology Department, Middlebury College, Middlebury, VT 05753. E-mail: rettinge@alumni.umich.edu.

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decision-making literature is that this is appropriate, since responses to simple gambles are generalizable to all of life's decisions. This is the assumption, explicit or implicit, of all formal decision theories.

According to these theories, people make decisions based on the values and probabilities inherent in the situation, without respect to the domain of the problem or its representation. Therefore people make medical decisions the same way they make legal, financial, or political decisions. This view is at odds with the claims of a number of psychologists who believe that the contents of a problem will affect a person's cognition at a fundamental level (see Goldstein & Weber, 1995, for a comprehensive review). If the problem happens to be a decision, then people's decision strategies, and ultimately their preferences, will be determined by all of the elements of the problem, including the probabilities and values, the content domain, the decision strategy, and the form of the mental representation.

The gamble metaphor implies that a simple monetary gamble structure provides a useful description of all everyday decisions. This conjecture is essential to modern decision theory, exemplified by von Neumann and Morgenstern's (1953) proposal that people's behavior in games can be used to infer their "utility function," a content-independent description of their evaluations: If the subjective value and the probability of each possible outcome available to a person in a situation are known, then it is possible to predict which course of action that person will choose.

Since all decisions we make are among options or courses of action that have possible outcomes marked by some degree of uncertainty or ignorance, it has been claimed that the essence of all decision making is estimating the likelihood of each possible outcome, determining the personal value of that outcome, and choosing the course of action that maximizes the subjective expected utility. In the most extreme form of this argument, no factor beyond the personal probabilities and values has any effect on the decision. This viewpoint is implicit in assumptions about the invariance and regularity of decisions across variations in problem formulations that leave the final outcomes and probabilities unchanged (e.g., one-stage versus two-stage gambles or gain versus loss framings; see Dawes, 1988, pp. 158–159; 1998, pp. 504–505, 516–521; Tversky & Kahneman, 1986). Under these assumptions, it is appropriate to generalize from the decision processes observed in stylized gambles to other, more familiar situations.

Standard utility theories, including prospect theory (Kahneman & Tversky, 1979) anticipate content effects and explain them without proposing wholesale changes in decision strategy. It is assumed that the subjective valuations and utilities placed on possible outcomes vary based on each individual's interpretation of each situation. Therefore the content of a decision acts to alter the *subjective gamble*, which in turn leads to content effects in decisions. We argue that this explanation is not sufficient to explain the variety of content effects reviewed below. Furthermore, if these changes inherent in the decision interpretation are sufficient to explain content effects, then one's reported subjective

values should be strong predictors of one's decisions. The experiment described below addresses this claim and finds limited support for it.

It is important to note that we are not claiming that utility theories ought to be scrapped or that they are fundamentally flawed. They were designed not as a means of describing the decision *process*, but as a comprehensive description of decision *behavior* in a wide range of circumstances. As a result, the decision literature is rich with detailed descriptions of the psychometric functions relating decision materials with actual choices. We, as cognitive psychologists are attempting to explicate the process that takes place when decisions are made and to demonstrate that that process is susceptible to content effects. Our proposal is that utility evaluation should be considered as a cognitive process like any other and evaluated as one of many alternative information processing strategies.

A detailed version of this proposal is spelled out in Payne, Bettman, and Johnson's (1993) adaptive decision-making paradigm. Decision makers are considered to be information processors with limited computational capacity, so that in order to select the option most favorable to them, they must represent information and make their decision with imperfect knowledge. This interpretation of the notion of bounded rationality explains the process of decision making as being strongly affected by one's limited cognitive resources. Decision strategies are decomposed into elementary information processes, and strategies are chosen based on compromises between their accuracy and the amount of cognitive capacity they require. The strategies that Payne *et al.* propose are useful descriptions of the cognition underlying many decisions. However, there are probably some decision strategies that have not been included in the original "cognitive strategies toolbox;" for example, explanation-based, reason-based, and affect-based strategies (Hastie & Pennington, 2000; Loewenstein, Weber, Hsee, & Welch, 1999; Shafir, 1993).

Furthermore, adaptive decision making proposes that strategy metadecisions are made based on a strict effort–error trade-off. Decision makers will do their best to reduce errors, but only if the time–effort cost is not too great and the stakes are low. As the stakes rise, the amount of effort is increased, which leads to the use of more cognitively complex strategies (Payne *et al.*, 1993). We endorse both the process-oriented nature of this view and the proposed particulars of the decision process. However, there is, we suggest, more to the choice of decision strategy than the effort–error trade-off. For example, certain decisions have a much more salient moral element, such as jury verdicts, than others, such as choosing a house. These differences can lead to content effects on decision strategy that are orthogonal to the issue of effort and even to the stakes involved in a decision. A decision about a traffic ticket might invoke a moral decision strategy more than the choice of a house, despite the small stakes. We suggest that the content of a decision can exert a direct influence on the choice of decision strategy, bypassing the issue of effort entirely.

Decisions are often influenced by changes in the content domain of a problem and even by small changes in wording. Although normative decision theorists prescribe invariant and regular decision-making processes, human decision

makers rarely, if ever exhibit them. Furthermore, these deviations from normative theory cannot always be explained by appeals to subjective reinterpretation of the decision or even by adaptive changes to one's decision strategy. One anomaly appears in the form of so-called *content effects* on decision making. For example, when presenting decisions to participants, Wagenaar, Keren, and Lichtenstein (1988) held the *underlying gamble* constant while varying the semantic content, following a framing manipulation introduced by Kahneman and Tversky (1979, the classic Asian disease decision problem). Two cover stories were used, both involving life and death possibilities. One required participants to decide which of two medical treatments to use in attempting to save the inhabitants of an island from a disease. The other described a decision problem about whether or not to use force to obtain the release of hostages. The researchers also manipulated the perspective of the decision maker (medical officer, islander, parent, or hostage negotiator) and the passivity (action or inaction) of the choice. The content had complex effects on participants' decisions. For example, participants who took the islander perspective were more likely to choose an active solution regardless of its riskiness, whereas the action versus inaction factor had no effects in the context of a hostage negotiation cover story. These scenarios differ in complex ways, and while it is unlikely that the content manipulation changed participants' values for the lives themselves, it is entirely possible that their utilities for the *outcomes* did change. While these results are suggestive of content effects, without an assessment of subjective utilities for the outcomes, a utility-based (or adaptive decision-making) explanation cannot be ruled out.

Goldstein and Weber (1995) conducted another exemplary series of experiments to study content effects. Their first experiment examined the differential effects of processing strategy in the domains of social decisions (marital choice) and object decisions (buying a CD player). They hypothesized that choosing a spouse would engender more narrative strategies, while a more numerical strategy is more appropriate (and therefore likely) for buying a CD player. The dependent measure was the difference between preferences for attractive and unattractive options, on the logic that narrative strategies will invoke schemas, causing participants to import information from their experience. The importation of additional information would lead to a widening of the gap between attractive and unattractive options, when compared to a simpler weighing and adding strategy. The ease of using the appropriate strategy was manipulated by changing the type of evidence presented. Some evidence presentation formats were designed to promote the construction of an overarching narrative schema such as "childhood sweetheart," or "the Rolls Royce of CD players," which, in turn, facilitated narrative strategies. Other formats were designed to promote evaluation by isolated features, which would induce traditional weighing and adding decision strategies (Payne *et al.*, 1993). Goldstein and Weber therefore predicted that when schema-inducing information is presented, participants will use narrative strategies, but only when choosing spouses.

Participants were, in fact, more sensitive to the difference between attractive

and unattractive spouses when narrative, schema-based processing was facilitated. For CD players the evidence manipulation had little effect. This can be explained by the fact that tallying pros and cons for a simple consumer product is easy, even when presented with schema-inducing evidence formats. From this study we see that a change in decision content can influence decision strategy and ultimately participants' choices. It is reasonable to assert that different patterns of decisions in different domains are due to differences in the importance of each potential outcome or in differences in subjective valuation of the outcomes. However, it is equally possible that content directly influenced participants' decision strategies, leading to different decisions. The present research, by collecting strategy and mental representation data as well as decision outcomes, is designed to distinguish between these possibilities.

Heath and Tversky (1991) showed that, even in the domain of simple monetary gambles, content matters. Participants were asked to make decisions among gambles that were formally identical, but differed in content. Participants were given the choice of betting on their own predictions of a future event in a domain that they were knowledgeable about (i.e., winning and losing the bet would be determined by their predictive accuracy), betting on an event in an unfamiliar domain, or betting on a chance event that had the same probability as their prediction. The probabilities were matched with each participant's individual confidence ratings. Although the probabilities were matched, and were sometimes biased in favor of the chance event, participants preferred to wager on their predictions in a domain of personal expertise than on chance events, even though it cost them money. When their personal expertise was low, participants preferred to bet on the outcome of the chance event rather than on their predictions, also to their financial detriment.

Heath and Tversky (1991) concluded that these findings result from participants' beliefs that they will be able to take personal credit when they are right about high-knowledge predictions, but to attribute their wrong answers to the environment when they are wrong. This is preferable to the chance event bet, in which no credit or blame is possible. Conversely, when they are relatively ignorant, their correct answers will be attributed as "lucky" and their incorrect answers as ignorance, thus producing a preference for chance events involving no blame or credit. This explanation can be interpreted as a change in the subjective utilities of the outcomes or, as we propose, as a change in explicit decision strategy above and beyond changes in the subjective valuations of the outcomes. As with the results from Wagenaar *et al.* (1988), it is not possible to distinguish between these accounts unless participants' subjective utilities for the outcomes are measured.

There is another way to conceive of content as affecting decisions. Recent research (Hogarth & Kunreuther, 1995; Shafir, 1993) has endorsed an argument approach to preferential decisions. Shafir argues that the compatibility between the contents of a decision and the phrasing of the decision question (accept or reject a course of action) will determine choices. A seminal set of experiments demonstrates that an option with both strongly positive and negative attributes will be both chosen and rejected more often that its bland

counterpart. This approach also moves content toward the forefront of the theoretical explanation.

These content effects represent a challenge to models of decision making that are based on studies using simple, abstract materials. If we believe that the gamble metaphor is inappropriate, we must replace it with both a new methodology and new theories. Two lines of research, one represented by Beach's (1990) image theory and the other by Pennington and Hastie's explanation-based decision making model (1993), have proposed that the contents of a decision will affect the mental representation of the situation described in the problem and perhaps also produce changes in decision strategies. This is distinct from expected utility-inspired theories, which all assume that there is a single decision rule that is invariant across content domains.

Beach has proposed image theory, in which the context of the decision has an impact via a preliminary decision framing process that determines what information is adduced in the decision process. The "frame" for a decision is influenced by the interaction between the content of the decision and the decision maker's images of the world. Decision makers are hypothesized to have images that include information about mores and principles, about goals and how to achieve them, or about concrete strategies for addressing specific problems. This brings different beliefs, rules, and principles into play for different decisions, as a function of their contents.

Explanation-based decision making (EBDM; Pennington & Hastie, 1988, 1991, 1992) is based on the insight that participants construct a story or stories when hearing a legal case, learn the appropriate verdict categories, compare their story of "what happened" to each candidate verdict, and finally decide which verdict best fits the story. Although emphasis has been on legal decisions, EBDM is hypothesized to apply to many domains. The contents of decision problems play their greatest role during explanation construction. In the case of jurors' decisions, stories are constructed in an active process of comprehension in which information is integrated into a complex mental representation of the decision situation, summarizing "What happened?" in the decision relevant events (e.g., the crime or accident that resulted in the trial). That representation is composed of embedded *episodes*, which are sequences of events that are elaborated and explained by causal information (Kintsch, 1988; Trabasso & van den Broek, 1985). Participants explain events using information from the trial, from their knowledge of similar events, and from beliefs about the world in general (e.g., alcohol makes people quarrelsome and aggressive, corporations will cut corners on safety measures to increase profits). Pennington and Hastie (1991) describe stories as events linked by *causal chains*, which encode necessity and sufficiency relationships among events. The causal structure of stories plays an important role in EBDM because it provides a framework within which decision makers can evaluate individual pieces of evidence, draw on their experiences in the world to make inferences, and evaluate the evidence as a whole by comparing it to their broad understanding of the structure of stories. Thus we see a cognitive model of decision making that emphasizes the use of content at the expense of utility calculations.

Although many decision domains are likely to engender a weight-and-add strategy, such as those proposed by Payne and his colleagues (1993), many other strategies, including explanation-based, affect-based, and case-based reasoning decision making are also possible. The literature guides us by proposing that certain attributes of decision scenarios such as the decision makers' personal involvement, familiarity with the content domain, and the presence of emotional or morally evocative events in scenarios will affect participants' decision strategies. For example, Blais and Weber (under review) found that while rationality dominated in financial domains (e.g., stock market investments), it was least popular for career decisions (e.g., everyday decisions in a classroom achievement situation). Rationality was also the most popular type of strategy for ethical dilemmas. This may apply to legal scenarios, although the ones presented here seem more concrete and personal than the dilemmas presented to participants by Blais and Weber.

Most content factors are outside the scope of standard utility theories, especially the implication that decision makers use different strategies in situations with different kinds of possible outcomes and different domains of experience. Adaptive decision making (Payne *et al.*, 1993) argues for changes in decision strategy based on the metastrategy of adapting the amount of effort needed to the time available and the importance of the decision. Content therefore influences strategy selection indirectly, via this mechanism.

These three theoretical possibilities (i.e., utility theories, adaptive decision making, and the current proposal) are differentiable empirically. Participants are expected to report use of more narrative, regret oriented, or aspiration directed strategies and have better memory for situational material with a presentation format that supports explanation-based (narrative) strategies. In contrast, if participants are exclusively using a strategy that mimics expected utility evaluation, their recall of decision scenarios should be dominated by information about the probabilities and explicit values described, and memory errors will be consistent with their edited and reweighted subjective values and probabilities. These cases should be easy to distinguish based on the data. Support for these hypotheses will demonstrate the value of the proposal that decision contents affect decision makers' strategy choices.

The goal of the present research is to begin to explain content effects such as those described above. Our approach utilizes an experimental methodology wherein participants are presented decisions that have an identical underlying structure but different content. This study allows us to evaluate participants' decisions, their memory for particular attributes of the decision scenario, and their self-reported strategy usage. We are especially interested in discovering content effects on decision representations that produce differences in participants' ultimate decisions. To accomplish this we appropriate techniques for assessing knowledge structures from research on text comprehension and memory. We will capitalize on results that demonstrate that propositions that are central to a scenario are better recalled than those that are peripheral (Kintsch, 1976) and that memory for information that supports a decision is better than memory for irrelevant or disconfirming information (Dellarosa & Bourne, 1984).

Participants' memory for the underlying structure (probabilities of each possible outcome and the associated values) of the decision are measured both using free recall and specific memory cue probes. The information that was most central to a knowledge representation constructed in the service of making a decision will be remembered best.

The logic of the present experiment is as follows: Because participants in all four conditions are asked to make the same underlying decision, with only the content varying, if there are differences between the conditions they are due to that content. Furthermore, we also measure each decision maker's subjective utilities for each potential outcome as well as his or her mental representations and decision strategies. If differences in preferences are found across domains, and the subjective utilities of the outcomes do not vary, then we can further conclude that some other factor is implicated. If further analyses indicate that decision problem content influences mental representations and self-reported strategy use, and that those factors, in turn, influence decisions, then we can conclude that these are some of the mechanisms by which domain content affects decision making.

Participants were asked to make judgments in one of several content domains (i.e., legal, classroom grades, stock market, and a casino gamble). The surface features of the decision scenarios varied across domains but were natural and sensible in each domain. Critically, the underlying basic decision structure remained constant in all domains.

We claim that the different domains induce different decision schemata (i.e., mental representations) and choice strategies. In particular, when contrasted with a content-free gamble, the addition of content will change the decision process. We use measures of judgment strategy and mental representation to show that decision contents influence decision making. This experiment use a one-way, between participants treatments design. The independent variable is the manipulation of "cover story" in each of the four content domains. Dependent measures are discussed below.

Participants read stories in four domains: legal (choice between paying versus contesting a traffic fine), academic (final exam versus a term paper), financial (accept a loss versus further investment in stocks), and a simple gamble (stop versus play on). These domains were included because they represent a subset of the real life decisions that our participants, students enrolled in General Psychology, might make. (Medical decisions, while well represented in the decision-making literature and surely important in the world, were excluded because we could not construct appropriate "gain" options.) The simple casino gamble scenario was included as a point of reference to previous, content-free research. We predicted that decisions in the gambling domain would be distinct from the others, with a tendency to rely on common sense numerical calculation strategies.

Critically, we also measured participants' subjective utilities for the possible outcomes. We predict that there will be no differences in utilities among the conditions. This will lend strong support to our claim that content affects decision strategy, and thus utility-based theories are unable to account for

them. This result would also be difficult to explain by an error–effort tradeoff inherent in adaptive decision making (Payne *et al.*, 1993). Changes in decision strategy do not lead to changes in "error" because there are no differences between the conditions on utility, the typical dimension on which error is determined.

The specific predictions for strategy usage and mental representation, derived from the prior literature (see Blais & Weber, under review; Goldstein & Weber, 1995) are that the gamble will invoke a numerical calculation style of decision making with an appropriate representation, since there is not much information from which to build any other representation. The legal domain will be the most elaborated and therefore most narrative. Because issues of morality and personal immediacy both come to bear in this domain, moral principle and affect-based strategies and representations should dominate. Predictions in the classroom grade and stock investment domain strategies are less obvious, although the classroom grade scenario is most familiar to our participants. This leads us to expect that participants will use a stereotyped computational strategy because the task is routine. On the other hand, familiarity may trigger more elaborated processing, leading to narrative representations. The stock scenario is likely to be treated like a gamble, although it is likely that participants will accept more risk in this domain because it is an investment, and it is our intuition that losses are particularly galling in this domain given the investment climate at the time of the study. Given this climate, extreme risk seeking behavior is likely.

METHOD

Participants

One hundred four college students enrolled in General Psychology at the University of Colorado, Boulder received partial credit toward a course requirement in exchange for their participation. Not all participants provided complete questionnaires and therefore some analyses were conducted based on smaller sample sizes. Twenty-five participants received the gamble materials, 26 the stock, 28 the grade materials and 25 the legal domain materials.

Materials

Stories were developed in the following domains: legal (traffic ticket), academic (choice between final exam or a term paper), financial (small stock investment), and a casino gamble. The stories were short (averaging 175 words) and contained sufficient information to understand the basic decision situation (pretesting ensured that participants could identify the correct decision tree structure from the problem statement texts). All four stories had the same probabilities and analogous values underlying them. In each story participants chose between a sure loss or a two-stage gamble in which they could come out ahead of their starting point, have a small loss, or have a large loss (relative

to the sure loss). The expected values of the two options were identical, and the values and probabilities were all equally easy to calculate. A complete set of materials is included as an Appendix.

Design and Procedure

Participants were first presented one of the four decision scenarios, with a title and instructions to read the scenario and consider the decision problem it posed. After examining the scenario for as long as they wished, participants completed questionnaires containing the following items. All participants were asked the same questions, which were customized for each domain.

1. Which option do you prefer? (e.g., Plead guilty–plead not guilty).

2. How confident are you that you made the right choice? Participants were asked to circle a confidence rating from between 50% (completely unsure) to 100% (absolutely confident).

3. Try to describe your thinking when you made your choice of what to do. Try to write down a list of "rules" or procedures that you could tell to someone else so that they would think about the choice the same way you did and reach the same conclusion about what to do. This was an open-ended prompt to report their strategy. We predicted that different content domains will cause different strategy usage. This question provides a coarse-grained measure of decision strategy. Responses to this question were coded into categories inspired by the decision strategies proposed by Goldstein and Weber (1995). They emphasized what they called "feature-focused" and "narrative" processing. Our most similar categories are Numerical Calculations and Story Construction, respectively. Two coders evaluated each participant's free response, and the few differences in codings were resolved by discussion. The possible strategies were:

Numerical calculations. "I made a lot of arithmetic, numerical calculations to decide what to do."

Avoid the worst (security). "I found the worst outcome and picked the option that would give me the best chance to avoid it."

Choose the favorite (high aspiration). "I found the best outcome and picked the option that would give me the best chance to get it."

Regret-focused. "I asked myself, 'If I wind up with regrets, which choice will I regret least?'"

Emotion-focused. "I focused on how I would feel if each outcome had happened."

Morality focus. "I focused on the morality of the situation (right or wrong), including the best interests of society."

Story construction. "I constructed a story in my head for each possibility and picked the best one.

4. Please recall and summarize, in your own words, the decision scenario. In this free recall question, participants were instructed to be as complete and accurate as possible. Previous research (Dellarosa & Bourne, 1984) demonstrated that decision makers tend to remember information that supports their

decision better than information that does not. Answers to this question were also coded, using a propositional scheme. Each story was broken down into simple propositions, which are described as relationships among elementary concepts in the decision scenario. Participants were given credit for each proposition that was correctly recalled.

5. Participants were asked to rate the value that each possible outcome held for them. This rating was performed using a thermometer scale in which each participant drew lines on the thermometer from each possible outcome to a point on the scale. Participants first rank-ordered the possible outcomes and then indicated how good or bad each outcome was to them. The instructions were as follows: "We're interested in how good and bad you thought each outcome was . . . . Draw an arrow to the thermometer [pictured on the page] indicating the position that describes how bad this outcome was, relative to the best and worst events." A ruler was used to convert the arrows to numerical ratings. These ratings are taken as a measure of their personal valuation for each outcome. Note that participants rated the outcomes as events and not only for their dollar values. Participants were free to include nonfinancial considerations in evaluating the outcomes, making these ratings like utility and making it possible to test the hypothesis that participants' decisions were not made simply using utility-maximization strategies.

Data Analysis

In order to simplify analysis of participants' decisions, the dichotomous choice variable was converted to a continuous variable by use of each participant's confidence rating. Preference was rescaled on a zero 0 to 100 continuum, where 0 reflects complete confidence in the risky option, 50 represents ambivalence, and 100 is complete confidence in choosing the safe option. All of the analyses reported below have been replicated using the categorical variable and provide the same pattern of results. The continuous versions of the dependent variable have been reported for ease of interpretation. However, participant choice was maintained as a categorical variable when it is used as an independent measure.

Participants' strategy use was assessed using the open-ended question described above. An ordered variable was created by ranking the strategies from a narrative pole to a numerical–calculation pole. The order of the strategies on this variable is: calculation, avoid-the-worst, choose-the-favorite, regrets, emotion-focused, moral, and story, although other orderings yield similar results. A dichotomous (numerical–narrative) strategy variable was created by comparing those participants who used the calculation, avoid-the-worst, and choose-the-best strategies with those who used the emotional, narrative, regret-oriented, and moral strategies. Participants' memory was measured by counting the number of simple text propositions (see Kintsch & van Dijk, 1978, for an explanation of propositions) they correctly reported during free recall. Three measures of decision problem memory were created: the total proportion of

propositions recalled, the proportion of number propositions recalled (i.e., propositions including a probability or an outcome value), and the proportion of nonnumber propositions recalled.

RESULTS

Recall our claim that decision making is influenced directly by the domain content of the decision problem and that the mechanism of that influence is a direct connection between domain content and cognitive decision strategy. In order to support those claims, we first demonstrate content effects. Once those effects are established, we demonstrate that they are not due simply to changes in participants' valuations of the outcomes in the different domains. We then show, using a number of measures, that both self-reported decision strategy and mental representations (as indexed by recall measures) are influenced by the content domain. The relationship between strategy usage and memory is discussed before establishing the critical logical link, which is that both strategy use and mental representations are related to actual decisions.

The most fundamental question addressed by this study is, "Are there differences in participants' judgments caused by content domain?" In fact, there are (see Fig. 1). When presented the gamble scenario, most participants prefer the safe option (80%). By contrast, for the stock story, most participants are risk seeking (35% choosing the safe option), and roughly equal numbers are risk prone and risk averse for the grade (46% safe) and legal stories (52% safe; for the categorical (risky-safe) response variable, Pearson X^2 (3) 11.36, $p = .01$; for the continuous (0–100) response variable, $F(3, 99) = 3.69$, $p < .01$). It is particularly interesting to note that the gamble case is reliably different from the others (contrast $F(1, 95) = 9.68$, $p = .002$).

Having demonstrated that there are differences in participants' judgments associated with the four content domains, it is critical to show that they are the result of processing changes and not merely shifts in valuation of the outcomes. Our measure of subjective utility was the thermometer rating scale. Differences in the thermometer ratings of the subjective value of each option

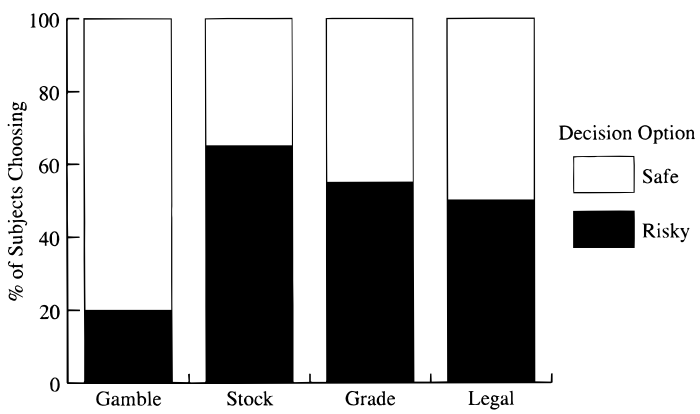

FIG. 1. Domain content effects on decisions.

were calculated for each participant. This entails asking each participant to rate how good or bad each event was relative to the others. These ratings were rescaled and then used to calculate an approximation of subjective expected utilities by the formula, EU $= p_x - V_x$ where p is the actual probability of an outcome x, and v is the participant's rating of the value of x. In this way, utilities were estimated for each possible outcome for each participant. Note that this is a rough-and-ready assessment of subjective value and does not distinguish between actual changes in subjective value and shifts in participants' risk preferences (see Keller, 1985, and Dyer & Sarin, 1982, for discussions of this issue).

On average, there were no differences among the content domains in rated utilities for any event. This result is summarized in Fig. 2. Furthermore, calculating the utilities for the risky and safe options creates an estimate of each participant's global valuations of both options. This valuation, according to all utility theories, should predict decisions. To test this, we entered participants' valuations of the four outcomes into a linear regression predicting strength of choice. Knowing the participants' valuations does reliably predict their choices ($F(3, 84) = 3.04$, $p = .03$, $r^2 = .10$), but only accounts for 10% of the variance. Interestingly, content domain accounts for roughly the same amount of variance ($F(3, 99) = 3.69$, $p = .01$, $r^2 = .10$). This can be interpreted to mean that while utility-based principles play a role in explaining decision behavior, there is much more going on in decision making. It also reminds us that the manipulation of decision content is a blunt instrument and that individual differences play a substantial role in the information processing underlying decision making.

Having demonstrated that content does influence decisions but not subjective values, we turn to the possibility that differences in information processing

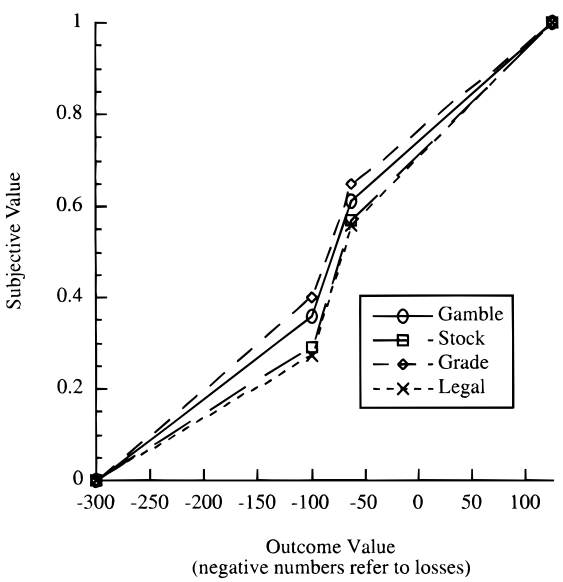

FIG. 2. Subjective values of each option, by condition.

cause the content effects. Strategy usage varies by condition (see Fig. 3). The most popular strategy for the gamble scenario was choosing to avoid the worst possible outcome (41%). The calculation strategy was the most popular for the stock story (33%) and the grade story (50%), and legal participants preferred a morality strategy (37%). Numerical calculation was popular in all four conditions (average: 37%), whereas regrets were only mentioned by two participants (2%). In general, participants used numerical (calculation, avoid worst, choose favorite) strategies most in the grade domain (100%), followed by gamble (79%), stock (70%), and legal (50%; X^2 (3) = 16.44, $p < .05$). Strategy use was contingent on condition (in Fig. 3). The differences there are reliable (X^2 (18) = 56.64, $p = .00003$; Cramér's $V = .43$, $p = .00003$). Thus, manipulating content changed strategy use as well.

We can also consider strategies based on whether they qualify as numerical or narrative story oriented. For these purposes, avoid-the-worst, choose-the-favorite, and calculation strategies are contrasted with the narrative, emotion-focused, regret, and moral strategies. When evaluated in this manner, notable differences are found among the content conditions. The legal story is associated with an even (50%, 50%) distribution of numerical and narrative strategies, while the grade (100%), stock (70%), and gamble (79%; X^2 (3) = 16.44, $p = .009$) were dominated by a majority of numerical strategies. These findings are a condition for the claim that strategy mediates content effects. Unless strategy changes with condition, it cannot be an explanation for changes in strategy.

Similar logic applies to participants' mental representations. We must find differences in their recall of the stories (an indication of their representation) in order to claim that mental representation mediates content effects. After reading each of the four stories, participants recalled different amounts of information from those stories. Differences in means are reliable using Bonferroni modified LSD at $p = .05$. Participants recalled more of the total propositions from the legal story ($M_{legal} = 55$) than from any other ($M_{gamble} = 41$, $M_{stock} = 40$, $M_{grade} = 42$). This pattern also holds true for the nonnumber propositions ($M_{gamble} = 35$, $M_{stock} = 41$, $M_{grade} = 38$, $M_{legal} = 66$). Number propositions were

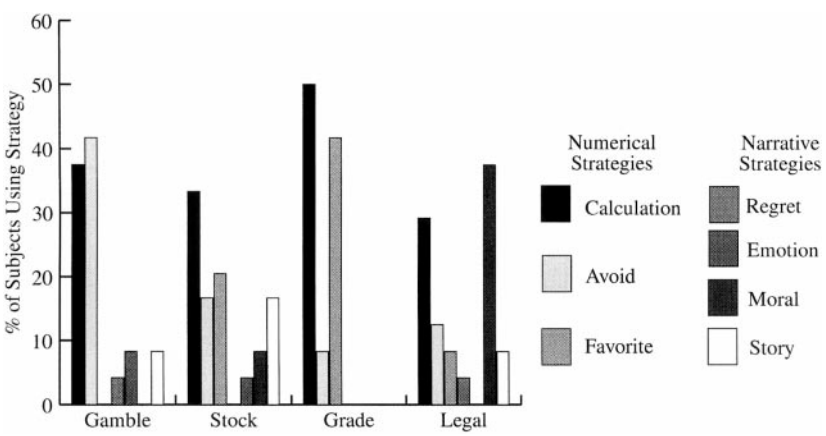

FIG. 3. Domain content effects on strategy usage.

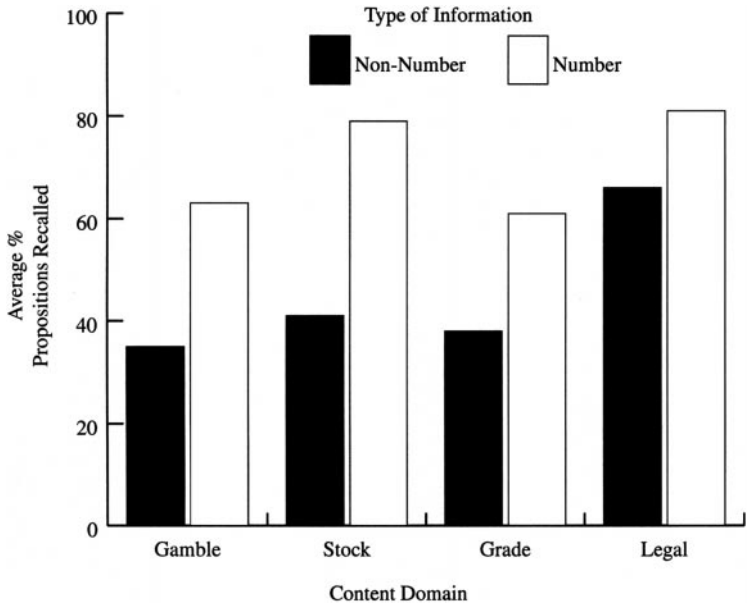

FIG. 4. Recall of numerical and other information, by condition.

recalled best in the stock ($M = 79$) and legal ($M = 81$) stories, as compared to the gamble ($M = 63$) and the grade ($M = 61$). Recall for number propositions in the stock and legal domains are not reliably different from one another, nor are gamble and grade, but the former are reliably different from the latter. There is a reliable interaction between domain content and type of proposition as well ($F(3, 96) = 6.73$, $p < .0001$). In the legal and grade conditions, the difference in recall between number and other propositions is smaller than it is for the stock and gamble stories (see Fig. 4).

Because participants were asked to choose among the analogous options in all conditions, the effect of manipulating the surface contents (i.e., domain) on memory for the decision options can be evaluated. Figure 5 shows the pattern of recall for the decision elements in each condition. Both similarities and differences are clear. For example, participants had the lowest recall for the 50% chance of a negative outcome in three out of the four conditions. Furthermore, recall was better for the worst outcome, particularly for its value ($300 or 30 points), than for the $100 or 10 point outcome. This is expected, because in all cases there was a substantial use of the avoid-the-worst strategy, which focuses attention on this piece of information. These differences in memory across conditions allow us to conclude that both mental representations and strategies were influenced by changes in decision content.

Surprisingly, there is no relationship between the number of either number ($F(6, 85) = .30$, ns) or nonnumber propositions ($F(6, 85) = .92$, ns) recalled and the strategy that participants report using. Nor is there a reliable interaction ($F(6, 85) = .62$, ns) between the type of proposition and strategy use.[1] This is

[1] It was not possible to code a dominant strategy for all participants, reducing the sample size for these analyses to 92.

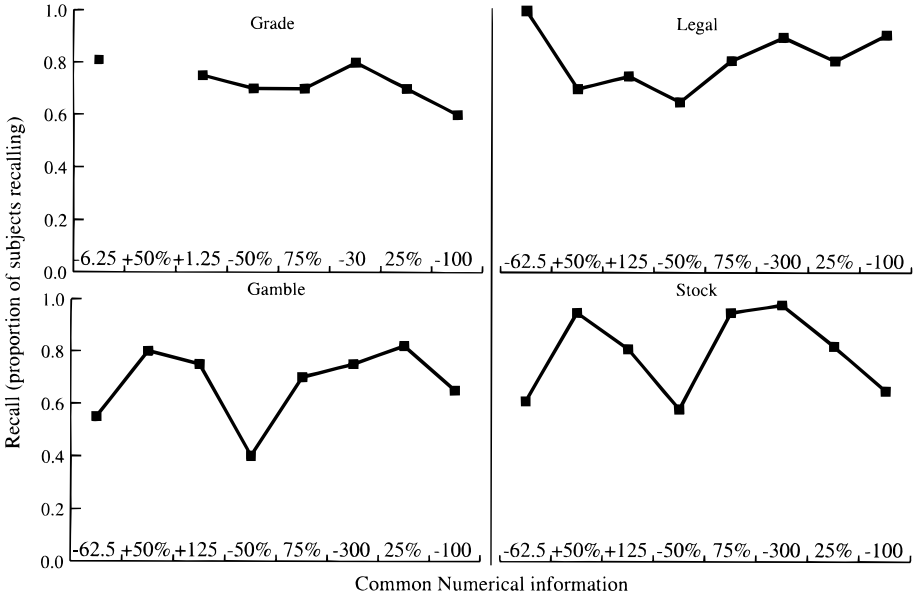

FIG. 5. Recall for numerical information from the decision scenarios. Note that negative values refer to either the values of losses or the likelihood associated with them.

likely due to the coarse measure of memory that we apply here. Memory accuracy for the common number propositions was the same for each strategy (no $F > 1$). The interaction between accuracy for the different propositions and the dominant strategy ($F(30, 445) = .68$, ns) was not reliable, indicating that the pattern of accuracy was the same for all strategy groups. While we certainly predicted that strategy use and mental representations would be associated, the fact that they are not does not affect the logic of our argument. It is likely that this result is due to the very rough memory measures we are using. More refined descriptions of participants' mental representations (such as those in Rettinger & Hastie, in press), may allow us to find these relationships.

In order to conclude that content effects in general are produced by these changes, we must also demonstrate that changes in strategy and mental representation influence actual decision outcomes. To examine the effect of strategy on decision outcomes, each participant's strategy was coded based on his or her response to the open-ended question. The dominant strategy used by each participant was noted, although not all participants had a single dominant strategy. Each participant's choice of strategy is a useful predictor of his or her judgment (see Fig. 6). Participants using numerical types of strategy are more likely to choose a safe option. This effect is driven by the avoid-the-worst and the calculation strategies. The choose-the-favorite, regrets, story, and morality strategies all are associated with risky decisions (X^2 (6) = 33.94, $p < .0001$). Recall that subjective value ratings accounted for roughly 10% of the variance in judgments. By comparison, the dominant strategy accounts for 34% of the variance in judgments ($F(6, 85) = 7.37$, $p < .0001$, $r^2 = .34$). Contingency table analyses also reveal reliable differences in judgments for various strategies

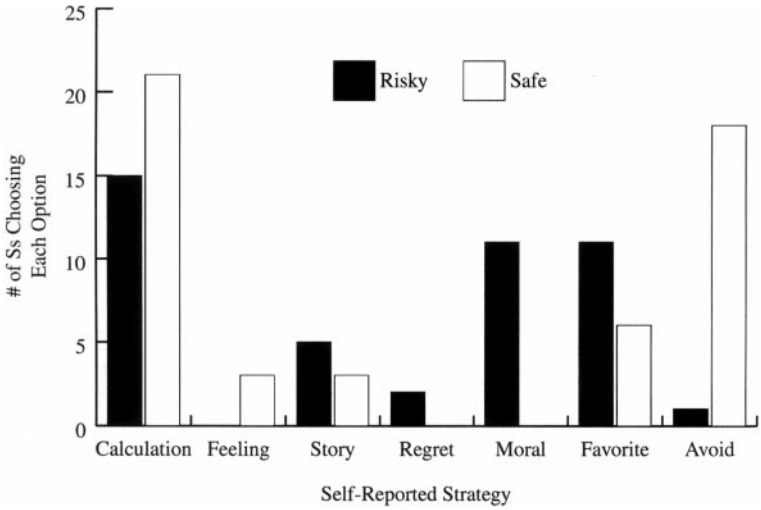

FIG. 6. Effects of strategy on participants' judgment.

(X^2 (6) = 33.94, p = .00001, Cramér's V = .59, p = .00001). Thus we can conclude that there is a significant strategy–judgment relationship.

The effects of mental representation on judgment can be assessed based on the memory–judgment relationships, because memory is taken to be indicative of participants' mental representations. The information that was common among the decision scenarios was extracted and used, this time, as independent variables in the prediction of judgments. If content effects are due in part to shifts in mental representation, then recall for the common elements (which is how we operationally define those representations) should influence participants' decisions. We find a range of relationships between the various elements of memory and judgment, and while some are significant, most are not. Participants' recall of the probability of "winning" was most predictive of their decision (t(92) = 2.25, p = .03), indicating that participants who remembered their chance of winning as larger were more likely to take that risk. Although the other elements were not reliable and the overall relationship between memory and judgment was not either (F(6, 87) = 1.88, p = .09), there is an interesting trend in that direction. More detailed analyses of the proposition-by-proposition memory results also suggest a complex relationship between memory and judgment (Rettinger & Hastie, in press).

DISCUSSION AND CONCLUSIONS

It is clear that the content domain in which a decision problem occurs plays an important role in determining the decision outcome. A casino gamble is treated differently by participants than decisions in more familiar, more causally elaborated, and more morally evocative domains. Participants were risk-averse for the gamble, whereas they were risk-prone for a stock market investment with exactly the same monetary expected values. This is a prima facie

refutation of the notion that a uniform gamble format can represent all decisions. Furthermore, as Fig. 2 demonstrates, participants had similar subjective valuations of the decision outcomes across the domains. Utility theory and adaptive decision-making interpretations of content effects do not permit this outcome and thus may be rejected. Our results indicate that different content domains cause changes in both decision strategy and preferred mental representation. Different strategies and representations lead to the salience of different information and beliefs, which in turn lead to different decisions.

The role of strategy shifts in moderating content effects on decisions was fairly straightforward. As Fig. 3 clearly indicates, strategies vary dramatically across the four content domains. Although numerical strategies (particularly calculation) are popular across domains, alternative strategies vary systematically. This is not surprising, because the simple numerical expected values of both options are identical. Once participants determine this fact mathematically (and it seems that most do), they use other information to resolve their decisions. In the legal domain, for example, moral considerations influence decision making. Because the "right" thing to do in these materials was to fight an unfair ticket, participants who reported moral decision making preferred the risky choice. Participants who made their decision by finding their favorite outcome and then choosing to maximize the likelihood of this outcome were risk seeking as well. By contrast, participants who chose to avoid the worst outcome were risk averse. The clear message here is that content domain determines decision strategy (to some extent) and that different strategies lead to different outcomes. Although strategy was not directly manipulated, our results provide strong support for the interpretation that domain influences decisions by changing the preferred strategy.

Memory for the underlying structure of the decisions also varied across domains. Because recall is a reliable indicator of the mental representation (Kintsch & van Dijk, 1978), we conclude that participants represented decisions differently based on the content domain of the decision. Figure 5 supports this claim with reliable qualitative differences in the recall of decisions. Differences in recall between domains provide insight into how the mental representation may combine with decision strategy to affect decision making.

An important difference among the representations is signaled by the perfect recall of the value of the sure loss ($62.50) in the legal condition as contrasted with the relatively poor recall of this value in other conditions. Participants in the legal condition were not deciding merely on the basis of numerical considerations, but were deciding, on nonmonetary grounds, whether pleading not guilty was "worth it," relative to the sure loss. As a result, the sure loss is salient and recall of it is increased. Another notable difference is the improved recall of the likelihood and value of the gain in the stock case. This fits with the risk seeking behavior in this condition, since participants who focus on the possible gain are more likely to choose the option that permits it to happen.

We propose that the fundamental route for content effects on decisions is through information processing changes rather than through changes in the subjective values (or probabilities or decision weights) of the possible outcomes.

While participants in different conditions report no differences in subjective values, they still make different decisions. Participants' personal values for the outcomes predicted 10% of the variance in decisions, which also supports the claim that examining the information processing will contribute to our understanding of decision making, over and above economic theories. These results do not disconfirm traditional utility theory models. Utility theory is flexible enough to allow for changes in preferences, when factors such as content domain, that could moderate values or utilities vary (e.g., Becker, 1976) or even when identical options are embedded in a certain, sure thing context versus an uncertain, risky contingency. However, the cognitive mechanisms that account for these differences lie outside the scope of utility theories and we submit our results are an argument for the usefulness of such cognitive hypotheses.

We relied on self-reports to create a summary list of the seven most common decision strategies, ordered from most deliberate and analytic to most "gut level" and intuitive: numerical calculations, story construction, regret focus, morality focus, choose-the-favorite, avoid-the-worst, and emotional reactions. This continuum of strategies predicts how decisions are made, what mental representations are used, and the final decision outcome. An obvious question raised by this research is, "What elements of a decision problem will cause changes in strategy?" We are not the first to pose this question, and a number of answers are available in the literature:

Factor 1: Personal importance. Wagenaar and his colleagues (1988) found that personal importance (i.e., whether the decision consequences are directly experienced by the decision maker or not) played a role in decision making. Recall that in one condition in the Wagenaar *et al.* (1988) experiment, participants were presented a variant of the classic Asian disease problem (Tversky & Kahneman, 1981) and instructed to take the point of view of either a potential victim of the disease or a public health official. Participants in the role of potential victims were more risk seeking than those in the role of health officials, and, when action was linked to risk, potential victims became more risk seeking, while nonvictims became less risk seeking. This sort of interaction suggests a difference at a fundamental strategic level. Our interpretation is that increased personal importance or involvement leads to more elaborate narrative processing. As the stakes increase, people may be less willing to be seen as simply calculating in the face of personal crisis and therefore consider more information about their personal values, as well reflected societal appraisal.

Factor 2: Familiarity. If a decision maker is familiar with a particular type of decision, it is predicted that he or she will elaborate the given information with his or her background knowledge. This results in a more explanation-based mode of decision making in which scenarios are "simulated" and evaluated, rather than a simpler mode that utilizes feature weighting and adding

strategies. However, as the decision maker becomes an expert in a given domain, case-based reasoning and reasoning by analogy may supersede an explanation or scenario-based strategy. Decisions are then based on the similarity of the current instance to previous ones or on abstract rules generated as a result of experience.

Factor 3: Duration of possible outcomes. Another possible difference among decisions is the temporal duration of the possible outcomes. Goldstein and Weber (1995) compared the choice of a roommate with the choice of a house to purchase and noted differences in the length of time that the possible outcome is expected to last. A feature weighting strategy may seem appropriate for choosing a rental house, where the future horizon of the consequences is limited. However, as the expected duration of the experienced outcome increases, it becomes more attractive to consider the scenarios that arise from each option. This will result in a more narrative mode of decision making. Participants' representations will be more story-like, as information is imported from experience into the decision situation. In turn, narrative representations will likely lead to elaborated processing. Participants are unlikely to construct an elaborate representation and then use a minimax decision strategy.

Factor 4: Moral relevance. Decisions might also vary in terms of the amount of morally relevant information they evoke. A legal decision is likely to lead to thoughts about moral implications and consequences, whereas a casino gamble or stock investment with the same financial results does not. It is possible that the consideration of moral content simply activates the use of a different set of editing rules or a different value function than contents that activate thoughts about financial gains. However, it is likely that moral or emotional contents lead to nonnumerical reasoning. For example, some options may be so morally repellant that participants choose to avoid them, even at a high cost, as Lopes (1983) predicts. The moral or emotional content may also lead to narrative processing, as participants try to create stories about each possible outcome and evaluate the stories. A related possibility is that participants faced with emotionally or morally laden scenarios determine which choice is least likely to engender strong regrets in the future and avoid the most potentially upsetting option.

Wang (1996) noted that decision strategies are selected evolutionarily as well as through individual learning and experience. Decision strategies that increase reproductive fitness will dominate over evolutionary time. Two attributes of decisions that are salient under this view are the social nature of decisions (i.e., whether the decisions affect others, especially others with similar genetic endowments) and the number of people affected. The data from Wang's studies were used not only as an argument for "significant changes in choice preference" (p. 57), but also for changes in judgment strategy. Decisions about family members are likely to be determined by considerations of fairness and need, rather than equity or market efficiency.

Factor 5: Possible outcome concreteness. Two other attributes of decisions that might lead to variations in decision-making strategy are the concreteness of the outcome measure (e.g., money or saving a life) and, given a concrete outcome, whether it is measured in terms of lives or dollars. When the consequences of a decision are concrete and are measured in terms of lives, people are likely to experience increased responsibility, maybe moral responsibility, and are more likely to elaborate the given information. This elaboration will lead to narrative representations and the strategies associated with them. (It should be noted that all of the materials we presented to our participants are concrete, and none involved decisions about human lives, so we are unable to verify these claims in the present study.)

In summary, the content of a decision problem plays a major role in determining the information processing that participants used in making choices. Content domain affected judgments, self-reported decision strategy, mental representations of the decisions, and the ultimate choice. Furthermore, these information processing effects seemed to be independent of effects of content on subjective values or probabilities. It is especially interesting to note that the casino gamble, which is often used as a metaphor for all decisions, was distinctively different from the other content domain scenarios.

APPENDIX: JUDGMENT SCENARIOS

Reckless Driving Traffic Ticket

You are given a speeding ticket with a $62.50 fine. When you pay the fine you include a letter complaining to the traffic judge because you feel you were ticketed "unfairly." You get a letter back from the traffic judge explaining that because of your letter, your case is being given special consideration. In the letter, the judge offers you the opportunity to either plead "guilty" or "not guilty" to the ticket even though you have already paid a fine.

You must decide whether to plead guilty or not guilty. If you plead guilty, then you have already paid your $62.50 fine, but you must go down to the courthouse and fill out paperwork waiving your right to a hearing. The letter explains that this will take about 2 hours. If you choose to plead not guilty you will get your earlier fine back, then you will have a hearing. You might be found not guilty (50% chance) at your hearing. If you are found not guilty, then you will be able to get $125 as a settlement for your "false arrest." If you are found guilty (also a 50% chance), you will be fined. There is a 75% chance that your fine will be $300 and a 25% chance that it will be $100. The letter says that the hearing will take about 2 hours.

Assuming that the information above is correct, and that both options are otherwise equal in terms of fees, taxes and convenience, do you choose to plead guilty or not guilty?

Stock Investment

You own some stock in a medium-sized company. You use the products that the company makes, and like them. The company has recently lost money, and

the stock is worth $62.50 less than when you bought it. Your broker calls you and tells you that there is an opportunity to invest more money to get a chance to make your money back. If you choose not to invest any more, then you will have lost the $62.50 with no chance of recovering it. If you decide to invest the extra money, then there are two possibilities. There is a 50% chance that the stock will go up. In this case, you will get back your original investment plus an additional $125. However, there is also a 50% chance that the stock will go down. If it does go down, there are two possible levels of loss. There is a 75% chance that it will go down a great deal. That means that you will have lost $300 total. If the stock goes down, then there is a 25% chance that it will lose a little of its value. In this case, you will lose $100.

Assuming that the information above is correct, and that both options are otherwise equal in terms of fees, taxes and convenience, do you choose to sell now or wait?

Statistics Course Grade

You are enrolled in a statistics class that requires you to drop some assignments at the end of the semester. You have completed all of the assignments in the class and now must choose what to drop. You may either drop your final project grade or your final exam grade. This decision is complicated because you don't know your exact grade on the final compared to everyone else. Grading is on a 0–200 point scale.

You got a so-so grade on the project, so if you choose to drop the exam, you will reduce your grade in the class by 6.25 points. If you drop the project there are two possibilities. One is that you aced the exam. There's a 50% chance of this. If you aced the exam, your grade will improve by 12.5 points. If you did not ace the exam, then you'll lower your grade. There are two possible amounts that your grade will go down. There is a 75% chance (if you haven't aced the exam) that your grade will be reduced by 30 points, because your grade was low relative to your classmates. There is a 25% chance (if you haven't aced the exam) that your grade will be reduced by 10 points (of the 200) because no one else did well either.

Assuming that all the information above is correct and that the exam and the paper are truly equal in terms of effort, do you prefer to take the exam or the paper?

Casino Gambling

You are in a casino and you've just bet $62.50 on a new sequential lottery game kind of like "Keno," in which The House draws numbers from a bingo cage. The game involves betting against other players and the house on which numbers will be drawn.

You have lost the first bet. You can quit now and your losses will be $62.50. Your other choice is to continue playing the game. If you play again the stakes are higher because other players have been betting too. If you continue, then

you enter a two-stage lottery. In the first stage, you have a 50% chance of winning. That would leave you with total winnings of $125 more than when you started and you are finished.

However, there is a 50% chance that you will move on to a final lottery. In the final stage there is a 75% chance of losing everything, bringing your total losses to $300. There is a 25% chance that you will "win" in the final stage. If this happens, then you will have total losses of $100.

Given the choices above, do you choose to continue to play the game or quit assuming that both choices are equal in terms of fees, taxes and convenience?

REFERENCES

Beach, L. R. (1990). *Image theory: Decision making in personal and organizational contexts*. Chichester: Wiley.

Becker, G. (1976) *The economic approach to human behavior*. Chicago: University of Chicago Press.

Blais, A.-R., & Weber, E. U. (in press). Domain-specificity and gender differences in decision making. *Risk Decision and Policy*.

Dawes, R. M. (1988). *Rational choice in an uncertain world*. San Diego: Harcourt, Brace, Jovanovich.

Dawes, R. M. (1988). Behavioral decision making and judgment. In D. Gilbert, S. Fiske, & G. Lindzey (eds.), *The handbook of social psychology* (Vol. 1, pp. 497–538.) Boston: McGraw-Hill.

Dellarosa, D., & Bourne, L. E. (1984). Decisions and memory: Differential retrievability of consistent and contradictory evidence. *Journal of Verbal Learning and Verbal Behavior*, **26,** 669–682.

Dyer, J. S., and Sarin, R. (1982). Relative risk aversion, *Management Science*, **28,** 875–886.

Goldstein, W. M., & Weber, E. U. (1995). Content and discontent: indications and implications of domain specificity in preferential decision making. In J. Busmeyer, D. L. Medin, & R. Hastie (Eds.), *Decision making from a cognitive perspective* (Vol. 32, pp. 83–126). San Diego: Academic Press.

Hastie, R., & Pennington, N. (2000). Explanation-based decision making. In T. Connolly, H. Arkes, and K. R. Hammond (Eds.), *Judgment and decision making: An interdisciplinary reader* (2nd ed.). New York: Cambridge University Press.

Heath, C., & Tversky, A. (1991). Preference and belief: Ambiguity and competence in choice under uncertainty. *Journal of Risk and Uncertainty*, **4,** 5–28.

Hogarth, R. M., & Kunreuther, H. (1995). Decision making under ignorance: Arguing with yourself. *Journal of Risk and Uncertainty*, **10,** 15–36.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, **47,** 263–291.

Keller, R. L. (1985) An empirical investigation of relative risk aversion, *IEEE Transactions on Systems, Man, and Cybernetics*, **15,** 475–482.

Kintsch, W. (1976). Recalling and summarizing stories. *Languages*, **40,** 98–116.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, **95,** 163–182.

Kintsch, W., & van Dijk, T. A. (1978). Towards a model of text comprehension and production. *Psychological Review*, **85,** 363–394.

Loewenstein, G., Weber, E. U., Hsee, C., & Welch, E. (1999). *Risk as feelings*. Unpublished manuscript. Carnegie Mellon University.

Lopes, L. L. (1983). Some thoughts on the psychological concept of risk. *Journal of Experimental Psychology: Human Perception and Performance*, **9,** 137–144.

Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. New York: Cambridge University Press.

Pennington, N., & Hastie, R. (1988). Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology: Learning Memory and Cognition*, **14,** 521–533.

Pennington, N., & Hastie, R. (1991). A cognitive theory of juror decision making: The story model. *Cardozo Law Review*, **13,** 519–557.

Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the story model for juror decision making. *Journal of Personality and Social Psychology*, **62,** 189–206.

Pennington, N., & Hastie, R. (1993). A theory of explanation-based decision making. In G. Klein, J. Orasanu, R. Calderwood, & C. E. Zsambok (Eds.), *Decision making in action: Models and methods*, (pp. 188–201). Norwood, NJ: Ablex.

Rettinger, D. A., & Hastie, R. (in press). The role of comprehension in decision making. In S. L. Schneider & J. Shantegu (Eds.), *Emerging perspectives on judgment and decision research*. New York: Cambridge Univ. Press.

Shafir, E. (1993). Choosing versus rejecting: Why some options are both better and worse than others. *Memory & Cognition*, **21,** 546–556.

Trabasso, T., & van den Broek, P. (1985). Causal thinking and the representation of narrative events. *Journal of Memory and Language*, **24,** 612–630.

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