The Effects of Framing, Problem Variations, and Providing Rationale on Choice

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Tversky and Kahneman reported a large effect of the framing of decision options on choice. When options were phrased positively in terms of gains, people chose the sure thing. But when options were phrased negatively in terms of losses, people chose the risky option. However, not all researchers have replicated this finding, especially when using different decision problems and task requirements. Consequently, problem and/or task variables may be important. The current study investigated two problem variables: degree of apparent gain/loss in the risky option (e.g., partial vs. total) and probability of success in the risky option. The effect of requesting a rationale on the framing effect was also studied. Although framing significantly affected choice, its effects were mediated or moderated by rationale request, degree of apparent gain/loss, and probability, sometimes in complex ways. The findings suggest that framing is less pervasive than previously believed.

A widely cited study by Tversky and Kahneman (1981) reported a very large effect (eta squared ≈ .25) of the "framing" (phrasing) of alternative outcomes on choice. Tversky and Kahneman used a decision problem that asked subjects to choose between two treatment alternatives for an "unusual Asian disease, which is expected to kill 600 people." When the two alternatives were phrased positively in terms of the number of people who would be saved, 72% of subjects chose the sure thing—the treatment that would save 200 for certain. In contrast, when alternatives were phrased negatively in terms of the number of people who would die, 78% of subjects chose the risky alternative—the treatment that offered a 1/3 chance that no one would die (but a 2/3 chance that all 600 would die). The essential feature of the *framing effect* as described by Tversky and Kahneman was a *reversal in the majority choices* of subjects receiving different framings of the decision problem outcomes. They argued that this reversal occurred because the alternative framings caused subjects to view the outcomes as gains in the positive frame and as losses in the negative frame. Prospect theory (Kahneman & Tversky, 1979) predicts that people's choices will differ depending on whether the outcomes are gains or losses.

PROSPECT THEORY AND THE FRAMING EFFECT

Prospect theory (Kahneman & Tversky, 1979) was developed as an alternative to classical utility theory for describing human choice behavior. Prospect theory incorporates a basic psychological principle of perception and judgment—sensitivity to *changes* in magnitude of stimuli rather than the absolute magnitude of stimuli. In classical utility theory, choice is determined by the magnitude of the final asset position (and attitude toward risk). In contrast, prospect theory proposes that the salient feature determining choice is the apparent degree of *change* in wealth or welfare from an initial reference point. The central feature of prospect theory is a value function that takes the form of an S-shaped curve. According to Kahneman and Tversky (1979), three characteristics of the value function are important: (a) Value

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is defined in terms of deviations from an initial reference point; (b) the function is generally concave for gains (indicating risk aversion) and convex for losses (indicating risk seeking); and (c) the curve is steeper for losses than for gains. In addition to the value function, a weighting function was hypothesized—but Kahneman and Tversky argued that most choices are predominantly determined by the value function. Only rarely would the weighting function change the order of preferences.

The framing effect (Tversky & Kahneman, 1981) is a near mirror-image reversal of preference depending on the framing (i.e., phrasing) of the options. In some decision situations, perspective can be manipulated by changing the reference point. That is, the *apparent* domain of the outcomes can be influenced by using either the current asset position or an expected asset position as the reference point (Kahneman & Tversky, 1979). Outcomes may then be made to appear either as losses or as gains. The reversal in choices (the framing effect) is a direct result of the shape of the value function. The characteristics of the value function imply that choices will be risk averse in the domain of gains and risk seeking in the domain of losses (except in rare instances in which the probabilities are extreme, causing the weighting function to play an important role in choice). In addition, preferences in the domain of losses should be slightly stronger than preferences in the domain of gains, because the curve is steeper for losses than for equivalent gains. For example, the Asian disease problem described by Tversky and Kahneman (1981) illustrates a reversal of preference from 78% for the risky option when the problem was framed negatively in terms of losses to 72% for the risk-averse option when the problem was framed positively in terms of gains.

Although the framing effect is a necessary consequence of the value function for gains and losses described in prospect theory (Kahneman & Tversky, 1979), two attempts to replicate the framing effect have been unsuccessful (Fagley, 1985a; Fagley & Miller, 1987).[1] Two potentially important differences in these studies, however, may have reduced the framing effect. First, problems other than Tversky and Kahneman's (1981) Asian disease problem were used. The problems used 2/5 rather than 1/3 as the probability of success in the risky option, and they involved cancer treatment rather than programs for combating an "unusual Asian disease." This suggests that problem variations may influence the occurrence of the framing effect; that is, they may interact with framing. Second, subjects were asked to explain the rationale for their choice. But requesting a rationale may also interact with framing. The failure to replicate the framing effect represents a problem for prospect theory because Tversky and Kahneman have reported that the framing phenomenon is robust. Consequently, it should not be influenced by minor variations in problem characteristics or procedures.

Recently, a significant relation between framing and choice was observed in a close replication. Fagley and Miller (1990) reported a significant effect of framing on choice, but responses were not consistently in the direction predicted by prospect theory for problems involving nonextreme probabilities (i.e., risk averse in the positive frame and risky in the negative frame). Furthermore, responses differed considerably among the five decision problems used. The problems differed on several dimensions, including probability of success in the risky option. This indicates that problem characteristics are important in whether or not a framing effect is observed.

The present study investigated the generality of the framing effect by explicitly examining whether two kinds of variables interact with framing to influence subjects' choices: (a) variations in the decision problems (probability and degree of apparent[3] gain or loss associated with outcomes) and (b) the procedural variation of requesting a rationale for choice. Three probabilities of success in the risky option were investigated: 1/3, 1/2, and 2/3. We reasoned that there should come a point at which the likelihood of success in the risky option is so great that even subjects seeing the positive frame would choose the gamble (even though prospect theory predicts risk aversion regarding gains). We hypothesized that at higher probabilities the effect of framing would be neutralized. An overall effect of probability was also expected; that is, if subjects are attending to the details of each problem, more should select the risky option when its likelihood of success is greater. Nevertheless, the moderating effect of probability on framing was the primary focus.

The variable representing the degree of apparent gain (or loss) was based on whether the outcome of the risky alternative involved a partial or total apparent gain/loss. For example, the Asian disease problem in which 600 fatalities are expected presents a risky option involving total apparent gain/loss. The positively framed version states, "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" (Tversky & Kahneman, 1981, p. 453). In contrast, a partial apparent gain would be presented by the following alternative: "If Program B is adopted, there is a 1/3 chance that 450 will be saved and a 2/3 chance that 75 will be saved." This would be a partial gain/loss situation because in either of the two possible outcomes of the risky option, some people are saved. A main effect of degree of apparent gain/loss was predicted. A risky option with a partial gain/loss is less

risky than one with a total gain/loss. So more people should be willing to select the risky option when it involves a partial rather than a total apparent gain/loss.

Two levels of the procedural variable of requesting a rationale were explored—requesting a rationale and not requesting one. The focus of this manipulation was to determine whether there was an *interaction* between requesting a rationale and framing, rather than a main effect. We hypothesized that requesting a rationale might reduce the effect of framing on choice. This could help explain previous failures to replicate framing effects.

Three aspects of this study should be emphasized. First, subjects' choices were obtained on several decision problems, rather than just one, providing a more representative sample of choice behavior. Second, probability and degree of apparent gain/loss were investigated, giving a more complete picture of problem characteristics that affect choice and which may interact with framing. Finally, the Asian disease problem itself was included as an additional problem to allow direct comparison with the original findings reported by Tversky and Kahneman (1981).

METHOD

Subjects. Ninety-six undergraduates in introductory management courses at two western state universities participated (44 women, 50 men, and 2 who did not report their sex).

Materials. Seven decision problems were used to measure subjects' choices between risk-averse and risky alternatives. In addition to Tversky and Kahneman's (1981) Asian disease problem, six similar problems were constructed. Although probability and degree of apparent gain/loss were varied, all the problems shared the following characteristics of the original Tversky and Kahneman problem: (a) Each problem presented two alternatives, (b) the first alternative was a sure thing, (c) the second alternative was a binary-valued gamble, and (d) the outcomes of the two alternatives were of equal expected value.[2] Two random sequences and two corresponding counterbalanced sequences of the problems were constructed, for a total of four different sequences.

As in Tversky and Kahneman's (1981) study, two framings of the decision problems were created—positive (outcomes in terms of apparent gains) and negative (outcomes in terms of apparent losses). Two versions of the positively and negatively framed instruments were created—one requesting only a choice and the other requesting a rationale in addition to a choice. Both framing and rationale request were studied between subjects.

Procedure. Each subject responded to a questionnaire representing one of four (2 framing × 2 rationale request) conditions. All subjects were asked for their choices through questions such as "Which plan would you choose as owner?" Subjects in the rationale-requested condition were also asked, "Please explain your rationale."

Design and analysis. Primary analyses involved the set of six decision problems and were conducted in phases. First the overall analysis was computed—a split-plot analysis of variance of choice scores. The independent variables were framing, sex of subject, rationale request, probability, degree of apparent gain/loss, and their interactions. This analysis included three between-subjects variables (framing, sex, and rationale request) and two within-subjects variables (probability of success and degree of apparent gain/loss). To permit unambiguous interpretation of nonsignificant results (Fagley, 1985b), sample size sufficient to detect a medium effect was used (see Cohen, 1977). Subsequent phases of the analysis dissected significant interactions.

RESULTS

Subjects' responses to each decision problem were scored −1 (if they chose the sure thing) or +1 (if they chose the risky alternative). Cell means and standard deviations of these choice scores are reported in Table 1. A mean less than zero indicates that most subjects chose the sure thing; a mean greater than zero indicates that most subjects chose the risky option; and a mean near zero indicates that approximately equal numbers of subjects chose the risk-averse and risky options.

Six of the 96 subjects were deleted from the statistical analyses because of missing data on the decision problems. Five statistically significant results emerged from the initial overall analysis. In general, more risky choices were made in the negative framing condition than in the positive, $F(1, 82) = 5.16$, $p = .026$, and as the probability of success in the risky option increased, $F(2, 164) = 37.09$, $p < .001$. However, these general tendencies had some exceptions, as indicated by significant interactions between probability and frame, $F(2, 164) = 7.12$, $p = .001$, and between degree of gain/loss and probability, $F(2, 164) = 12.09$, $p < .001$. For instance, when probability was 2/3, more risky choices were made in the positive framing condition than in the negative. And more risky choices were made when the degree of gain/loss was partial than when it was total (i.e., all-or-none) except when the probability was 2/3. The fifth significant effect was the four-way interaction of frame, degree of gain/loss, rationale request, and probability, $F(2, 164) = 4.40$, $p = .014$. In order to interpret this complex interaction, data were

TABLE 1: Mean Choice Scores (and Standard Deviations)

		No Rationale Requested		*Rationale Requested*	
Probability	*Degree Gain/Loss*	*Positive Frame*	*Negative Frame*	*Positive Frame*	*Negative Frame*
1/3	Partial	-.48	.04	-.74	-.09
		(.90)	(1.02)	(.69)	(1.02)
	Total	-.91	-.22	-.39	-.73
		(.42)	(1.00)	(.94)	(.70)
1/2	Partial	-.57	.39	-.04	-.09
		(.84)	(.94)	(1.02)	(1.02)
	Total	-.74	-.30	-.83	-.36
		(.69)	(.97)	(.58)	(.95)
2/3	Partial	.30	-.13	.13	.00
		(.97)	(1.01)	(1.01)	(1.02)
	Total	.65	.48	.30	.36
		(.78)	(.90)	(.97)	(.95)
Asian disease problem		-.13	.30	.30	.36
		(1.01)	(.97)	(.97)	(.95)

NOTE: Scores can range from -1 (for risk-averse choices) to +1 (for risky choices). Means are based on 22 or 23 scores, depending on missing data.

analyzed for each rationale request condition separately. Sex of subject was dropped from further consideration because it was not involved in any significant effects.

To interpret the four-way interaction, for each rationale request condition, a split-plot ANOVA was computed with frame as the sole between-subjects variable and with degree of apparent gain/loss and probability of success as within-subjects variables. For the 46 subjects who were not asked to give a rationale for their choices, four statistically significant findings were observed. In general, more risky choices were made in the negative framing condition than in the positive, $F(1, 44) = 6.08$, $p = .018$, and when probability of success in the risky option was greater, $F = 19.29$, $p < .001$. Again, however, significant interactions moderated these overall tendencies: degree by probability, $F(2, 88) = 8.83$, $p < .001$, and frame by probability, $F(2, 88) = 9.65$, $p < .001$.

Further analysis of the frame by probability interaction showed that more risky choices were made in the negative framing condition than in the positive only when probability was 1/3 or 1/2 (F [1, 44] = 10.03, p = .003, and F [1, 45] = 12.40, p = .001, respectively), regardless of the degree of gain/loss. When probability was 2/3, more risky choices were made in the positive framing condition than in the negative, though not significantly more, $F(1, 45) = 3.24$, $p = .08$.

In contrast, for the 45 subjects who were asked to give a rationale for their choices, no overall effect of frame was observed, $F(1, 43) = 0.66$, $p = .423$. There was, however, an overall effect of probability, $F(2, 86) = 17.16$, $p < .001$, such that more risky choices were made when the probability of success in the risky option was greater, and an interaction of frame, degree of gain/loss, and probability, $F(2, 86) = 4.74$, $p = .011$.

A follow-up analysis of the three-way interaction looked at the effects of frame, degree of apparent gain/loss, and their interaction within each probability. No overall effect of framing was observed for any of the three probabilities (all ps > .35). When probability was 1/3, however, framing and degree of gain/loss interacted, $F(1, 44) = 7.16$, $p = .01$, more risky choices being made in the negative framing condition than in the positive only when the degree of gain/loss was partial, $F(1, 45) = 5.13$, $p = .028$. When probability was 1/2, significantly more risky choices were made when the degree of gain/loss was partial than when it was total, regardless of framing, $F(1, 44) = 7.62$, $p = .008$.

The proportion of subjects choosing the risky option for each problem is shown in Table 2. Examination of Table 2 reveals several interesting findings concerning the framing effect. There are two ways one could look for a framing effect: by looking for a reversal of majority choices and by looking for a significant relation between framing and choice. Using the first criterion, the reversal of majority choices predicted by prospect theory was observed in only 4 of the 14 problem by rationale request conditions. All occurred when no rationale was requested, and 1 was in the opposite direction to that predicted by prospect theory—choices were risky in the positive frame and risk averse in the negative frame. Using the criterion of a relation between framing and choice, only 3 of the 14 conditions showed a framing effect. One of these occurred when a rationale was requested. Of the 3, only 1 also showed a reversal of majority choice (when p was 1/2, degree was partial, and no rationale was requested).

It is interesting to note that when a rationale was requested, *no majority choice reversal* due to framing was observed in the Asian disease problem originally used by Tversky and Kahneman. Although a reversal in majority choice was observed when a rationale was not requested, the relation between framing and choice was not significant. This is noteworthy in light of other failures to replicate. Furthermore, the effect size of .22—measured by the phi coefficient—was relatively small compared with the "large" effect (phi = .5) reported by Tversky and Kahneman (1981).

DISCUSSION

Although framing significantly affected choice, with more risky choices in the negative framing condition, its effect was mediated or moderated by several other vari-

TABLE 2: Proportion Selecting the Risky Option

		No Rationale Requested			*Rational Requested*		
Probability	*Degree Gain/Loss*	*Positive Frame*	*Negative Frame*	*Phi*	*Positive Frame*	*Negative Frame*	*Phi*
1/3	Partial	.26	.52	−.27	.13	.42	−.36*
	Total	.04	.39	−.42*	.30	.13	.20
1/2	Partial	.25	.71	−.48*	.48	.42	.02
	Total	.13	.38	−.26	.09	.30	−.29
2/3	Partial	.65	.42	.22	.57	.54	.07
	Total	.83	.71	.11	.65	.71	−.03
Asian disease problem		.43	.67	−.22	.65	.67	−.03

NOTE: Proportions are based on 22 or 23 subjects, depending on missing data. For the phi coefficients, positive framing was coded +1, and negative framing was coded −1; in addition, risky choices were coded +1, and risk-averse choices were coded −1.
*$p < .05$.

ables, including requesting a rationale and probability of success in the risky option. Taken as a whole, the findings suggest that framing is less pervasive than suggested by Tversky and Kahneman (1981; Kahneman & Tversky, 1984). From the perspective of which variables have the greater impact on choice, regardless of framing, probability of success in the risky option greatly affected whether the risky option was chosen. In general, the greater the probability of success, the more people selected the risky option. This indicates that subjects were carefully reading each decision problem rather than developing a response set as their choices were sensitive to differences in probability of success.

Regarding the conditions under which framing effects are observed, it appears that framing effects may be limited to situations where no rationale is requested and where the probability of success in the risky option is less than 2/3. Having to give a rationale is probably a more realistic test of the practical importance of framing because most real-life decisions require decision makers to give at least a brief rationale (if only informally to their spouse, secretary, or colleagues). Asking subjects to "briefly explain your rationale" was believed to be a milder intervention than, say, asking them to provide a justification for their choice. Yet it had a great impact on the occurrence of framing effects. Previous studies by Fagley (1985a) and Fagley and Miller (1987), which found no framing effect using a problem involving total apparent gain/loss and a probability of 2/5 of success in the risky option, asked subjects to provide a rationale. Consequently, variability in the findings may have been due, at least partly, to requesting a rationale. It is important to note that requesting a rationale cannot explain other previous variability in findings. For example, Fagley and Miller (1990) did not ask for rationales, and yet they obtained much weaker framing effects than reported by Tversky and Kahneman (1981).

The disappearance of framing effects at probability = 2/3 suggests that the probability-weighting function may have a different shape than hypothesized by Kahneman and Tversky (1979). According to Kahneman and Tversky's hypothesized weighting function, all but extremely small or large probabilities ($p < .1$ or $p > .9$) tend to be underweighted (see Schneider & Lopes, 1986, for an extended discussion). It is the underweighting of intermediate probabilities that leads to preference for certainty regarding gains and for risks regarding losses—the basis of the framing effect. Our data suggest that somewhere between the probabilities of 1/2 and 2/3, probability ceases to be underweighted, causing framing to disappear. In contrast, the weighting function hypothesized by Kahneman and Tversky indicates only two points of changeover—when probabilities are extremely large or small. In discussing the shape of the weighting function, Kahneman and Tversky (1984) stated, "These considerations suggest a category-boundary effect: A change from impossibility to possibility or from possibility to certainty has a bigger impact than a comparable change in the middle of the scale" (p. 344). But our findings suggest that another "category-boundary effect" may exist for the change from unlikely ($p < .5$) to likely ($p > .5$), near the middle of the scale. Furthermore, it makes intuitive sense that a change in the perception of probability would occur around $p = .5$ at the category boundary separating "unlikely" from "likely."

A perusal of the responses to the individual decision problems reveals that, of the two problems showing a reversal in choice, only one showed risk aversion in the positive frame and risk seeking in the negative frame as predicted by the value function and the weighting func-

tion in prospect theory. Kahneman and Tversky (1979) argued that choice was primarily determined by the value function, even though a weighting function was also hypothesized. As noted earlier, the weighting function was expected to change the preference order of prospects only when probabilities are extreme, which they were not in the current problems. Consequently, because few of the problems showed the form of reversal predicted by the value and weighting functions, the results of the current study suggest that either (a) the value function does not play the primary role in determining choice as asserted, (b) the shape of the value function is not as hypothesized, or (c) the shape of the weighting function is different from that hypothesized, causing it to play a larger role in choice.

Another research question involved whether the original findings reported by Tversky and Kahneman (1981) for the Asian disease problem could be replicated. Although the results were in the direction predicted by prospect theory and observed by Tversky and Kahneman when no rationale was requested (i.e., more subjects chose the risky option in the negative framing condition than in the positive), the effect of framing was not statistically significant. When a rationale was requested, framing had negligible effects—a majority of subjects chose the risky option in both framing conditions.

The current findings appear more consistent with research (e.g., Cohen, Jaffray, & Said, 1987; Hershey & Schoemaker, 1980; Schneider & Lopes, 1986) that has focused on the value function itself and the "reflection" effect (more accurately called the *domain* effect by Fagley & Miller, 1987). These studies have shown that subjects' choices in the domains of gain and loss are often inconsistent with the hypothesized value function of prospect theory.

QUESTIONS FOR FUTURE RESEARCH

At this point, it seems clear that framing occurs to differing degrees depending on problem variables and task requirements. Consequently, future research should concentrate on systematically exploring the relation between problem and task variables and the value and weighting functions of prospect theory. Two examples of these kinds of research questions are, first, what shape is the probability-weighting function? Where does the changeover from underweighting to overweighting occur? Our findings suggest that a change from underweighting to overweighting may occur between probabilities of 1/2 and 2/3, whereas the hypothesized weighting function of prospect theory suggests that this turnaround in the effect of framing on choice should not occur until probabilities become extreme ($p < .1$ or $p > .9$). Second, is the probability weighting function the same shape regardless of other problem and task variables such as arena, degree of apparent gain/loss, and providing a rationale? That is, can one family of weighting functions adequately account for observed choices? Pursuing these questions will require a broader sampling of the continuum of probability. In addition, a closer look at values between 1/2 and 2/3 is needed because framing disappeared in this range, suggesting that the weighting function undergoes a major change at this point.

NOTES

1. Several other studies have investigated framing effects (e.g., Levin et al., 1986; Neale & Bazerman, 1985), but these have not been direct replications of Tversky and Kahneman's (1981) study. Different operationalizations and different tasks have been used.

2. The expected value of an option is computed by multiplying each outcome by its probability of occurrence and then summing the products across all outcomes possible for an option.

3. The word *apparent* is used to highlight that the outcome is the same in the positive and negative framing conditions, but in the positive frame it is viewed as a gain whereas in the negative frame it is viewed as a loss.

REFERENCES

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (rev. ed.). Orlando, FL: Academic Press.

Cohen, M., Jaffray, J., & Said, T. (1987). Experimental comparison of individual behavior under risk and under uncertainty for gains and for losses. *Organizational Behavior and Human Decision Processes, 39*, 1-22.

Fagley, N. S. (1985a, August). *Factors affecting choice of risky options.* Paper presented at the annual meeting of the American Psychological Association, Los Angeles.

Fagley, N. S. (1985b). Applied statistical power analysis and the interpretation of nonsignificant results by research consumers. *Journal of Counseling Psychology, 32*, 391-396.

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. (1990). The effect of framing on choice: Interactions with risk-taking propensity, cognitive style, and sex. *Personality and Social Psychology Bulletin, 16*, 496-510.

Hershey, J. C., & Schoemaker, P.J.H. (1980). Prospect theory's reflection hypothesis: A critical examination. *Organizational Behavior and Human Performance, 25*, 395-418.

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.

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.

Neale, M. A., & Bazerman, M. H. (1985). The effects of framing and negotiator overconfidence on bargaining behaviors and outcomes. *Academy of Management Journal, 28*, 34-49.

Schneider, S. L., & Lopes, L. L. (1986). Reflection in preferences under risk: Who and when may suggest why. *Journal of Experimental Psychology: Human Perception and Performance, 12*, 535-548.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453-458.