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Predicting Frames

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Kahneman and Tversky's (1979) "prospect theory" has demonstrated that the way in which a decision problem is formulated, or "framed," can have strong and predictable effects on the perceived attractiveness of the options it offers. At times, the relative attractiveness of two options may be reversed as the result of a reframing that should make no difference at all, according to traditional economic theories of choice. To predict people's behavior with the theory, one must be able to predict what frame they will impose on a particular problem. The seven studies reported here explored different ways of predicting frames, with results that were generally discouraging for the prediction of individuals' choices, generally encouraging for the prediction of group choices.

With their "prospect theory," Kahneman and Tversky (1979; Tversky & Kahneman, 1981) have provided a significant new tool for the analysis of choices made under conditions of uncertainty. The primitives of this descriptive theory of decision making are a value function, $v(x)$, which attaches a subjective worth to each possible outcome of a gamble or prospect, and a weighting function, $\pi(p)$, which expresses the subjective importance attached to the probability of obtaining a particular outcome. The attractiveness, V, of a gamble that offers a chance of p to gain (or to lose) x and a chance of q to gain (or to lose) y would equal $\pi(p)v(x) + \pi(q)v(y)$.

One important feature of the value function is that it assesses outcomes in terms of the change they represent from some reference point, which could represent one's current status, one's anticipated status, or some other psychologically significant point. A second feature is that the function is steeper for losses than for gains, meaning that a given change in one's status hurts more as a loss than it pleases as a gain. A third feature is that it is concave above that reference point and convex below it. Such negatively accelerated curves mean, for example, that the subjective difference between gaining (or losing) $10 and $20 is greater than the difference between gaining (or losing) $110 and $120.

Perhaps the most notable feature of the probability weighting function is the great importance attached to outcomes that will be received with certainty. Thus, for example, the prospect of losing $50 with probability 1.0 is more than twice as aversive as the prospect of losing the same amount with probability .5. For intermediate (i.e., noncertainty) values, the weighting function is somewhat insensitive to changes in probability. For example, a .5 chance of winning $50 would not be 25% more attractive than would be a .4 chance of winning $50.

The nonlinearities of the value and probability weighting functions mean that people's choices should be sensitive to the way in which decisions are formulated or "framed." In their expositions, Kahneman and Tversky have offered powerful demonstrations of how the same decision problem may be framed in ways that are formally equivalent in terms of classical (utility theory) models of choice behavior but that produce reversals of preference that can be predicted on the basis of prospect theory.

In these demonstrations, each decision problem is presented in a format that is consistent with one particular frame. The pros-

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pect theory analysis proceeds under the assumption "either that the original formulation of prospects leaves no room for further editing, or that the edited prospects can be specified without ambiguity" (Kahneman & Tversky, 1979, p. 275). In such studies, the theorist's ability to control the way in which stimuli are presented and interpreted is crucial to being able to predict how the various portions of a stimulus will be integrated into the production of a response (here, a choice). In order to predict behavior in less controlled situations, one must be able to anticipate how problems will be represented and what frames people will use to interpret them.

The present studies examine people's choices between prospects on which it is possible to impose several different frames whose usage should lead to different choices of options, according to prospect theory. These studies ask, in effect, how do we predict which frame people will adopt, so that we can then predict their choices (in accordance with the theory). Because it is so difficult to study simultaneously the interpretations that people give to stimuli and the (decision) rules that they use to evaluate and choose between those stimuli, these studies assume the truth of prospect theory and use it to discern what interpretations have been given. This research strategy cannot lead to rejection of the descriptive validity of the theory, for any failure is seen as lying with the interpretation. Nonetheless, repeated difficulty in finding the interpretation needed to make the theory work can suggest limits to its practicality (as well as to the imagination of the interpreter).

Basic Study

Although prospect theory allows considerable latitude in framing, it is by no means mute with regard to the formulations that people will adopt:

> Prospect theory describes two phases in the choice process: an early phase of editing and a subsequent phase of evaluation. The editing phase consists of preliminary analysis of the offered prospects which *often* yields a simpler representation of these prospects. (Kahneman & Tversky, 1979, p. 274; emphasis added)

The three central editing operations are (a) *coding*, describing each outcome in terms of changes from a neutral reference point (usually one's current asset position); (b) *segregation*, isolating riskless components of risky decisions (e.g., a gamble that either gave \$300 with .8 probability or \$200 with .2 would be "naturally decomposed into a sure gain of \$200 and the risky prospect" [Kahneman & Tversky, 1979, p. 274] of winning \$100 with .8 or \$0 with .2); and (c) *cancellation*, "discarding of components that are shared by the offered prospects"[1] (Kahneman & Tversky, 1979, p. 274).

However, as indicated by the word *often* in the quote above, the theory, although not mute, is deliberately not altogether explicit about how these editing operations are performed. Regarding coding, the reference point "can be affected by the formulation of the offered prospects and by the expectations of the decision maker" (Kahneman & Tversky, 1979, p. 274) and, hence, need not be one's current asset position. The segregation operation will only be carried out where the riskless component is "readily seen" by decision makers. It would not occur, for example, where people were overwhelmed by the surface structure of a problem. Regarding cancellation, "a pair of prospects can be decomposed into common and distinctive components in more than one way, and different decompositions sometimes lead to different preferences" (Kahneman & Tversky, 1979, p. 271).

The present studies consider three frames that reasonable individuals might impose on or derive from the decision problem described in the introductory section of Table 1. The three "ways one might attempt to think about the problem" attempt to capture these three perspectives:

Frame 1. Here, one accepts the problem as it is presented in the description, performing no editing beyond the necessary act of

[1] In addition to these three substantive operations, there are also three neatening or stylistic operations: (d) *combination*, adding the probabilities associated with identical outcomes. Thus, a gamble that gave one \$200 with .25 probability, \$200 with .25, or \$0 with .5, would be translated to receiving \$200 with .5 and \$0 with .5; (e) *simplification*, rounding of probabilities or outcomes; (f) *detection of dominance*, eliminating from further consideration any choice option that is inferior to some other option in all respects. These operations are not considered here.

choosing a reference point (coding). The point chosen is the present situation (no lives lost yet).

In terms of the theory, the value of the sure-loss option is simply $V(B) = \pi(1)v(-50) = v(-50)$, given the convention that $\pi(1) = 1$ and $\pi(0) = 0$. The value of the gamble option would be: $V(A) = \pi(.5)v(-40) + \pi(.5)v(-60)$, or $V(A) = \pi(.5)[v(-40) + v(-60)]$. Option A will then be preferred to Option B if $\pi(.5)[v(-40) + v(-60)] > v(-50)$ or, equivalently, if $\pi(.5) < v(-50)/[v(-40) + v(-60)]$ (remembering that the sum in brackets is negative, which results in reversal of the inequality when it is used as a divisor). Given the convexity of the value function for losses, the ratio of the values will be greater than .5. One way of seeing this is to note that convexity means that $v(-50)$ is closer to $v(-60)$ than to $v(-40)$. Hence, twice $v(-50)$ will be more than the sum of $v(-60)$ and $v(-40)$. Given the assumed shape of the probability weighting function, $\pi(.5)$ will be less than .5, meaning that the inequality holds. Hence, prospect theory predicts that anyone adopting this perspective will be risk seeking, in the sense of preferring a gamble to a sure thing with the same expectation.

Frame 2. Here, one first isolates and then cancels the certain loss of 40 lives that is common to both options. Having done this, one proceeds to evaluate a sure loss of 10 (more) lives and a gamble involving equal chances of losing 0 and 20 (more) lives.

Despite this cancellation procedure, the evaluation and comparison of the two prospects would be similar to that for the prospects as seen from Frame 1. The value of the sure-loss option is $V(B) = \pi(1)v(-10) = v(-10)$. The value of the gamble option is $V(A) = \pi(.5)v(0) + \pi(.5)v(-20) = \pi(.5)v(-20)$. Option A will be preferred to Option B if $\pi(.5)v(-20) > v(-10)$ or, equivalently, if $\pi(.5) < v(-10)/v(-20)$. Given the convexity of the value function for losses, the right-hand side of this inequality will be more than .5 (because losing 20 lives is not twice as bad as losing 10). Given the shape of the probability weighting function, the left-hand side will be less than .5, leading to a preference of the gamble (Option A) for those adopting this frame.

Table 1
Basic Stimulus

A civil defense committee in a large metropolitan area met recently to discuss contingency plans in the event of various emergencies. One emergency under discussion was the following: "A train carrying a very toxic chemical derails and the storage tanks begin to leak. The threat of explosion and lethal discharge of poisonous gas is imminent."

Two possible actions were considered by the committee. These are described below. Read them and indicate your opinion about the relative merits of each.

Option A: Carries with it a .5 probability of containing the threat with a loss of 40 lives and a .5 probability of losing 60 lives. It is like taking the gamble:
.5 lose 40 lives
.5 lose 60 lives.

Option B: Would result in the loss of 50 lives:
lose 50 lives.

Here are three ways one might think about this problem:

1. This is a choice between a 50–50 gamble (lose 40 or lose 60 lives) and a sure thing (the loss of 50 lives).
2. Whatever is done, at least 40 lives will be lost. This is a choice between a gamble with a 50–50 chance of either losing no additional lives or losing 20 additional lives (A) and the sure-loss of 10 lives (B).
3. Option B produces a loss of 50 lives. Taking Option A would mean gambling over a .5 chance to *save* 10 lives and a .5 chance to *lose* 10 additional lives.

Frame 3. Here, one realizes that the best (in the sense of least bad) outcome that one can guarantee is losing 50 lives. Taking this guarantee as something in hand, the sure-loss option now involves staying put; the gamble is over saving 10 lives or losing 10 more. Such a focus on the minimax outcome could be modeled by prospect theory in one of two ways, the first of which seems much more plausible: (a) shifting one's reference point to the 50 lives that one has written off or (b) canceling 50 lives lost from both prospects. In either case, the sure-loss option becomes $V(B) = v(0) = 0$, whereas the gamble is now $V(A) = \pi(.5)v(10) + \pi(.5)v(-10)$. Here Option A will be preferred to Option B if $\pi(.5)[v(10) + v(-10)] > 0$ or, equivalently, if $v(10) > v(-10)$. However, because the value function for losses is steeper than is the value function for gains, the loss of 10 lives should loom larger than should the gain of 10. Hence those who adopt this perspective should prefer the sure loss to the gamble (i.e., Option B to Option A).

Although all three of these frames can be modeled by prospect theory, it is not clear

that they are equally attractive. For example, if one believes that people tend to be captive of whatever superficial problem representation they receive (e.g., Slovic, Fischhoff, & Lichtenstein, 1982; Tversky & Kahneman, 1981), then the most natural of these frames should be Frame 1, which seems most compatible with the problem description and which requires the least editing before the prospects can be evaluated. Similar considerations would suggest that the relative popularity of Frames 2 and 3 might depend upon whether cancellation (2) seems more or less natural than reference points shifts (3).

Experiment 1 explores these questions by asking subjects to rank the frames in terms of naturalness. Whatever the overall results of this popularity poll, one would expect the gamble option to be preferred by subjects who judge Frames 1 and 2 as most natural, whereas the sure loss will be preferred by those (few or many) subjects who judge Frame 3 to be most natural.

Experiment 1

The first study presented the problem appearing in Table 1. Participants were asked to indicate (a) the phrasing that seemed to them to be most natural, (b) the phrasing that seemed least natural, (c) the option that they would select, and (d) the strength of that preference (on a 4-point scale). According to the present interpretation of prospect theory, those who adopt Frames 1 and 2 should also prefer the gamble option (see Option A in Table 1), whereas those who adopt Frame 3 should prefer the sure-loss option (see Option B in Table 1).

Method

Subjects received a one-page form labeled "Civil Defense." After presenting the problem appearing in Table 1 verbatim, the form asked them:

> Which of these three phrasings seems to be the *most* natural way of thinking about this problem?
>
> 1. 2. 3. (circle one)
>
> Which of these three phasings seems to be the *least* natural way of thinking about this problem?
>
> 1. 2. 3. (circle one)
>
> Which option would you select?
>
> ____ Option A.
> ____ Option B.
>
> How strong is your preference for the alternative you just checked? Check one:
>
> Slight preference ☐
> Moderate preference ☐
> Strong preference ☐
> Very strong preference ☐

For this study and the following ones, the relevant form was one of several given in a self-paced session involving unrelated judgmental tasks. Subjects were recruited through advertisements in the University of Oregon student paper and a state employment service office. Typically, subjects recruited this way are divided evenly between men and women, with men averaging about 24 years in age and women about 21.

In the present study, 42 individuals received the form described above, while another 42 received a simpler form omitting the discussion of the three ways of looking at the problem.

Results

The bottom row of Table 2 presents the option choices of subjects who received the simple form, which had no discussion of or questions about frames. Of these 42 individuals, 36 preferred the gamble to the sure loss. Such risk seeking in the realm of losses is quite contrary to standard utility theory, which assumes that large losses receive disproportionate weight, leading to risk aversion. This pattern of preferences is, however, quite compatible with prospect theory, assuming that a frame such as 1 or 2 is adopted. From these option preferences, one would expect Frame 3 to be much less popular than Frame 1 or 2, with Frame 3 being adopted by about 15% of all individuals.

Table 2
Frame and Option Preferences in Experiment 1

	Option preference		
Frame preference	Gamble	Sure loss	Total
Subjects with long form			
Choice as most natural			
1	12	4	16
2	12	0	12
3	12	2	14
Choice as least natural			
1	11	0	11
2	9	3	12
3	16	3	19
All subjects	36	6	42
Subjects with simple form	36	6	42

The right-hand column of the top section of Table 2 shows the popularity of the frames, as judged by subjects receiving the long form. The frames were judged equally attractive, from the perspectives of choices as most natural frame and choices as least natural frame.

According to these popularity ratings, one third of all subjects in the long form group should prefer the sure-loss option, being those subjects who preferred Frame 3. However, as the remainder of the table shows, the sure-loss option was just as unpopular with the long form as with the simple form; only 6 of 42 subjects preferred it. Moreover, the sure loss was no more popular among subjects who found Frame 3 to be most natural, nor was it any less popular among subjects who found Frame 3 to be least popular.

The strength of preference ratings provided no additional information. If the verbal ratings are converted into a scale from 1 (slight preference) to 4 (very strong preference), mean ratings were approximately 2.2 for all frame and option preferences.

Experiment 2

In Experiment 1, prospect theory provided no guide to predicting subjects' choice preferences on the basis of their frame preferences. Although general principles of experimental design might prompt one to prefer a pair of options that are more balanced in terms of their overall attractiveness, the unpopularity of the sure loss still does not explain the relative naturalness of Frame 3 or the lack of a relation between frame and option choices.

One aspect of the experimental manipulation to which these difficulties might be attributed is the fact that the civil defense problem is initially presented in a manner that seems most compatible with Frame 1. Perhaps that perspective leads readers to an initial preference for the gamble. When asked about the most natural frame, one third of the subjects may still like Frame 3; however, as far as choices go, their minds have already been made up in favor of the gamble indicated by Frame 1. Experiment 2 tests this hypothesis by offering revisions of the basic form that used initial presentations more compatible with Frames 2 and 3.

Method

Three new forms were created. One initially described the options in a manner that seemed to reflect Frame 2:

> *Option A*: Would result in the loss of at least 40 lives. However, it does offer a .5 probability of containing the threat with the loss of 40 lives. On the other hand, there is also a .5 probability of losing 20 additional lives. It is like taking the gamble:
>
> .5 lose no more lives (in addition to losing
> .5 lose 20 more lives. 40 lives)
>
> *Option B*: Would result in the loss of 50 lives.
> lose 50 lives

A second new form tried to capture Frame 3 in its description of options:

> *Option A*: Would result in the loss of 50 lives.
> lose 50 lives
>
> *Option B*: Carries with it a .5 probability of saving 10 lives compared with Option A and a .5 probability of losing 10 lives. It is like taking the gamble:
>
> .5 saving 10 lives
> .5 losing 10 additional lives.

Because the Frame 3 form reversed the order of the options for the sake of a less awkward presentation, a new version of the original form was also devised. This form was identical to the original except that the order of the options was reversed to facilitate comparisons with Frame 3. Contrasting this order-reversed form with the original form should reveal whether the order in which options are presented affects their attractiveness.

A total of 155 individuals judged either one of these new forms or additional copies of the original long form (from Experiment 1).

Results

Order reversal. Reversing the order of the options in the Frame 1 form made no difference in either frame preference or option preference. With each order, subjects were divided approximately equally in terms of which frames they thought were most natural and least natural. With each order, most subjects found the sure-loss option to be less attractive; 16.7% picked the sure loss when it was presented first, compared with 20.8% who picked it when it was listed second ($Z = .54$). The two groups were pooled.

Alternative problem presentations. The left-hand side of Table 3 shows the percentage of subjects judging each frame to be most natural, within the three experimental groups, each of which received an initial problem presentation designed to be particularly compatible with one of the frames. These naturalness ratings suggest that the presentation manipulation was only mildly successful. All

Table 3
Frame and Option Preferences in Experiment 2 (Civil Defense Problem)

Frame presented	*n*	% of subjects choosing frame as most natural: Frame preference 1	2	3	% of subjects choosing sure-loss option: Frame preference 1	2	3	Ave %
1	114	32	35	33	25	15	18	19
2	46	22	37	41	10	12	26	17
3	37	30	22	49	27	25	17	22
Ave %		29	33	38	23	15	20	19

Note. The number of subjects involved in each cell equals the entry in the left-hand part of the table multiplied by *n* for that row and divided by 100. For example, 38 people (33 × 114/100) were presented Frame 1 and preferred Frame 3; 7 of these 38 chose the sure-loss option, producing the 18% in the corresponding cell on the right-hand side.

three frames received a higher proportion of "most natural" ratings in the formulation designed to highlight them than with the two other formulations. However, this difference approached statistical significance only with Frame 3 ($Z = 1.47$). Regarding choices of least natural frame (not shown), Frames 1 and 2 were as likely to be rated least natural in the forms designed to highlight them as in the other forms. Frame 3, however, was much less likely to be rated least natural in the form highlighting it (13.5% vs. 33.8%, $Z = 2.42$).

The weakness of this manipulation reduces the likelihood that the pattern of results observed in Experiment 1 was due to the particular problem wording used there. People's frame preferences seem to be relatively independent of the frame they see first. The robustness of those frame preferences also reduces the chances that subjects' option choices would be altered by the present manipulation.

As the right-hand side of Table 3 shows, the sure-loss option was as unattractive here as it was in Experiment 1, garnering only 19% of all choices, half of what it should have received had it been preferred by all subjects who preferred Frame 3. The popularity of the sure loss was unrelated to either the frame that subjects received (right-hand column) or the frame that they preferred (bottom row). Indeed, it was chosen by only 17% of the subjects who both received and preferred Frame 3.

Experiment 3

Although participants in Experiment 2 saw the problem in only one formulation, they read descriptions of all three frames prior to choosing an option. Conceivably, this reading exercise weakened the experimental manipulation by diluting the impact of the frame used in the problem description. Experiment 3 examines this possibility by reversing the order of the option-preference and frame-preference tasks, so that subjects will have seen only one formulation at the time they make their option choices. One possible drawback of this ordering is that subjects will not have made a deliberative choice between frames when they choose options. However, before considering further which order is superior, it is worth seeing whether order makes any difference.

Method

Forms were identical to those used in Experiment 2, except that the option-selection task preceded the naturalness-judgment task. That task was moved to a separate page in order to reduce the chances that subjects might still read about the three frames prior to selecting an option. All three forms presented the sure loss first. As an indirect manipulation check, subjects were asked later in the experimental session to remember which of the three frames they had received and which option they had selected. Eighty-two individuals judged this set of forms.

Results

Responses in Experiment 3 were, in general, very similar to those observed in Experiment 2. The sure loss remained unpopular; it was chosen by 26.8% of subjects (compared with 19.3% in Experiment 2). As before, it was no more popular among subjects who received the Frame 3 version; it was selected by 27.6% of those subjects compared with 26.4% of subjects receiving Frame 1 or 2. Nor was the sure-loss option any more popular among subjects who judged Frame 3 to be most natural after making their choice; it was chosen by 24.0% of those who

preferred Frame 3 and by 28.7% of those who preferred the other frames.

In addition to showing the robustness of Experiment 2's results, Experiment 3 provided some subsidiary information about frame judgment. Postponing the naturalness judgments had no effect on subjects' (minimal) propensity to judge the presented frame as being most natural; 36.6% did so here, versus 36.0% in Experiment 2. Nonetheless, when asked unexpectedly after 40 min. of unrelated tasks to remember which of the three frames had been used in their problem description, 75.0% did so correctly (compared with the 34.0% that would be expected by chance). When asked after the memory task which frame they now preferred, 75.3% expressed the same preference as they had earlier. This consistency of preference was quite similar for those who had initially preferred Frames 1, 2, and 3 (71.4%, 76.7%, and 77.3%, respectively). Although these recall tasks focused additional attention on the frame that was presented, they did not increase its popularity: Still only 36.0% of subjects judged the presented frame to be most natural. Apparently, people do attend to frames; however, their frame preferences are not readily manipulated.

Ninety-one percent of subjects remembered which option they had chosen. This percentage was somewhat higher among those who chose the gamble (94.6% vs. 81.0% for those who chose the sure loss, $Z = 1.86$), perhaps reflecting a somewhat weaker strength of preference among subjects choosing that option.

Experiment 4

A natural question to ask at this juncture is how general these results are. Experiments 4, 5, and 6 test their generality by varying different parameters of the research design. Experiment 4 replaces the civil defense context with analogous options using dollars. It asks, in effect, whether there is something special about losses of life that makes people's choices insensitive to frames. Although the lead examples in Tversky and Kahneman's (1981) presentation of framing effects involved losses of life and subsequent examples used dollars, they did not undertake any systematic variation of the kinds of stakes.

Method

Forms comparable to those used in Experiment 2 were created by replacing all losses of life by losses of an equivalent number of dollars. Instead of the civil defense introduction, subjects were told simply to "imagine that you are faced with two unattractive options." One hundred and seventeen individuals judged these forms.

Results

Two versions of the Frame 1 form were again used. Again, reversing the order of options had no discernible effect. In both cases, approximately one third of subjects chose the sure loss. Their choices of most and least natural frame were essentially identical. Hence, responses to those two forms were combined.

The left-hand side of Table 4 shows frame preferences as a function of frame presented. As before, frame preferences were quite robust, showing little response to frame presentation. Frame 2 was somewhat more popular when its formulation was used; Frame 1 was somewhat less popular. There seems to be some shift in the overall popularity of the different frames with the two kinds of stakes. Frame 1 was judged most popular 29% of the time in the lives context, compared with 40% with the dollars context ($Z = 2.05$). Frame 3's share of choices as most

Table 4
Frame and Option Preferences in Experiment 4 (Dollar Problem)

		% of subjects choosing frame as most natural			% of subjects choosing sure-loss option			
		Frame preference			Frame preference			
Frame presented	*n*	1	2	3	1	2	3	Ave %
1	38	29	32	39	36	17	40	32
2	40	43	43	15	41	24	0	28
3	39	49	18	33	26	0	23	21
Ave %		40	31	29	34	17	26	27

Note. The number of subject involved in each cell equals the entry in the left-hand part of the table multiplied by *n* for that row, divided by 100. For example, 6 people ($15 \times 40/100$) preferred Frame 3 when they were presented Frame 2; none of these 6 preferred the sure loss, producing the 0% on the corresponding cell on the right-hand side.

popular dropped correspondingly from 38% to 29% ($Z = 1.62$). If robust and common, such context dependency could further complicate the task of predicting what frames people will adopt (and what choices they will make).

Given the reduced popularity of Frame 3, one would expect the sure loss to be even less popular here than it was in the lives context. However, it was actually somewhat more popular, being chosen by 26% of subjects here, compared with 19% in Experiment 2 ($Z = 1.49$). Perhaps limiting one's losses is a more attractive (or palatable) option when those losses are dollars rather than lives.

As shown by the right-hand side of Table 4, there was again no relationship within experiments between option choice and either frame preference or frame presentation.

Experiment 5

For subjects who are unversed in prospect theory, it is necessary to devise a verbal equivalent of each frame, both for presenting the problem in a particular formulation and for inquiring about the naturalness of each frame. One possible concern about Experiments 1–4 might be that the manner in which each frame was described verbally somehow failed to capture its formal properties. Experiment 5 used different descriptions designed to highlight the reference point in each frame and to increase the similarity between the way that each frame was described and the way that the corresponding problem description was formulated.

In Experiments 1–4, neither frame preference nor frame presentation predicted option choice. If one could choose which of those two variables would be related to option choice, frame presentation would be the more useful predictor. As an experimenter, one can control which frame is used. As an observer, one might hope to discern the frame latent in the presentation of a real-world problem. Even if option choices were related to frame preferences, we know so little about how those preferences are determined that it would be difficult to exploit that relationship. The modest shifts in the overall popularity of Frames 1 and 3 between the dollars and lives contexts suggest that these preferences may not even be stable across content areas. Experiment 5 explored the stability of frame preference by presenting each subject with both a dollars and a lives problem (both using the same new frame formulations).

Method

Three new civil defense forms were created, each cast in the perspective of one frame. Because the order in which options were presented had no effect in Experiments 2 and 4, the same ordering was used here for each form (sure loss first).

In the description of the "three ways one might think about the problem," Frame 1 was left untouched. Frame 2 was changed nominally to mention the sure loss first. Frame 3 was reworded to make the reference point more independent conceptually of the sure-loss option. It read:

Frame 3. One can guarantee that no more and no less than 50 lives will be lost. Option A assures that that will happen. Option B means gambling over a .5 chance to *save* 10 lives and a .5 chance to *lose* 10 additional lives.

The Frame 1 form was unchanged except for this rewording of the frame descriptions.

The introduction of the Frame 2 form was changed in order to accentuate the 40 lost lives that were common to both options. Specifically, a sentence was added stating that "Forty people's lives are going to be lost whatever you do." The option descriptions were then changed to:

Option A: Would result in the loss of 10 additional lives.
lose 10 additional lives.
Option B: Offers a .5 probability of containing the threat with the loss of 40 lives. On the other hand, there is also a .5 probability of losing 20 additional lives. It is like taking the gamble:
.5 lose no additonal lives
.5 lose 20 additional lives.

Analogous changes attempted to highlight the reference point in the Frame 3 form. To the introduction was added "Fifty lives are in imminent danger." The options were described as:

Option A: Would constrain the loss of life to those 50 people. That is, it would result in
saving 0 lives
losing 0 additional lives.
Option B: Carries with it a .5 probability of saving 10 of those people whose lives are in danger and a .5 probability of losing 10 additional lives. It is like taking the gamble:
.5 saving 10 lives
.5 losing 10 additional lives.

A set of three forms for the dollars context was constructed making comparable changes. Each subject received a dollars form using the same frame some 15 min. after completing the civil defense form, following several unrelated intervening tasks. This within-subjects design was intended to give some preliminary idea of the consistency of option and frame preferences across these two domains. However, given the transparent similarity of

the two tasks and the proximity of their presentation, the comparisons must be treated cautiously.

A total of 127 individuals completed these forms, with roughly equal numbers receiving each frame formulation.

Results

Civil defense. The left-hand side of Table 5 reports the frame preferences of subjects shown each form. Over all forms, the rewordings reduced Frame 3's share of most natural judgments from 38% to 25% (Z = 2.41) while increasing selections of Frame 1 (from 29% to 34%, Z = 0.94) and of Frame 2 (from 33% to 41%, Z = 1.45). Whether these changes suggest small or large sensitivity of frame preference to verbal representation depends on how large one judges the present wording changes to be. The attempt to increase the similarity between the frame descriptions shown to all subjects and the problem descriptions designed to capture each frame was moderately successful. Each frame was judged to be more natural by subjects whose problem description was intended to match that frame than by subjects receiving one of the other two problem descriptions. Overall, 45.7% of subjects preferred the frame they saw.

The right-hand side of Table 5 shows option choice as a function of frame given and frame preferred. Even though the popularity of Frame 3 dropped by one third (compared with Experiment 2), the popularity of the sure-loss option increased from 19% to 30% of all choices (Z = 2.20). Within Experiment 5, the frequency of choosing the sure loss was unrelated to the frame used or to the frame chosen as most natural (or to choices of least natural—not shown).

Dollars. Although they should be used cautiously, responses to the dollar forms were similar to those seen with the civil defense forms in the present study and the dollar forms of Experiment 4: (a) In Experiments 2 and 4, the sure loss was more popular with the dollar problem than with the civil defense problem (31% vs. 19%). Here, the respective percentages were 40% and 30%. (b) The increased popularity of the sure loss was achieved without a corresponding increase in the popularity of Frame 3. (c) There was no relation between frame preference and option choice. (d) As with the civil defense forms, Experiment 5's rewording increased Frame 1's popularity (from 40% to 50% of "most natural" choices). (e) As with the civil defense forms, all three frames were most often judged most natural by subjects whose problem had been presented in terms of that frame.

Table 5
Frame and Option Preferences in Experiment 5

Frame presented	n	% of subjects choosing frame as most natural: Frame preference 1	2	3	% of subjects choosing sure-loss option: Frame preference 1	2	3	Ave %
Civil defense problem								
1	43	51	28	21	36	25	33	33
2	41	15	59	27	33	25	45	32
3	43	35	37	28	40	19	17	26
Ave %		34	41	25	37	23	31	30
Dollars problem								
1	40	63	18	20	44	14	38	38
2	41	39	39	22	38	31	33	34
3	42	50	24	26	57	50	27	48
Ave %		50	27	23	47	33	32	40

The only deviation from this pattern of similarities was that subjects who received the Frame 3 form chose the sure-loss option more often than did subjects who received the other forms (48% vs. 36%, Z = 1.27). Although this change is in the anticipated direction, given the welter of comparisons showing no difference or modest changes in the opposite direction, it is hard to attribute very much significance to it.

Consistency. Comparing responses to the dollars and the lives versions revealed that the great majority of subjects also preferred the same frame for both problems (69.0% vs. the 36.8% that would be expected by chance). Their option choices were somewhat less consistent, with 63.1% choosing the same option both times, compared with 54.0% expected by chance. If one assumes that subjects addressing the dollar problem had no memory of the civil defense problem, these results might be taken to indicate that they had more

stable (or better articulated) frame preferences than option preferences. If one assumes that subjects remembered everything, the result at least indicates that they did not feel compelled to be consistent.

Experiment 6

An implicit assumption of the preceding experiments is that people interpret the naturalness question as an enquiry regarding the frame that they themselves have used. Conceivably, however, they might have interpreted it as a judgment of consensus (how most other people would judge the problem) or of normative status (how the problem should be considered). Because prospect theory is not a normative theory, it makes no statement as to which frame subjects should use. That does not mean that subjects do not decide spontaneously that the experimenter has some "right answer" in mind when asking about naturalness. If subjects did interpret "most natural frame" as "proper frame," then the absence of any relationship between frame and option preference would mean rejection of prospect theory as a normative guide (a finding that would not trouble advocates of the theory unless one believed that a descriptively valid theory must be normatively appealing). Or, one could argue that subjects did give the theory normative status, but were unable to follow its dictates in linking a frame preference with an option choice. To clarify the meaning of the naturalness judgment, subjects in Experiment 6 were asked explicitly about what frame had guided them.

Method

Forms were identical to those of Experiment 3, except that subjects were asked "which of these three phrasings most closely captures the way in which you thought about the problem when making your choice between the two options." Following description of the three frames, this question preceded the two questions regarding the most and least natural ways of thinking about the frame. In all, 180 subjects participated, with approximately equal numbers receiving forms that emphasized each of the three frames.

Results and Discussion

In the aggregate, the frame-you-used wording produced patterns of results like those produced by the most-natural-frame wording. Again, only a minority of subjects (41.7%) chose the frame highlighted in their questionnaire. Pooling across the three forms, each frame again had a substantial body of adherents, with Frames 1, 2, and 3 chosen by 18.3%, 45.6%, and 36.1% of subjects in Experiment 6, respectively, compared with 28.0%, 41.5%, and 30.5% of subjects in Experiment 3, $\chi^2(2) = 3.22$, $p > .10$.

The sure-loss option was for some reason a bit more popular here than in Experiment 3; it was chosen by 35.0% of subjects compared with 26.8% ($Z = 1.33$). Preference for the sure loss was, however, still unrelated to choice of frame. It was chosen by 35.4% of those who reported using Frame 3 and by 34.8% of those who reported relying on Frame 1 or 2. Thus, subjects either did not know what frames they used or did not use prospect theory to translate that frame into a choice. The sure loss was chosen slightly, but not significantly, more often by those who received Frame 3 than by those who received Frame 1 or 2 (42.6% vs. 31.1%, $Z = 1.54$).

As mentioned, subjects chose the most (and least) natural frame after pointing to the one they used. The juxtaposition of these tasks would seem to force subjects to find some way to distinguish between the "most natural" frame and the one they had just reported choosing (otherwise, why would they be asked two separate questions). Because their sequential position renders the naturalness judgments suspect, they are reported only cursorily. In general, they looked much like those observed elsewhere: The presented frame was chosen by a minority of subjects (40.0%) as most natural, and there was no relation between frame preference and option preference, $\chi^2(1) = .34$. Some 51.6% of subjects chose as most natural the frame that they reported using (compared with the 31.1% that would be expected by chance). Even among these "consistent subjects," who might be seen as having the most robust frame preferences, there was no relation between frame and option choice.

Experiment 7

All of the forms used in Experiments 1–6 have involved one particular gamble, albeit

presented in a variety of ways and contexts. The "hidden story" of these studies has been the persistent popularity of the gamble relative to the sure loss, independent of the frame used or preferred. One step toward establishing the generality of the present results is clarifying the generality of that aversion to sure losses (or preference for risk seeking). Experiment 7 varies the parameters of the civil defense problem, always keeping the sure loss equal to the expected value of the gamble.

If we had more detailed knowledge of the shapes of the value function and the probability weighting function, it would be possible to derive precise predictions regarding the way in which these changes should affect the option preferences of individuals adopting various frames. Conversely, one could use the changes in option preferences observed with such changes in the options as a means to assess the shapes of the functions. As such detailed analyses are beyond the scope of the present article, the new problems will be exploited primarily as indicators of the robustness of the preference for risk seeking observed above.

Method

Eight variants of the basic problem were created and presented to groups of approximately 40 subjects drawn from the same pool as the previous studies. The problems are described on the left-hand side of Table 6. The "gamble parameters" are the probabilities and magnitudes of the two outcomes of the gamble; "sure loss" is the magnitude of the sure loss, which was always set equal to the expected value of the gamble. The variations may be briefly described as:

- Problem 1 changes the gamble's outcomes from 40 and 60 (in the basic problem) to 0 and 100. This change raises the maximum possible loss considerably but also provides a .5 chance of escaping with no loss at all.
- Problem 2, like Problem 1, offers the chance of no loss at all with the gamble. However, the maximum possible loss and sure loss were both raised considerably.
- Problems 3 and 4 use the gamble losses of Problems 1 and 2, respectively. However, they shift the gamble's probabilities for (no loss, loss) from (.5, .5) to (.8, .2). The sure loss is correspondingly reduced by a factor of 2½.
- Problems 5 and 6 use the gamble losses of Problems 3 and 4 but reduce the probability of the loss outcome even more. The sure loss is also reduced.
- Problems 7 and 8 are like the basic problem in offering no hope of escaping without loss. They differ from the basic problem in the variance of the gamble's outcomes.

These problems were all presented in the same format as was the basic problem. Alternative frames were neither used nor asked about because the present data were collected some years ago, prior to the development of prospect theory. Subjects were, however, asked how the number of lives lost with the sure-loss option would have to change for them to change their preferences. Specifically, they were asked (where A represents the gamble):

1. If you chose A over B, how few lives would have to be lost in the certain-loss option (B) before you would take it?

I would choose B if "only" _____ lives were lost for certain.

2. If you chose B over A, how high could the life toll in the certain-loss option go before you would shift to A?

Table 6
Option Preferences for Variations of Civil Defense Problem

Problem number	Problem description: Gamble parameters P_1	L_1	P_2	L_2	Sure loss	Preferences: n	% of subjects choosing sure loss	*Mdn* switching value: Chose gamble	Chose sure loss
1	.5	0	.5	100	50	39	3	2	51
2	.5	0	.5	100,000	50,000	34	9	50	75,000
3	.8	0	.2	100	20	39	13	0	25
4	.8	0	.2	100,000	20,000	36	11	100	60,000
5	.99	0	.01	100	1	41	29	0	5
6	.99	0	.01	100,000	1,000	46	4	50	37,500
7	.5	1	.5	99	50	39	13	1	75
8	.5	25	.5	75	50	38	18	25	60
Basic[a]	.5	40	.5	60	50	42	14	—	—
Total						312	13		

Note. P = probability; L = loss of lives.
[a] Results from simple form of Experiment 1—not included in totals.

I would shift to A if the certain loss with B rose to _____ lives.

Such judgments could, in principle, be used to parameterize the various curves in prospect theory. However, they are used here only to get some idea of how strong subjects' preferences were for the options they chose.

Results

Choices. The clearest pattern in Table 6 is the preponderance of subjects who preferred the gamble in every variation of this civil defense problem. Sure-loss choices ranged from 3% (Problem 1) to 29% (Problem 5), averaging 12.5% over all conditions. This suggests that the results obtained with the particular values used in the basic problem were not unrepresentative of what would have been obtained with a wide variety of other values. Although such consistency of option choices does not guarantee that the relations between choices and frames would be the same with all these problem variants, it does suggest that replication of Experiments 1–6 with different parameter values is not the most promising way to explore the effects of framing.

Both because the variations in results across problems are fairly small and because the problems were not designed to discriminate between frames, a detailed exposition is inappropriate here. Attention to a few examples may help show the kind of predictions that prospect theory makes in such cases (whatever frame is adopted) and the modest support for those predictions that is found here. For example, contrast Problem 1 with the basic problem: The convexity of the loss function means that reducing L_1 from 40 to 0 should have more impact than increasing L_2 from 60 to 100. As the sure loss is the same in both cases, the gamble should be more attractive in Problem 1, which it is (Z = 1.88). Similar logic leads one to expect the gamble to be more attractive in Problem 7 than in the basic problem, which it is not. On the other hand, compare Problems 1 and 7: Adding a first life lost to L_1 should do more to reduce the gamble's attractiveness in Problem 7 than subtracting 1 life from the 100 associated with L_2 does to increase it. Problem 7's gamble is, indeed, less attractive (Z = 1.70). Within the limits of the present method and sample sizes, the combination of the basic problem with 1 and 7 suggests that qualitative effects, such as crossing the threshold from 0 to 1 life lost, may be more important than quantitatively large changes.

As a final example, consider the contrast between Problems 5 and 6. The relatively great popularity of the sure loss in Problem 5 is surprising because of the relatively great weight given both to the first unit of loss and to outcomes known with certainty. Prospect theory would presumably account for this popularity by noting that small probabilities are overweighted, meaning that a substantial portion of subjects gave enough weight to P_2 (equal to .01) to compensate for the aversiveness of the sure loss. In Problem 6, the probabilities remain the same, but the stakes have escalated considerably. The great drop-off in support for the sure loss (Z = 3.16) suggests that the value function for losses is much less steep in the 1,000 to 100,000 range than it is in the 1 to 100 range.[2]

Strength of preference. The switching values, indicating the value that the sure loss would have to assume for subjects to change their preferences, offer some hints as to the strength and nature of subjects' preferences. In general, those who chose the gamble initially were very reluctant to switch. With Problem 1, for example, the median switching value of 2 means that they wanted to have the sure loss cut by 96%, from 50 to 2. With Problems 3, 5, 7 and 8, the median subject wanted the sure loss reduced to L_1, the lesser of the gamble's possible losses, before switching. If taken literally, these responses would reflect risk seeking in the extreme. It remains to be seen, however, whether numerical judgments, such as switching values, will prove as robust as the categorical judgments of option preference. Two specific qualifications of the present method are that (a) these were values for switching, not values indicating when the two options were equally attractive;

[2] Alternatively, one could argue that something about the size of the stakes makes the .01 probability much more likely to be considered an impossibility in Problem 6 that in Problem 5. Such an influence of values on probability weighting is not only intellectually unsatisfying but also is at odds with the great importance that people seem to attach to unlikely, but potentially catastrophic, events (Slovic, Fischhoff, & Lichtenstein, 1979).

(b) these judgments were given by individuals who had already made an explicit commitment to one option. Nonetheless, it seems as though these subjects were willing to incur quite large risks in order to avoid a sure loss of life.

So few subjects chose the sure loss that it is difficult to reach any firm conclusions on the basis of their switching values. It appears, though, that these individuals were much less dogged in their choices. For most problems, only a modest increase in the sure loss was needed for these subjects to switch to the gamble. In no case was a subject willing to let the sure loss rise to the value of L_2 before switching.

Like subjects in Experiments 1–6, these subjects also indicated the strength of their preference for the chosen alternative on a 4-point scale. These ratings provided the same picture as did the switching values. For seven of the eight problems, subjects who preferred the gamble were more confident in their choices than were subjects who chose the sure loss. Over all problems, the mean preferences were 2.5 versus 1.9, respectively (using the same scoring system as in Experiment 1).

Discussion

If one assumes that people adopt Frames 1 or 2, then the present results provide strong support for one of prospect theory's strongest predictions. According to the theory, people should and, according to these data, people do prefer the gamble to the sure loss. Moreover, they do so despite a variety of changes in parameters, context, wording, instructions, and order of presentation. Although these variations do not exhaust all possibilities, they do cover several local ranges fairly well.

This prediction (and set of behaviors) runs contrary to the predictions of the standard expected utility model. That theory applies no weighting function to probabilities and assumes that people are risk averse for losses. From that perspective, the expected utility of the gamble will be equal to $.5u(-40) + .5u(-60)$, whereas the expected utility of the sure loss will be simply $u(-50)$. Risk aversion assures that the average of $u(-40)$ and $u(-60)$ will be less than $u(-50)$. Hence, people will prefer the sure loss, which has less negative utility.

Why, however, should one assume that people adopt Frame 1 or 2 rather than Frame 3? Frame 3 is not only a fairly popular perspective among subjects but also quite a legitimate one from prospect theory's point of view. Indeed, one could not even treat such a perspective within expected utility theory, which assumes that prospects are evaluated by looking at their effect on one's total asset position, not by comparison with a reference point reflecting where one could be by accepting a sure loss.

According to Tversky and Kahneman (1981):

> A diversity of factors determine the reference outcome in everyday life. The reference outcome is usually a state to which one has adapted; it is sometimes set by social norms and expectations; it sometimes corresponds to a level of aspiration, which may or may not be realistic. (p. 456)

In this light, the present studies can be viewed as having explored—and established—what reference point people tend to adopt in this sort of problem. The robustness of this dominant perspective is perhaps demonstrated most clearly by the negligible impact of trying to present the problem so as to accentuate Frame 3's perspective. Unlike some of the problems used as demonstrations by Kahneman and Tversky (1979; see also Fischhoff, Slovic, & Lichtenstein, 1980; Tversky & Kahneman, 1981), this kind of problem does not evoke labile preferences. If one wished to extract a general principle, it might be that even though shifts to a minimax loss reference point are theoretically possible, they are not commonly undertaken. That is, people do not readily adapt to absorbing losses. Such a principle would be one step toward developing the substantive theory of how people respond to particular decision problems that is needed to give prospect theory greater predictive validity.

The difficulty with this interpretation is that it does not account for the fact that Frame 3 was judged to be the most natural perspective by roughly one third of all subjects in each condition of Experiments 1–6. Nor does it account for the absence of any relation within those studies between frame preference and option preference. Indeed, to

the extent that overall preference levels for Frame 3 did vary across experiments (from 23% to 38%), its popularity was negatively correlated ($\gamma = -.80$) with variations in the popularity of the sure loss (from 14% to 40%). Clearly, one would like to be able to predict people's choices from their appraisal of what frame seems to fit a problem best, particularly when those naturalness judgments seem quite robust (as suggested by Experiment 5). If one can only infer frames from preferences after assuming the truth of the theory, one runs the risk of making the theory itself untestable. The dissatisfaction that many people have with utility theory often arises from observing the convoluted lengths to which one must go in reinterpreting decision problems so as to find something whose utility people were maximizing (Fischhoff, Goitein, & Shapira, 1981).

One quick way to dispel these doubts is to dismiss naturalness judgments as a research tool, arguing that people cannot introspect accurately about the factors influencing their decisions and choices. An analysis of the situations in which introspections are more and less likely to be accurate is beyond the present article (see, e.g., Ericsson & Simon, 1980; Nisbett & Wilson, 1977; Smith & Miller, 1978; White, 1980). Tversky and Kahneman's (1981) feeling that "individuals who face a decision problem . . . are normally unaware of alternative frames and of the potential effects on the relative attractiveness of options" (p. 457) might be seen as supporting the mistrust of introspections about decision processes such as those studied here. If one accepts prospect theory, then the present results might encourage one to agree with them.

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