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Gain–Loss Framing and Choice: Separating Outcome Formulations from Descriptor Formulations

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This article reexamines the assumptions underlying the disease problem used by Tversky and Kahneman (1981) to illustrate gain–loss formulation effects. It is argued that their reported effect may have been due to asymmetries in the ambiguity of the sure and risky prospects and to the entanglement of two distinct types of formulation manipulations: one having to do with the expected outcomes that are made explicit (positive vs negative) and the other having to do with the descriptors used to convey the relevant expected outcomes (lives saved/not saved vs lives lost/not lost). Two experiments using a formally equivalent problem in which these confounds were eliminated revealed no significant predictive effect of either descriptor or outcomes frames on choice, although a marginally significant framing effect was obtained in Experiment 1 when the signs of the two framing manipulations were congruent. Implications for prospect theory are discussed.

Key Words: framing effects; formulation effects; choice; gains and losses.

Pessimists see the wine glass half empty, optimists see it half full. As this adage of lay personology suggests, the same event may be viewed in different ways by different people. Moreover, sometimes each of these alternative perspectives are objectively correct. A wine glass half empty *is* a wine glass half

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full. A coin that lands heads up *is* a coin that lands tails down. And a medical procedure that offers a 90% chance of survival is also one that offers a 10% chance of mortality. In these examples, the statements constitute complementary descriptions of the same event. Each description implies the other and, from a normative standpoint, it should not matter which one is chosen.

As the earlier adage implies, however, different descriptions may be associated with quite different construals and feelings (McFarland & Miller, 1994) and may prompt quite different choices and behavior (Banks et al., 1995; McNeil, Pauker, Sox, & Tversky, 1982). Also, because it is a norm of conversational pragmatics that people avoid redundancy in their statements (Grice, 1975, Hilton, 1995), they tend not to use multiple descriptions, especially if the descriptions are complements. It would be uncommon—perhaps even strange—to describe a wine glass as both half *empty* and half full. Doing so would violate Grice's *maxim of manner* which stipulates that, among other things, interlocutors should be brief in their utterances. Instead, one would likely truncate the statement, making explicit only one of the two complements (Reyna & Brainerd, 1991).

Considerable research has examined the effects that alternative descriptions or "frames" can have on decision making—particularly how framing influences people's preferences and choices (for reviews, see Kühberger, 1998; Rothman & Salovey, 1997). Tversky and Kahneman (1981) first introduced the term *decision frame* to refer to an individual's conception of a situation that entails the making of a choice (see also Slovic, Fischhoff, & Lichtenstein, 1977). They stated that "the frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision-maker" (p. 453). And they offered several empirical demonstrations of how the same situation (or similar situations) could be framed in different ways that lead to seemingly irrational preference reversals.

Two different senses of the term framing need to be distinguished. In some cases, the alternative frames refer to situations that are not exactly the same but that are equal in terms of a key underlying feature such as expected utility. An example taken from Thaler (1985) is losing a $10 bill versus losing a show ticket that costs $10. Another example, illustrating what Kühberger (1998) termed *task-responsive* framing, is an experiment in which the "same" Prisoner's Dilemma-type game was described to players as either "The Wall Street Game" or "The Community Game." Ross and Ward (1995) reported that players were much more likely to defect rather than cooperate in the former game despite the fact that the payoff matrices in the two games were identical (and regardless of their self-reported dispositional propensities toward either cooperation or competition). The experiment illustrates how the framing of context can exert a powerful influence on participants' construals of what the game was about (see also Bless, Betsch, & Franzen, 1998).

In other cases, different frames are used to describe the same objective situation, as in the "glass half-full/half-empty" adage. In such cases the framing manipulation entails describing the exact same event in complementary ways, and differences in decision making that result from such manipulations are

termed *formulation effects* (Kahneman & Tversky, 1984)—or, alternatively, *strong* (Frisch, 1993) or *strict* (Kühberger, 1998) framing effects. The focus of this article is on formulation effects; in particular, the effects of formulating prospects in terms of either gains or losses on choice.

THE DISEASE PROBLEM

The classic illustration of a gain–loss formulation effect was demonstrated by Tversky and Kahneman (1981) using the disease problem as follows:

> Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences are as follows:
>
> If Program A is adopted, 200 people will be saved.
>
> If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.
>
> Which of the two programs would you favor?

Another group of participants given the same initial paragraph to read were asked to choose between the following two prospects:

> If Program C is adopted, 400 people will die.
>
> If Program D is adopted, there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die.

When the two prospects were framed in terms of the number of *lives saved*, the majority (72%) favored the sure option (Program A) over the risky option (Program B). However, when the two prospects were framed in terms of number of *deaths*, the majority (78%) favored the risky option (Program D) over the sure option (Program C).

According to Tversky and Kahneman (1981), Program A is a complementary description of Program C and, likewise, Program B redescribes Program D. The normative principle of *descriptive invariance* states that the manner in which prospects are formulated should not influence their preference order (Kahneman & Tversky, 1984). Consequently, if Program A is favored over Program B, then Program C should be favored over Program D. Tversky and Kahneman's findings thus were taken as evidence demonstrating that people violate the invariance principle and that instabilities of preferences can be elicited by seemingly trivial variations in wording. Although recent meta-analyses (Kühberger, 1998; Kühberger, Schulte-Mecklenbeck, & Perner, 1999) indicate that Tversky and Kahneman's (1981) framing effect is an outlier in terms of its magnitude, the differences between gain–loss framing conditions are, on average, of a moderate effect size for disease-type problems.

THE PROSPECT THEORY VALUE FUNCTION AND GAIN–LOSS FORMULATION EFFECTS

Tversky and Kahneman (1981) interpreted the previous results in terms of prospect theory (Kahneman & Tversky, 1979). According to prospect theory, outcomes are experienced as either gains or losses relative to a subjective reference point. Subjective value is predicted to be a concave function of utility in the domain of gains and a steeper convex function in the domain of losses. This S-shaped function implies risk aversion in the gains domain and risk seeking in the losses domain. Accordingly, people are likely to choose the sure option when the prospects are framed as gains relative to a reference point of "no lives saved." In contrast, they are likely to choose the risky option when the prospects are framed as losses relative to a reference point of "no lives lost." In other words, prospect theory predicts that people would adopt the *final state* of affairs if nothing were done as their subjective reference point in response to prospects formulated as gains and they would adopt the status quo as their subjective reference point in response to prospects formulated as losses (Kühberger et al., 1999).

THE ASSUMPTION OF PROSPECT COMPLEMENTARITY

In some cases the complement of a description is obvious. If on a coin flip the coin lands with heads facing up, we know that tails faces down. In other cases, however, it may be unclear what a description implies beyond the information given. Tversky and Kahneman (1981) assumed that the fully explicated version of Programs A and C in the disease problem is that *200 people will be saved and 400 people will die.* Frisch (1993; see also Maule, 1989, for a verbal protocol analysis) demonstrated, however, that 41% of participants who demonstrated this classic "framing effect" did not agree that the two versions should be treated as the same when they were later presented side by side.

A closer analysis of the disease problem reveals why the two versions may be viewed differently. This analysis builds on the fact that in both the gain and loss frames the risky option is completely specified but the sure option is left ambiguous. That is, in Program A there are 400 lives about which participants are told nothing and in Program C there are 200 such cases. By contrast, in Programs B and D are unambiguous—participants are informed of the two possible outcomes and their associated probabilities.

The ambiguity of the certain prospects, in turn, may have led to unanticipated violations of the assumption of complementarity. Specifically, participants may have thought that, of the 400 unmentioned people in Program A, at least some might also be saved and, of the 200 unmentioned people in Program C, at least some might die. Berkeley and Humphreys (1982) suggested that, whereas Program A connotes a sense of agency, Program C does not. Given the uncertain and prolonged nature of the described situation (viz., an anticipated epidemic), this interpretation is both plausible and compatible with the type of probabilistic mental models (Gigerenzer, Hoffrage, & Kleinbölting, 1991) that people

would likely generate in reasoning about this case. The ambiguity of the certain prospects may also have made it easier for linguistic norms to systematically bias the interpretation of the prospects. For instance, Macdonald (1986; see also Jou, Shanteau, & Harris, 1996) proposed that people tend to implicitly add the term *or more* to statements about quantities. Clearly, it would be easier to do so if the total number of relevant cases (viz., the 600 people in the disease problem) are not explicitly accounted for.

Recently, Kühberger (1995) obtained empirical support for the notion that framing effects in the disease problem may be due to missing information. He controlled for asymmetries in prospect ambiguity by filling in the missing information for the certain prospects—what I call the *additive method*. For example, under the gains frame, participants read that if Program A is adopted, 200 people will be saved and 400 people will not be saved. Kühberger was able to replicate Tversky and Kahneman's (1981) basic finding when the original wording was used, but he found no "framing" effect when the asymmetry in prospect ambiguity was controlled.

THE ASSUMPTION OF EQUAL EXPECTED UTILITIES OF PROSPECTS

If the assumption that Programs A and C are complementary descriptions is violated, then it no longer follows that the four prospects have equal expected utilities, as Tversky and Kahneman (1981) suggested. Based on the preceding analysis, the following set of ordinal relations in the expected utilities of these prospects would instead be anticipated as follows:

$$U_A > U_B = U_D > U_C. \quad (1)$$

In (1), U_i represents the expected utility of ith program. Note that the two inequalities in (1) match the preference order that Tversky and Kahneman (1981) reported. Given the present analysis, however, it should be clear that these findings do not constitute convincing evidence that people violate the invariance principle in responding to this problem.

One objective of the present research is to build on Kühberger (1995) by controlling for asymmetries in prospect ambiguity using a *subtractive method* in which information from the risky prospects (Programs B and D) is deleted. For instance, Program B might state that "there is a 1/3 probability that 600 people will be saved" and Program D might state that "there is a 2/3 probability that 600 people will die." As noted earlier, because people tend to truncate their descriptions of acts, outcomes, and contingencies in the real world (Reyna & Brainerd, 1991), the subtractive method of controlling for asymmetries in prospect ambiguity is likely to yield findings with greater external validity than the additive method. The main reason for using the subtractive method, however, is to be able to distinguish the effects of two distinct types of gain–loss formulation manipulations that have yet to be systematically disentangled in an experiment. I now turn to a discussion of this distinction.

GAINS VERSUS LOSSES: FORMULATIONS OF DESCRIPTORS OR EXPECTED OUTCOMES?

A theoretical issue that remains unresolved is whether gain–loss formulations have an effect on choice due to the nature of the descriptors used or due to the expected outcomes that are explicitly stated in a given prospect. Consider the disease problem: In Program A, a positive outcome is described in terms of a positive descriptor. Instead this prospect could have been worded "If Program A is chosen, 200 people will not die." By using a negational phrase, a positive expected outcome (i.e., 200 lives saved) is described using a negative descriptor (i.e., dying). Likewise, using a negational phrase, Program C could be redescribed as "400 people will not be saved."

Levin, Schneider, and Gaeth (1998) referred to this as a "simple negation versus alternative terminology" distinction and suggested that it is particularly relevant in goal framing. However, these authors did not explore the implications of alternative linguistic forms of positive and negative frames (e.g., to gain vs to not lose and to lose vs to not gain) for theoretically unpacking the meaning of gain–loss framing. Here, the distinction is made between *descriptor formulations* and *outcome formulations* of gain versus loss. Descriptor formulations refer to whether the root label used to describe an expected outcome is intrinsically positive or negative in evaluative terms. Describing a prospect in terms of "saving" or "not saving" is an example of a positive descriptor because the root label "save" is intrinsically positive in evaluative terms. Outcome formulations, by contrast, refer to whether the expected outcome explicitly described in a prospect is of positive or negative valence. The expectation of saving (or not losing) lives is an example of the former, whereas the expectation of losing (or not saving lives) is an example of the latter. Both descriptor and outcome formulations, however, are relevant to the framing of outcomes as discussed by Tversky and Kahneman (1981).

Table 1 presents the possible interactions between these two types of gain–

TABLE 1

Interactions between Descriptor and Outcome Formulations

Outcome formulation	Descriptor formulation		
	Positive	Mixed	Negative
Positive	Congruent framing (sure option in TK gain frame)	Descriptor reframing (200 saved; that is, 200 won't die)	Incongruent framing (200 will not die)
Mixed	Outcome deframing (risky option in TK gain frame)	Full deframing (200 saved and 400 die)	Outcome deframing (risky option in TK loss frame)
Negative	Incongruent framing (400 will not be saved)	Descriptor reframing (400 die; that is, 400 will not be saved)	Congruent framing (sure option in TK loss frame)

Note. TK refers to Tversky and Kahneman's (1981) disease problem.

loss formulations. By crossing these two types of formulations at three levels, we can distinguish, for instance, between congruent and incongruent gain–loss frames. Frames that use negational statements to describe a positive expected outcome in terms of a negative descriptor or a negative expected outcome in terms of a positive descriptor are incongruent. When the valence is matched in terms of outcome and descriptor formulation, the frame is congruent. Another distinction is among framed, partially deframed (or reframed), and fully deframed alternatives. For instance, in descriptor reframing, a positive expected outcome may be described in terms of a positive label but then restated in terms of a negative label. In outcome deframing, all expected outcomes are made explicit, although the descriptor may invariably be positive or negative. In full deframing, positive expected outcomes are described in terms of positive labels and negative expected outcomes are described in terms of negative labels (e.g., 200 will be saved and 400 will die).

Because the framing of the descriptor and the expected outcomes were confounded in Tversky and Kahneman (1981) and in a score of studies that have followed, it is unclear to what extent the effects are attributable to each of these two factors. As shown in Table 1, in the original experiment, the sure option in the gain frame (Program A) described a positive expected outcome in terms of lives saved; the risky option in the gain frame (Program B) described a positive and a negative expected outcome in terms of lives saved; the sure option in the loss frame (Program C) described a negative expected outcome in terms of lives lost; and the risky option in the loss frame (Program D) described a positive and a negative expected outcome in terms of lives lost.

Kühberger (1995) noted this confound but did not fully disentangle it in his subsequent experiments while simultaneously controlling for the aforementioned asymmetries in prospect ambiguity. As mentioned earlier, in one experimental condition, he controlled for asymmetries in prospect ambiguity, but accomplished this by *adding* the missing information in certain prospects rather than by *deleting* some information from the risky prospects. Consequently, each prospect explicitly described a combination of positive and negative expected outcomes. By using the subtractive method noted earlier, one could similarly control for asymmetries in prospect ambiguity but also orthogonally manipulate both descriptor formulation and outcome formulation. This approach would allow for an evaluation of the independent effects of these two types of gain–loss formulations, as well as the effect of their interaction, on choice. The present research was designed to accomplish this task.

ALTERNATIVE CRITERIA FOR ASSESSING FRAMING EFFECTS

The effect of a framing manipulation may be assessed using at least two different criteria. The first, most common, and most liberal, approach involves using what I call the *intergroup difference criterion* (cf. Levin et al., 1998, on the distinction between choice shift and choice reversal). Here, researchers simply examine whether there is a statistically significant difference between

the two relevant framing conditions. Rejection of the null hypothesis is taken as evidence that framing effects have occurred.

A more conservative approach involves using what I call the *reference distribution criterion*. As with the intergroup difference criterion, this reference distribution criterion requires that a significant difference between framing conditions be observed. In addition, however, predictions about the distribution of choices in each framing condition must be made with respect to a reference distribution that may be either empirically or theoretically derived.

For instance, on the assumption that the prospects in the disease problem have equal expected utilities, expected utility theory would predict indifference between the sure and risky options. Consequently, a 50:50 split between participants favoring the sure option versus the risky option may be used as a reference distribution. Predictions concerning systematic deviations from this distribution may then be tested. For example, prospect theory predicts that loss frames will induce risk seeking, whereas gain frames will induce risk aversion. Accordingly, one might test whether the proportion of participants choosing the sure option is significantly greater than .50 in the gain-frame condition and whether the proportion of participants choosing the risky option is greater than .50 in the loss-frame condition. Such a finding would meet the requirements for what Wang (1996) termed *bidirectional* framing effects; that is, framing effects in which there is a reliable tendency toward risk seeking in one condition and a reliable tendency toward risk aversion in the other condition.

In the preceding example, the reference distribution is theoretically derived from expected utility theory. An alternative, empirical approach would be to obtain the reference distribution by examining choices in a full deframing condition such as that shown in Table 1. For example, the sure and risky prospects in the disease problem may be restated as follows:

> If Program E is adopted, 200 people will be saved and 400 people will die.
>
> If Program F is adopted, there is a 1/3 probability that 600 will be saved and a 2/3 probability that 600 will die.

Here, each prospect explicitly states the expected positive and negative outcomes using both positive and negative descriptors, respectively. As Kühberger et al. (1999) noted, this approach has seldom been employed. In the present research, responses to deframing conditions were obtained, allowing for an empirical implementation of the reference distribution criterion.

EXPERIMENT 1

Method

Upon request to complete a questionnaire, participants ($N = 193$ University of Hertfordshire undergraduates) were presented with a brief description of a situation similar in key respects to the disease problem. The present problem, however, was designed to be less uncertain than the disease problem. In the

present scenario, the threat was already present—not merely forecasted. Specifically, participants read the following:

> In a war-torn region, the lives of 600 stranded people are at stake. Two response plans with the following outcomes have been proposed.

Then, participants were asked to choose between two prospects that represented alternative plans for responding to the crisis. As with the disease problem, the first prospect (Plan A) was a sure option, whereas the second prospect (Plan B) was a risky option. In contrast to the disease problem, however, the certainty of the outcome in Plan A was explicitly noted by using the expression "it is certain that . . ." so that it more closely paralleled the wording of the alternative, risky prospect (viz., "there is an 'n' probability that . . .").

Participants were randomly assigned to one of eight experimental conditions. In two conditions, the prospects were worded exactly as in Tversky and Kahneman's (1981) disease problem (i.e., *TK-gain* vs *TK-loss* conditions). The next four conditions resulted from a 2 (Descriptor Frame: saved vs die) × 2 (Outcome Frame: positive vs negative) between-subjects factorial design (see Table 2). That is, the two prospects were formulated in terms of the number of people who either would be saved or would die (i.e., *saved* vs *die* conditions), and also in terms of either positive or negative explicit expected outcomes (i.e., *positive* vs *negative* conditions). In the final two *deframing* conditions, positive and negative descriptors were used to describe positive and negative outcomes, respectively. For instance, in one condition the wording was as follows:

> If Plan A is adopted, it is certain that 200 people will be saved but it is also certain that 400 people will die.
>
> If Plan B is adopted, there is a 1/3 probability that all 600 people will be saved but there is also a 2/3 probability that all 600 people will die.

TABLE 2

Certain and Risky Prospects as a Function of Descriptor Frame and Outcome Frame

Frame		
Descriptor	Outcome	Prospects
Saved	Positive	If Plan A is adopted, it is certain that 200 people will be saved. If Plan B is adopted, there is a one-third probability that all 600 people will be saved.
Saved	Negative	If Plan A is adopted, it is certain that 400 people will not be saved. If Plan B is adopted, there is a two-thirds probability that all 600 people will not be saved.
Die	Positive	If Plan A is adopted, it is certain that 200 people will not die. If Plan B is adopted, there is a one-third probability that all 600 people will not die.
Die	Negative	If Plan A is adopted, it is certain that 400 people will die. If Plan B is adopted, there is a two-thirds probability that all 600 people will die.

In the other deframing condition, the order in which the outcomes were mentioned was reversed. After reading the problem and considering the two relevant prospects, all participants were asked (as in Tversky & Kahneman, 1981) to indicate which one of the two plans they would favor.

Results and Discussion

First, I examined choice in the deframing conditions. The manipulation of outcome order had no effect on choice: 52% of participants chose the risky prospect when the positive outcome was mentioned first and 50% chose that prospect when the negative outcome was mentioned first. Overall, then, 49% of the deframing group favored the sure prospect and 51% favored the risky prospect. This distribution is almost perfectly matched to that predicted by expected utility theory (i.e., 50:50).

Next, I examined whether the original (but methodologically confounded) framing manipulation used in Tversky and Kahneman (1981) had an effect on choice. Fifty-four percent of participants in the TK-gain condition favored the risky prospect, whereas 85% of participants in the TK-loss condition favored the risky prospect, $\chi^2(1, N = 52) = 5.78, p < .02$. This effect of nonindependence meets the requirements of the intergroup difference criterion. Moreover, a McNemar test revealed that the percentage of participants choosing the risky option was significantly greater in the TK-loss condition than in the deframing condition, $p < .01$. This result is in line with prospect theory's prediction of risk seeking in the domain of losses. The findings, however, do not qualify as a bidirectional framing effect, which prospect theory also predicts, because there is no significant difference between the percentages choosing the risky option in the TK-gain and deframing conditions (see also Kühberger, 1995).

Next, I examined the effect of descriptor frame and outcome frame on choice among participants who responded to one of the four new framing conditions. The percentage of participants choosing the risky option as a function of the two framing manipulations is shown in Table 3. A logistic regression model of

TABLE 3

Percentage of Sample Favoring the Risky Prospect by Descriptor Frame and Outcome Frame

	Descriptor frame	
Outcome frame	Saved	Die
	Experiment 1	
Positive	48 (23)	57 (23)
Negative	58 (24)	72 (25)
	Experiment 2	
Positive	64 (36)	64 (36)
Negative	59 (37)	63 (38)

Note. Values in parentheses are cell sample sizes. *Saved-positive* and *die-negative* conditions are worded *affirmatively,* whereas *saved-negative* and *die-positive* conditions are worded *negationally.*

participants' choices was tested. The predictors entered included descriptor frame, outcome frame, and their interaction. The model was not statistically significant, $\chi^2(3, N = 95) = 3.42$, $p > .30$. Wald statistics revealed that none of the three predictors were significant, ps $> .60$.

An inspection of Table 3 reveals that the tendency toward choosing the sure option was strongest when the descriptor and outcome frames were both positive. Moreover, the tendency toward choosing the risky option was strongest when the two frames were both negative. Thus, a framing effect might be detected only if the two theoretically distinct framing manipulations are congruent in their sign, as was the case in Tversky and Kahneman (1981). To statistically test this hypothesis, I created a new framing variable that had three levels: (a) *congruent-positive,* (b) *incongruent,* and (c) *congruent-negative.* The first level corresponded to the *saved-positive* condition, the second level combined the *saved-negative* and *die-positive* conditions, and the third level corresponded to the *die-negative* condition. A logistic regression model of choice including only this new framing variable was marginally significant, $\chi^2(1, N = 95) = 2.95$, $p < .09$.

Finally, I examined whether any of the new framing conditions differed from the deframing condition in terms of participants' choices. McNemar tests revealed that, of these four framing conditions, only in the die-negative condition was the percentage of participants choosing the risky option significantly different from that in the deframing condition, $p < .03$.

The results of Experiment 1 indicate that when a series of methodological precautions were taken in this disease-type problem, there was no evidence of bidirectional framing effects and, indeed, there was very weak evidence of framing effects even when they were assessed in terms of the most liberal criterion. The findings suggest that past reports of gain–loss framing effects were the result of congruency in the manipulations of two theoretically distinct gain–loss formulations: one having to do with choice of root labels (descriptor formulation) and the other having to do with choices concerning which expected outcome to make explicit in a prospect and which to leave implicit (outcome formulation).

An alternative explanation for the null findings, however, is that there was insufficient statistical power to detect framing effects. If we use the results from the TK-gain and TK-loss conditions to calculate power based on the normal approximation to the binomial distribution. The proportion in the former condition was .46 and it was .15 in the latter condition. Setting $\alpha = .05$ with $n_1 = n_2 = 26$, power is .80 for a one-sided test. Based on these figures, 45 participants per condition would be required for a one-sided test with a power of .95. In Experiment 2, I reexamine the new framing conditions with a sample that exceeds these sample size requirements.

EXPERIMENT 2

In Experiment 2, the four methodologically improved framing conditions used in the previous experiment were examined in greater detail. Participants

given the "war problem" were asked to indicate which plan they favored from the perspective of a particular role: Namely, they were asked to imagine that they were either 1 of the 600 threatened people in the war-torn region or the military official in charge of making the final decision. Participants also were asked a series of questions aimed at revealing their interpretations of the prospects that they faced and their confidence in their choice.

Method

As in Experiment 1, participants ($N = 185$ University of Hertfordshire undergraduate volunteers) were presented with the war problem. They were randomly assigned to one of the four new framing conditions used in the previous experiment or to a fifth deframing condition (viz., the positive-outcome-first condition used in Experiment 1). The number of participants assigned to the framing conditions was 154 namely, for each main-effect test $n_1 = n_2 = 77$ (recall that it was estimated that 45 participants per group was required for power to be .95 for a one-sided test at $\alpha = .05$). After reading the scenario and the relevant prospects, participants were asked "Which of the two plans would you favor if, in the *official* condition, "you were the military official in charge of making the final decision?" or, in the *victim* condition, "you were one of the 600 stranded people?" Role assignment was random.

After indicating which plan they favored, participants rated their confidence that they picked the better plan on an 11-point scale ranging from *not at all confident* (0) to *extremely confident* (10). Next, participants in the framing conditions were asked two questions aimed at clarifying what they thought each prospect implied. For instance, in the *saved-positive* condition participants were asked: "Did you interpret Plan A to mean that, as well as 200 people certainly being saved, the remaining 400 people stranded in the war-torn region will certainly not be saved?" and "Did you interpret Plan B to mean that, in addition to there being a 1/3 probability of all 600 people being saved, there is also a 2/3 probability that nobody will be saved?"

All participants were asked whether their decision would depend on whether the people saved in Plan A were chosen randomly or had to be selected and if they would want to change their choice if they learned (a) that the people would be randomly selected or (b) that they would have to personally select those who would be saved (or who would die). Finally, participants in the *victim* condition were asked if they would favor the same plan if instead they were the military official in charge of making the final decision, and participants in the *official* condition were asked if they would favor the same plan if instead they were one of the stranded victims making the decision.

Results and Discussion

Choice. The choices of participants assigned to the four framing conditions were analyzed using logistic regression. The model, including outcome frame, descriptor frame, role, and all interaction terms, was not statistically significant, $\chi^2(7, N = 147) = 4.01$, $p > .75$. Wald statistics revealed that none of the

predictors were significant, ps $> .60$. Regardless of role taken, whether actual gains or losses were made explicit, and whether these outcomes were described as gains or as losses, the majority of participants in each condition chose the risky option (see Table 3, bottom panel). Collapsing over the four framing conditions, 63% of participants favored the risky option. This percentage did not differ from the percentage of participants who favored the risky prospect in the *deframing* condition (i.e., 76%), Mann–Whitney $U = 2409.50$, $p > .11$. However, it did differ from a 50:50 reference distribution, binomial $p = .003$.

The findings of this experiment, therefore, revealed no evidence of formulation effects even using a liberal, intergroup difference criterion and a sample size that met the estimated requirements for a high degree of statistical power. Moreover, as can be seen in Table 3, it is clear that even in the congruent framing conditions participants' choices did not differ from each other. The lack of an effect of role is not entirely surprising. Wagenaar, Keren, and Lichtenstein (1988) carried out a similar "official vs. potential victim" manipulation of role in their experiments and found inconsistent results. In one experiment, they found that the potential victim role led to more risk aversion than the officer role. In a second experiment, however, they found no role effect with an American sample and a more complex interaction effect between role and locus of action in a Dutch sample. In their third experiment, which changed the cover story used in the previous experiments but kept the formal properties or *deep structure* of the problem the same, no effect of role was observed.

Confidence. Mean confidence levels did not differ significantly as a function of whether the sure option or the risky option was favored, $t(181) = 1.18$, $SED = 0.34$. Nor did the mean confidence level across the four *framing* conditions differ reliably from the confidence level in the *deframing* condition, $t(181) = 1.17$, $SED = 0.40$. Wason (1959) demonstrated that it takes people longer to process negational statements than affirmative statements. One might expect, too, that confidence would be lower in the conditions in which the prospects were worded in negational terms than in the conditions in which they were worded affirmatively. However, as can be seen in Table 4, this was not the case, $t(143) < 1$.

A three-way (Role × Descriptor Frame × Outcome Frame) factorial ANOVA on the confidence ratings of participants in the framing conditions revealed a significant main effect of descriptor frame, $F(1, 137) = 5.96$, $p < .02$, $MSE = 3.94$. As shown in Table 4, mean confidence was greater when the prospects

TABLE 4

Mean Confidence as a Function of Descriptor Frame and Outcome Frame in Experiment 2

	Descriptor frame	
Outcome frame	Saved	Die
Positive	6.03	5.53
Negative	5.89	4.76

were framed in terms of lives saved rather than lives lost. It is clear from Table 4, however, that a "congruence effect" emerged. Specifically, participants were most confident in the *congruent-positive-frame* (i.e., *saved-positive*) condition, less confident in the *incongruent-frame* (i.e., *saved-negative* and *die-positive*) conditions, and the least confident in the *congruent-negative-frame* (i.e., *die-negative*) condition, $F(2, 142) = 4.22$, $p < .02$, $MSE = 16.65$; linear contrast, $F(1, 142) = 7.47$, $p < .008$, $MSE = 29.48$. These findings cohere with other research (e.g., Dunegan, 1993; for reviews, see Peeters & Czapinski, 1990; Taylor, 1991) that suggests that negative outcomes, or outcomes framed in negative terms, may prompt more careful and elaborate information processing than positive, or positively framed, outcomes.

Assumptions of prospect complementarity. Thirty-six percent of participants in the framing conditions did not interpret the sure option such that it implied the complementary expected outcome. For instance, the prospect "it is certain that 200 lives will be saved" was not also taken to mean that it is also certain that the remaining 400 lives will not be saved. Similarly, 32% of the sample did not interpret the risky option such that it implied the complementary outcome. A McNemar test revealed that these percentages did not differ significantly, although responses to the two questions were nonindependent, $\chi^2(1, N = 145) = 10.01$, $p = .002$. Moreover, participants' responses to either question did not differ significantly as a function of outcome frame, descriptor frame, or their interaction (Fs < 1).

In line with Frisch (1993), these findings suggest that, for roughly one-third of the sample, participants' representations of the formal structure of the problem may not have coincided with the deep structure assumed by Tversky and Kahneman (1981) to underlie this type of problem.

Victim selection. Fifty-one percent of the sample indicated that it would make a difference whether the victims were randomly or personally selected, and these indications were independent of role, $\chi^2(1, N = 147) = 0.17$. Nineteen percent of this subsample indicated that they would reverse their choice if they knew the victims would be randomly selected. Twenty-nine percent of the same subsample indicated that they would reverse their choice if they knew the victims would have to be personally selected. In either case, however, the percentage of participants who switched from the sure option to the risky option did not differ reliably from the percentage who switched the other way.

Beliefs about role. Even though participants' choices were independent of role, 76% of participants indicated that they would switch their choice if their role were switched. Even in this subsample, however, choice remained independent of role. Thus, when participants' attention is drawn to the impact of their role on their choice, they overestimate its significance. One interpretation of these results is that participants' verbal reports are unreliable because the true bases of their decision making are inaccessible to them (Nisbett & Wilson, 1977). There is, however, mounting evidence that sometimes experimenters inappropriately interpret participants' reports (Goldstein & Beattie, 1991) and

that often there is a nonnegligible positive correlation between reported and actual cue use (Ebenbach & Moore, 2000; Goldstein, 1990; Mandel & Lehman, 1998; Reilly & Doherty, 1989, 1992). Another explanation worth considering is that the apparent inconsistency between participants' choices and their verbal reports is due to the fact that role variations were manipulated in a between-subjects design and participants were unaware of the alternative role condition. By contrast, the question directly probing whether a change of role would affect the participant's choice makes the contrast between the two roles explicit. If roles were manipulated in a within-subjects design, participants' choices might have been more consistent with their verbal reports.[1]

GENERAL DISCUSSION

This research systematically removed a number of methodological confounds that were present in Tversky and Kahneman's (1981) influential demonstration of the formulation effect and that reappeared in several conceptual replications of that work (e.g., Bless et al., 1998; Fagley & Miller, 1987; Kühberger, 1995; Wang & Johnson, 1995; Wang, 1996; for a meta-analysis, see Kühberger et al., 1999). Specifically, the ambiguity of the sure and risky prospects was equalized by strategically removing information from the risky prospects; the levels of risk associated with each prospect were made equally explicit for the two prospects; and the framing of positive and negative outcomes (viz., people saved or not dying vs people not saved or dying) was fully crossed with the framing of the terms used to describe the relevant outcomes (viz., people saved or not saved vs people dying or not dying). When these methodological precautions were taken, no significant predictive effect of outcome or descriptor frame was observed in either experiment. The present findings thus add to a growing body of literature indicating that framing effects often are not as pervasive or robust as had once been considered (e.g., Bohm & Lind, 1992; Elliott & Archibald, 1989; Fagley & Miller, 1987; Kühberger, 1995, 1998; Li & Adams, 1995; Miller & Fagley, 1991).

In Experiment 1, however, there was a marginally significant gain-loss framing effect that was the result of congruence in sign between the two theoretically distinct framing manipulations. This suggests that past gain–loss framing effects, such as that obtained by Tversky and Kahneman (1981) in the disease problem, were at least in part the result of the congruence in sign of the outcome and descriptor formulations. As in the *congruent-positive* and *congruent-negative* conditions in this research, their gain and loss framing conditions were also "doubly positive" and "doubly negative," respectively. It is unclear why this "congruence effect" on choice was not replicated in Experiment 2. Past research (Larrick, Smith, & Yates, 1992; Miller & Fagley, 1991) indicates that asking participants to provide a rationale for their choice attenuates the effect of framing and it is possible that the inclusion of several follow-up questions in Experiment 2 might have had a similar effect. Nevertheless, there was

[1] I am grateful to Anton Kühberger for bringing this explanation to my attention.

evidence of a similar congruence effect on confidence ratings in Experiment 2. As the frame was described more positively in terms of expected outcome and descriptor, mean confidence increased.

A consistent finding in this research was the observed tendency toward risk seeking. As Fagley and Miller (1997) discussed, the stronger tendency toward risk seeking in human life problems than in money problems may be due in part to high aspiration levels (Schneider, 1992) and salient accountability concerns (Tetlock, 1992) in the former decision-making context. For example, Wang (1996) observed that participants were more likely to favor the risky prospect in a life–death decision task than in tasks concerning public property or personal money because, in the former case, the sure option did not meet the minimum requirements that most participants would find acceptable (see also Jou et al., 1996). The fact that a stronger risk-taking tendency was observed in Experiment 2 is consistent with this explanation, since higher aspiration levels may be anticipated for those playing the role of a threatened victim or an ultimately responsible military official than for those making the choice from the perspective of a relatively disinterested experimental participant.

Prospect Ambiguity and Missing Information

Past research (e.g., Frisch, 1993) suggests that framing effects are more likely when ambiguity about a choice problem is high. In this research, the risky prospects were made more ambiguous than in the disease problem, and yet the effect of framing was exceptionally weak. Consistent with the theoretical analysis provided earlier, the present findings indicate that asymmetries in prospect ambiguity may sometimes be more important for the emergence of apparent framing effects than a *high level* of ambiguity. As noted earlier, the systematic asymmetries in missing information in the disease problem suggest a plausible deep structure to the decision task that, even from a rational perspective, should lead people to favor the sure option given a gain frame and the risky option given a loss frame. The plausibility of that deep structure was purposely undermined in the present experiments by subtracting information about the risky prospect.

It is also worth noting that most of the research examining the effects of missing information on choice has investigated the multiattribute case in which information about one attribute (e.g., price) is present and information about another attribute (e.g., quality) is absent (e.g., see Levin et al., 1986; Levin, Johnson, Russo, & Deldin, 1985). The present research suggests that even in the single-attribute case (e.g., number of lives saved or lost), missing information—particularly asymmetries in missing information between prospects—can influence choice. In particular, the present findings, along with those of Kühberger (1995), strongly suggest that several past demonstrations of gain–loss formulation effects are likely to have been due in large measure to systematic asymmetries in the ambiguity of the relevant prospects as well as to the congruence effect noted earlier rather than to descriptor or outcome formulation effects. In the disease problem, the greater ambiguity of the sure

option invites optimism in the gain frame and pessimism in the loss frame relative to the alternative risky option.

Clearly, the foregoing interpretation does not mean that gain–loss formulations are unimportant in making choices. However, it does suggest that such formulations will tend to influence choice primarily under favorable conditions, namely when descriptive labels and expected outcomes coincide in hedonic valence (i.e., the congruence effect) and when there are opportunities for such hedonic uniformity in formulation to direct the decision-maker in how to fill in missing information about the relevant prospects. Future research building on the present findings and those of Frisch (1993), for example, might profitably examine how such inferential processes (which go beyond the predictions of prospect theory) influence framing effects.

Framing or Reflection Effects?

The present research builds upon Kühberger (1995) and the findings are highly consistent. Nevertheless, there is an important difference of interpretation between the two studies. According to Kühberger, "framing relates to phrasing the same outcomes as though they were gains versus phrasing them as if they were losses" (1995, p. 231). This corresponds to what I have called the *descriptor* frame. However, Kühberger also proposed that when the expected outcomes described actually differ in sign, it is appropriate to consider them as reflection manipulations, not framing manipulations. According to Kühberger's (1995) interpretation, what I have called the outcome frame would not be a framing manipulation because in one condition the prospective outcome is positive and in the other condition it is negative.

The *reflection effect* refers to having opposite preferences for gambles that differ in the sign but not the magnitude of the outcomes (Fagley, 1993; Kahneman & Tversky, 1979). An example of the reflection effect is that most people prefer a sure gain of $30 over an 80% chance to gain $40 but most people also prefer an 80% chance to lose $40 over a sure loss of $30 (Kahneman & Tversky, 1979). Clearly, the sure gain of $30 is not the same as the sure loss of $30 and, therefore, we are not dealing with a framing manipulation in this example. However, does the disease problem have similar features?

There are two reasons why manipulation of explicitly described outcomes in disease-type problems are better thought of as framing rather than reflection manipulations. First, "200 lives saved" is not a reflection of "400 lives lost" because the absolute magnitudes of these explicit outcomes are unequal (viz., 200 vs 400). Second, and more importantly, any account of the deep structure of the problem—rational or otherwise—would also take into consideration the *implicit* outcomes. For instance, 200 lives saved may be taken to imply 400 lived lost and vice versa. *De facto*, each prospect in the disease problem entails mixed expected outcomes, regardless of whether only the positive or the negative outcome is explicitly described. It is more profitable, therefore, to consider the present research as involving two distinct types of gain–loss formulation manipulations: one of which determines the expected outcome that is made

explicit in the prospect (outcome frame) and the other which determines the root label used to describe the outcome (descriptor frame).

Implications for Prospect Theory

In the present research, the crossing of outcome and descriptor frames relied upon the use of both affirmative and negational descriptions. The *affirmative–negational* distinction underlies information integration in several domains such as hypothesis testing (Klayman & Ha, 1987) and contingency estimation and causal induction (Mandel & Lehman, 1998). This distinction, however, poses a problem for prospect theory because all outcomes are translated into an affirmative (outcome-present) state when represented on the value function. Consequently, all measures of value in the gains domain are positive in sign and all measures of value in the losses domain are negative in sign. To represent outcomes that are phrased in negational terms without transforming them into affirmative terms, an alternative negational value function is needed in which losses are coded as negative values ($-v$) in the gains domain and gains are coded as positive values ($+v$) in the losses domain.

The notion of two value functions—one affirmative, $v_+(\cdot)$, and the other negational, $v_-(\cdot)$—raises some interesting theoretical questions. For instance, is $v_+(\cdot)$ for gains a reflection of $v_-(\cdot)$ for losses, and is $v_+(\cdot)$ for losses a reflection of $v_-(\cdot)$ for gains? Or, alternatively, are these symmetries broken? If $v_+(\cdot) \neq -v_-(\cdot)$, then prospect theory would require revisions to account for that inequality. In Experiment 1, framing effects were reliant upon congruence in the sign of the outcome and descriptor formulations, which in turn required the use of affirmative statements. Although further research is needed, this finding coheres with the hypothesis that $v_-(\cdot)$ may be more linear than the S-shaped $v_+(\cdot)$ as proposed in prospect theory (Kahneman & Tversky, 1979). This finding is also consistent with the notion that loss aversion is weaker in $v_-(\cdot)$ than in $v_+(\cdot)$, since loss aversion is presumed to underlie risk seeking behavior. Of course, in order to adequately discern the shape of any value function, positive or negative, one must plot subjective value for a range of utility values.

Another theoretical question concerns how negational wording might influence variability in the subjective reference points that participants adopt. For instance, would the prospect "200 people will not die" be as likely to evoke a status quo reference point of "0 people saved" as the prospect "200 people will be saved"? A related issue concerns the propensity for people to reframe negational, incongruent statements as affirmative, congruent ones. Kühberger and Huber (1998), for instance, found that people were more likely to reframe an affectively negative task (firing one of two candidates) as an affectively positive task (hiring one of two candidates) than vice versa. It seems plausible that people would be more likely to reframe negational statements as affirmative ones than vice versa because the latter are easier to process (Wason, 1959). These theoretical questions, which draw conceptual connections between research on cognitive positivity–negativity biases (Mandel & Lehman, 1998;

McGuire & McGuire, 1992; Peeters & Czapinski, 1990) and subjective valuation, could be valuably pursued in future research.

REFERENCES

Banks, S. M., Salovey, P., Greener, S., Rothman, A. J., Moyer, A., Beauvais, J., & Epel, E. (1995). The effects of message framing on mammography utilization. *Health Psychology,* 14, 178–184.

Berkeley, D., & Humphreys, P. (1982). Structuring decision problems and the "bias heuristic." *Acta Psychologica,* 50, 201–252.

Bless, H., Betsch, T., & Franzen, A. (1998). Framing the framing effect: The impact of context cues on solutions to the 'Asian disease' problem. *European Journal of Social Psychology,* 28, 287–291.

Bohm, P., & Lind, H. (1992). A note on the robustness of a classical framing result. *Journal of Economic Psychology,* 13, 355–361.

Dunegan, K. J. (1993). Framing, cognitive modes, and image theory: Toward an understanding of a glass half full. *Journal of Applied Psychology,* 78, 491–503.

Ebenbach, D. H., & Moore, C. F. (2000). Incomplete information, inferences, and individual differences: The case of environmental judgments. *Organizational Behavior and Human Decision Processes,* 81, 1–27.

Elliott, C. S., & Archibald, R. B. (1989). Subjective framing and attitudes toward risk. *Journal of Economic Psychology,* 10, 321–328.

Fagley, N. S. (1993). A note concerning reflection effects versus framing effects. *Psychological Bulletin,* 113, 451–452.

Fagley, N. S., & Miller, P. M. (1987). The effects of decision framing on choice of risky vs. certain options. *Organizational Behavior and Human Decision Processes,* 39, 264–277.

Fagley, N. S., & Miller, P. M. (1997). Framing effects and arenas of choice: Your money or your life? *Organizational Behavior and Human Decision Processes,* 71, 355–373.

Frisch, D. (1993). Reasons for framing effects. *Organizational Behavior and Human Decision Processes,* 54, 399–429.

Gigerenzer, G., Hoffrage, U., & Kleinbölting, H. (1991). Probabilistic mental models: A Brunswikian theory of confidence. *Psychological Review,* 98, 506–528.

Goldstein, W. M. (1990). Judgments of relative importance in decision making: Global vs. local interpretations of subjective weight. *Organizational Behavior and Human Decision Processes,* 47, 313–336.

Goldstein, W. M., & Beattie, J. (1991). Judgments of relative importance in decision making: The importance of interpretation and the interpretation of importance. In D. R. Brown & J. E. K. Smith (Eds.), *Frontiers of mathematical psychology: Essays in honor of Clyde Coombs* (pp. 110–137). New York: Springer-Verlag.

Grice, H. P. (1975). Logic and conversation. In P. Cole, & J. L. Morgan (Eds.), *Syntax and semantics: Volume 3: Speech acts* (pp. 41–58). New York: Academic Press.

Hilton, D. J. (1995). The social context of reasoning: Conversational inference and rational judgment. *Psychological Bulletin,* 118, 248–271.

Jou, J., Shanteau, J., & Harris, R. J. (1996). An information processing view of framing effects: The role of causal schemas in decision making. *Memory & Cognition,* 24, 1–15.

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

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist,* 39, 341–350.

Klayman, J., & Ha, Y.-W. (1987). Confirmation, disconfirmation, and information in hypothesis testing. *Psychological Review,* 94, 211–228.

Kühberger, A. (1995). The framing of decisions: A new look at old problems. *Organizational Behavior and Human Decision Processes,* 62, 230–240.

Kühberger, A. (1998). The influence of framing on risky decisions: A meta-analysis. *Organizational Behavior and Human Decision Processes*, 75, 23–55.

Kühberger, A., & Huber, O. (1998). Decision making with missing information: A verbal protocol study. *European Journal of Cognitive Psychology*, 10, 269–290.

Kühberger, A., Schulte-Mecklenbeck, M., & Perner, J. (1999). The effects of framing, reflection, probability, and payoff on risk preference in choice tasks. *Organizational Behavior and Human Decision Processes*, 78, 204–231.

Larrick, R. P., Smith, E. E., & Yates, J. F. (1992, November). *Reflecting on the reflection effect: Disrupting the effects of framing through thought*. Paper presented at Meetings of the Society for Judgment and Decision Making, St. Louis, MO.

Levin, I. P., Johnson, R. D., Deldin, P. J., Carstens, L. M., Cressey, L. J., & Davis, C. R. (1986). Framing effects in decisions with completely and incompletely described alternatives. *Organizational Behavior and Human Decision Processes*, 38, 48–64.

Levin, I. P., Johnson, R. D., Russo, C. P., & Deldin, P. J. (1985). Framing effects in judgment tasks with varying amounts of information. *Organizational Behavior and Human Decision Processes*, 36, 362–377.

Levin, I. P., Schneider, S. L., & Gaeth, G. J. (1998). All frames are not created equal: A typology and critical analysis of framing effects. *Organizational Behavior and Human Decision Processes*, 76, 149–188.

Li, S., & Adams, A. S. (1995). Is there something more important behind framing? *Organizational Behavior and Human Decision Processes*, 62, 216–219.

Macdonald, R. R. (1986). Credible conceptions and implausible probabilities. *British Journal of Mathematical and Statistical Psychology*, 39, 15–27.

Mandel, D. R., & Lehman, D. R. (1998). Integration of contingency information in judgments of cause, covariation, and probability. *Journal of Experimental Psychology: General*, 127, 269–285.

Maule, A. J. (1989). Positive and negative decision frames: A verbal protocol analysis of the Asian disease problem of Kahneman and Tversky. In H. Montgomery & O. Svenson (Eds.), *Process and structure in human decision making* (pp. 163–180). New York: Wiley.

McFarland, C., & Miller, D. T. (1994). The framing of relative performance feedback: Seeing the glass as half empty or half full. *Journal of Personality and Social Psychology*, 66, 1061–1073.

McGuire, W. J., & McGuire, C. V. (1992). Cognitive-versus-affective positivity asymmetries in thought systems. *European Journal of Social Psychology*, 22, 571–591.

McNeil, B. J., Pauker, S. G., Sox, H. C., & Tversky, A. (1982). On the elicitation of preferences for alternative therapies. *New England Journal of Medicine*, 306, 1259–1262.

Miller, P. M., & Fagley, N. S. (1991). The effect of framing, problem variations, and providing rationale on choice. *Personality and Social Psychology Bulletin*, 17, 517–522.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports of mental processes. *Psychological Review*, 84, 231–259.

Peeters, G., & Czapinski, J. (1990). Positive-negative asymmetry in evaluations: The distinction between affective and informational negativity effects. *European Review of Social Psychology*, 1, 33–60.

Reilly, B. A., & Doherty, M. E. (1989). A note on the assessment of self-insight in judgment research. *Organizational Behavior and Human Decision Processes*, 44, 123–131.

Reilly, B. A., & Doherty, M. E. (1992). The assessment of self-insight in judgment policies. *Organizational Behavior and Human Decision Processes*, 53, 285–309.

Reyna, V. F., & Brainerd, C. J. (1991). Fuzzy-trace theory and framing effects in choice: Gist extraction, truncation, and conversion. *Journal of Behavioral Decision Making*, 4, 249–262.

Ross, L., & Ward, A. (1995). Psychological barriers to dispute resolution. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 27, pp. 255–304). San Diego, CA: Academic Press.

Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin,* 121, 3–19.

Schneider, S. L. (1992). Framing and conflict: Aspiration level contingency, the status quo, and current theories of risky choice. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 18, 1040–1057.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1977). Behavioral decision theory. *Annual Review of Psychology,* 28, 1–39.

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin,* 110, 67–85.

Tetlock, P. E. (1992). The impact of accountability on judgment and choice: Toward a social contingency model. *Advances in Experimental Social Psychology,* 25, 331–376.

Thaler, R. H. (1985). Mental accounting and consumer choice. *Marketing Science,* 4, 199–214.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science,* 211, 453–457.

Wagenaar, W. A., Keren, G., & Lichtenstein, S. (1988). Islanders and hostages: Deep and surface structures of decision problems. *Acta Psychologica,* 67, 175–189.

Wang, X. T. (1996). Framing effects: Dynamics and task domains. *Organizational Behavior and Human Decision Processes,* 68, 145–157.

Wang, X. T., & Johnson, V. S. (1995). Perceived social context and risk preference: A reexamination of framing effects in a life-death decision problem. *Journal of Behavioral Decision Making,* 8, 279–293.

Wason, P. C. (1959). The processing of positive and negative information. *Quarterly Journal of Experimental Psychology,* 11, 92–107.

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