

Emotions within reason: Resolving conflicts in risk preference

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This research focused on differential effects of emotional and rational preferences in decision making and how people resolve conflicting risk preferences caused by inconsistency between their emotional reactions to and rational assessment of a risk problem. In addition, effects of the framing of choice outcomes on emotional, rational, and overall risk preferences were examined. Adopting a within-subjects design, Study 1 showed that the emotional choice preference was often the opposite of the rational choice preference and was more risk-seeking than the rational preference. The overall favourability rating for a chosen option was significantly higher when the emotional choice and rational choice were the same than when they were opposed. Emotional preferences were significantly more susceptible than rational preferences to the hedonic tone of risky choice framing. The overall preference was a compromise of the conflicting emotional and rational preferences in some risk domains, and resembled either the emotional preference or the rational preference in other risk domains. Study 2, using a between-subjects manipulation, further confirmed that emotional preference and rational preference had differential effects on risky choice.

In the studies reported in this paper, I focused on differential effects of emotional and rational preferences in decision making and how people resolve conflicting risk preferences caused by inconsistency between their emotional reactions to and rational assessment of a risk problem. In addition, I examined how the framing of choice outcomes affected emotional, rational, and overall risk preferences of the respondents.

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Emotional and rational preference in risky choice¹

Traditionally, feelings and emotions were treated by economists and psychologists alike as subverting rational processes and had no place in the rational theories of decision making. Recently, there has been a growing interest in constructive roles of emotions in decision making under risk or uncertainty (e.g., Elster, 1996, 1998; Lerner, Gonzalez, Small, & Fischhoff, 2003; Loewenstein, Hsee, Weber, & Welch, 2001; Mellers, Schwartz, & Ritov, 1999; Slovic, Finucane, Peters, & MacGregor, 2002) and in the suggestion that there are two distinct modes of information processing: experiential and rational (Epstein, 1994; Lieberman, 2000; Nisbett, Peng, Choi, & Norezayan, 2001).

Epstein (1994) proposed a dichotomy of information processing. He posits that individuals apprehend reality by two interactive, parallel processing systems. The rational system, deliberative and analytical, functions under the control of rules of logic and probability. The experiential system encodes reality in images, metaphors, and narratives. It functions under the influence of affect.

Although, according to Epstein (1994), the experiential system includes affect as a main component, affect is not a centerpiece in the system. Epstein focuses on the role of affect in the acquisition of information rather than decision making. Epstein argues that "affect is assumed to play an important role in the acquisition of information in the experiential system, but as behavior (including mental behavior) is practiced, it becomes increasingly proceduralized and affect free" (p. 714).

In contrast, the somatic marker hypothesis of Damasio (1994) argues for the necessity of affect in directing effective decisions. As its name suggests, the somatic markers are body states acquired through learning, associated with certain real or imagined decision outcomes, and reflected by activity within the ventromedial prefrontal cortex. These somatic markers subsequently control decision making by allowing feelings to be associated with expected choice outcomes. Decision rationality is thus shaped and modulated by body signals with the help of rational analysis.

The emphasis on the necessity of affect at the point of decision making appears to be a key difference between Damasio's somatic marker hypothesis and Epstein's dual systems theory. More recently, Loewenstein,

¹ It needs to be pointed out that the emotional-rational distinction used in this paper refers only to a subset of features related to this notion. The term "rational" is loaded with different connotations. In the present context, the operational definition of the term is restricted to cognitive processes involved in analytical and deliberative decision making. Although they are two different constructs, the distinction between emotional vs. rational modes of decision making are also related to the distinction between analytic vs. holistic processing styles. Particularly, emotion is often assumed to be a major component of holistic processing.

Weber, Hsee, and Welch (2001) have proposed a risk-as-feelings hypothesis. Many consequentialist models of risky decisions (e.g., regret theory by Loomes & Sugden, 1982) view emotions as resulting from one's decision. In contrast, the risk-as-feelings hypothesis highlights the role of anticipatory emotions (those experienced at the time of making a decision) rather than anticipated emotions (those expected to result from the consequences of a decision).

Experienced conflict between emotion and reason

The risk-as-feelings hypothesis (Loewenstein et al., 2001) assumes that due to different determinants, emotional reactions to risks can diverge from cognitive evaluations of the same risks. Behaviour is then determined by the interplay between these two, often conflicting responses to a choice problem. From this viewpoint, cognitive evaluations have affective consequences, and feeling states also exert a reciprocal influence on cognitive evaluations. Other researchers have also explored the possibilities that people may have "multiple selves" which have to negotiate before decisions are reached (Bazerman, Tenbrunsel, & Wade-Benzoni, 1998).

Previous studies have also shown that generating reasons can change initial feelings about other peoples and objects (e.g., food items, word puzzles, and artistic designs). This finding suggests interplays between affective and cognitive processes underlying judgement and decision making. Millar and Tesser (1986, 1989) suggested that thinking about reasons would make the cognitive components more acceptable than the initial affect, leading to changes in judgement and attitude. Wilson et al. (1993) reported that participants who were engaged in reflection (e.g., thinking about reasons for their preferences of art posters) were ultimately less satisfied with their choices. Within the current context, these aforementioned findings indicate that cognitive self-reflection may be in conflict with and reduce the emotional (hedonic) value of choice preference.

Although the role of emotions in decision making has long been acknowledged, little is known about dynamic interactions between the emotional and the rational modes of decision making. Part of the difficulty in studying emotions in decision making is due to the lack of consensus on an operational definition of emotion that would allow an empirical separation of differential effects of emotion or feeling vs. rational assessment. In this study, this problem was circumvented by leaving this difficult task of identifying the effects of emotional vs. rational processing to the decision makers. Participants were not only asked to indicate their overall preference regarding each of the decision options but also asked to make their decisions according to their emotional reactions to and their rational

analysis of a decision problem, separately. Given the subjective nature of this task, in this paper I do not make conceptual distinctions between emotion, affect, and feeling.

Found in common language the statements such as “I’m too emotional to think straight” are of evidence that people are aware of two modes of decision making. Although emotions are often interruptive, Kahneman (1999) suggests that the brain continuously constructs an affective or hedonic commentary on the current state of affairs. A body of evidence shows that such emotional reactions to risks often diverge from cognitive assessments of those risks; and when such a divergence occurs, emotional reactions often drive behaviour (Loewenstein et al., 2001). The predominance of emotional and experiential preference sometimes prevents people from picking optimal choices even when they know their choice is less optimal (Denes-Raj & Epstein, 1994).

Similarly, Epstein (1994) maintains that in most situations the experiential system is dominant over the rational system because it is less effortful and more efficient. His argument suggests that when the two modes of thinking clash, the experiential system wins the battle. In addition, according to Epstein (1994), people’s actual behaviour is primarily under the jurisdiction of the experiential system. However, when asked how a rational person would behave, people can in fact rely on the rational system and make different judgements and decisions.

STUDY 1

Empirical paradigm

Previous research has investigated how different factors differentially activate either emotional or rational modes of decision making but has rarely examined how decision makers naturally resolve ongoing conflicts between their emotional preference and rational preference and how the risk domains and information presentations influence conflict resolutions. Given the subjective nature of the experienced rivalry between emotional preference and rational preference, I assumed that the decision makers themselves could distinguish the directional effects of visceral reactions vs. rational assessments in risky choices. I tried to tap into people’s perceptions or subjective assessments of how emotion and reason interact. Even if people do not have a perfect grasp of their reactions, their intuitions would certainly be relevant to understanding the decision-making process.

In the current study, I developed a choice task to compare the relative impacts of emotional and rational modes of decision making on the overall

risk preference of a decision maker. This method also made it possible to examine how people resolve emotionality-rationality conflict without using any overt experimental interventions that differentially activate the two modes of deciding.

However, it needs to be noted that what was measured in the current choice tasks was not decision processes but people's perceptions or intuitions, which may or may not exactly map onto actual decision processes.

Research questions and hypotheses

The present study focused on differential effects of rational preference and emotional preference on risky choice and in particular on how people resolve the conflicts between these two kinds of risk preferences.

1. Both Epstein's (1994) model of experiential and rational systems and the risk-as-feelings hypothesis of Loewenstein et al. (2001) suggest that people experience conflicts between their emotional choice preference and rational choice preference. To what extent do emotional choice preferences and rational choice preferences drive overall choices? The current study explores quantitative evidence of concurrent influence of both emotional preference and rational preference on decision making in different risk domains.

2. It is conceivable that the degree of the favourability of a chosen option would be higher if the emotional and rational preferences are consistent. In contrast, if emotional and rational preferences are inconsistent, the decision maker would be more hesitant and less confident about his/her final choice. Thus, the strength of the overall choice preference would be positively correlated with the degree of agreement between the emotional preference and the rational preference.

3. People are expected to resolve conflicts between emotional preference and rational preference differently depending on the kind of risks they face. Three hypothetical resolutions are conceivable. One resolution would show that the final choice largely conforms to rational preference. Another resolution would lead to a final choice that largely follows emotional preference. The third resolution would be a compromise (an average) between the two kinds of risk preference. Experimental data gathered across different problem domains (arenas) were used to evaluate these conflict resolutions.

4. Another way of detecting differential effects of emotional preference and rational preference on risky choice is to compare scenarios involving human lives and scenarios involving money. I predict a greater amount of emotional involvement in the domain of lives (particularly when the outcomes are negatively framed) than in the domains of money. Based on our previous findings (Wang, 1996), I predict that the overall choice

preference would be more risk-seeking in the domain of lives than in the domain of money.

5. The two modes of deciding and thus two kinds of risk preference are expected to be sensitive to the way a decision problem is presented. In particular, emotional mode should be more susceptible than rational mode to verbal framing of choice outcomes. It has been argued that the hedonic tone of risky choice framing would be more likely to be amplified by the emotional system than rational system (e.g., Epstein, 1994).

Method

Participants

There were 81 volunteer students (54 women and 27 men) in psychology courses at the University of South Dakota, who took part in the study for extra course credit. They averaged 22.4 years of age. One participant was excluded from data analysis because of incomplete answers.

Materials and procedure

Participants were asked to make choices in six different risk domains, including a druggist problem (adapted from Kohlberg, 1981), a trolley problem (Thomson, 1976), a personal investment problem, a terrorist problem, a family disease problem, and a monetary gamble problem. The terrorist problem, family disease problem and monetary gamble problem each had two framing versions (see the Appendix for details).² Each participant thus received nine choice problems, which were presented to different participants in different random orders.

In studies of framing effects, a between-subjects design is typical for manipulating frame. However, there have been other framing studies which used within-subjects designs to test the robustness of framing effects (Levin, Johnson, & Davis, 1987) and to explore determinants of framing effects (e.g., Frisch, 1993). Recently, Levin, Gaeth, and Schreiber (2002) argued for the use of within-subjects manipulation of framing. According to the authors, one of the drawbacks of using typical between-subjects designs is that a significant framing effect could be caused by only an unidentified subgroup of participants with no effect for others, possibly even most others. Second, a

² The framing manipulation used in the terrorist problem and the family disease problem was a risky choice framing similar to the manipulation used in the Asian disease problem (Tversky & Kahneman, 1981). However, the risky choice framing in the monetary gamble problem was not just wording the same choice outcome different but a gain-loss framing reflecting a difference in the status quo. In this case, the positive framing described a gain (reward) situation whereas the negative framing described a loss (penalty) situation.

nonsignificant effect could be due to the existence of two subgroups who are influenced in opposite ways. An advantage of using a within-subjects design in the present study was that it allowed assessment of individual differences in framing effects (e.g., number of preference reversals due to framing) for each respondent.

Participants were presented with the nine choice problems in a random order and asked to choose between alternative options for each problem. They were instructed to choose according to their emotional reactions and their rational assessment separately. After participants indicated their emotional and rational choice preferences, they were asked to rate each choice option in terms of their overall preference on a 7-point scale with "1" representing not preferable at all and "7" representing very preferable. Situations where emotional preference and rational preference were either in tandem or in conflict could thus be identified and examined as to how the two kinds of risk preference affected the overall choice preference.

Results and discussion

Table 1 presents frequency and percentage (in parentheses) data of emotional, rational, and overall preferences (in columns) across nine choice problems (in rows). Note that the percentage figures in each cell represent choice distributions of participants. For instance, when making the emotional choice in the investment scenario, of the 80 participants, 29 (36.2%) of them chose the risk-averse option and the rest 51 (63.8%) participants chose the risk-seeking option.

During analysis of these data, I posed a series of questions regarding differential contributions of emotional and rational preferences to risky choice.

1. Did risk problems often elicit conflicts between rational preference and emotional preference? The results showed that they did. It was evident that emotional choice preference and rational choice preference were two distinct decision-making modes.

Within a risk domain, the emotional choice preference was often the opposite of the rational choice preference (see Table 1). Across the risk domains, the percentage of the participants who had the opposite risk preferences in different decision modes ranged from 16 to 54. Table 2 shows the extent of agreement/disagreement between the emotion choice and rational choice for each of the nine problems.

Significant differences between emotional and rational preferences were found in seven of the nine risk problems. The chi-square statistics for the seven problems were as follows: the druggist problem, $\chi^2 = 47.08$, $p < .0001$; the investment problem, $\chi^2 = 19.71$, $p < .0001$; the terrorist (kill) problem,

TABLE 1
Emotional, rational, and overall choices of nine problems

Problems	Choice options	Choice frequency (%)			Choice difference
		Emotional	Rational	Overall	
Druggist	Rob	42 (52.5%)	3 (3.8%)	10 (13.9%)	E > O = R
	Try	34 (42.5%)	70 (87.5%)	58 (80.5%)	
	Quit	4 (5.0%)	7 (8.7%)	4 (5.6%)	
Trolley	Switch	67 (83.8%)	64 (80.0%)	54 (91.5%)	E = O = R
	Not-switch	13 (16.2%)	16 (20.0%)	5 (8.5%)	
Investment	Risk-averse	29 (36.2%)	57 (71.3%)	39 (53.4%)	E > O > R
	Risk-seeking	51 (63.8%)	23 (28.7%)	34 (44.6%)	
Terrorist (save)	Risk-averse	43 (53.8%)	51 (63.7%)	44 (64.7%)	E = O = R
	Risk-seeking	37 (46.2%)	29 (36.3%)	24 (35.3%)	
Terrorist (kill)	Risk-averse	20 (25.0%)	47 (58.8%)	26 (38.8%)	E = O > R
	Risk-seeking	60 (75.0%)	33 (41.2%)	41 (61.2%)	
Disease (save)	Risk-averse	31 (38.8%)	44 (55.0%)	33 (54.1%)	E > O = R
	Risk-seeking	49 (61.2%)	36 (45.0%)	28 (45.9%)	
Disease (die)	Risk-averse	14 (17.5%)	33 (41.2%)	21 (31.8%)	E > O > R
	Risk-seeking	66 (82.5%)	47 (58.8%)	45 (68.2%)	
Money (gain)	Risk-averse	40 (50.0%)	59 (73.7%)	55 (75.3%)	E > O = R
	Risk-seeking	40 (50.0%)	21 (26.3%)	18 (24.7%)	
Money (loss)	Risk-averse	33 (41.2%)	55 (68.7%)	44 (62.0%)	E > O = R
	Risk-seeking	47 (58.8%)	25 (31.3%)	27 (38.0%)	

E, emotional choice; O, overall choice; R, rational choice; = indicates that no statistically significance difference; > indicates that the difference in choice frequency was significant at the level of $p < .05$.

$\chi^2 = 18.72$, $p < .0001$; the disease (save) problem, $\chi^2 = 4.24$, $p < .039$; the disease (die) problem, $\chi^2 = 20.86$, $p < .0001$; the money (gain) problem, $\chi^2 = 9.56$, $p < .002$; and the money (loss) problem, $\chi^2 = 12.22$, $p < .0001$.

The two risk problems which led to a high degree of agreement between emotional and rational preferences were the trolley problem and the positively framed terrorist problem. These two cases suggest that the common divergence between the two modes of decision making is not ubiquitous and is specific to the risk domain. This finding also suggests that the observed conflicts between emotion and reason were unlikely just a result of demand characteristics. The degree of agreement-disagreement between the two kinds of preferences varied in different risk domains independent of the same instruction for making sequential choices. This issue was further examined in Study 2.

2. Would choice preference be stronger when emotional preference and rational preference are in agreement?

TABLE 2
 Frequencies and percentages of agreement between emotional choice and rational choice and effects of agreement on the overall preference strength

<i>Problems</i>	<i>E-R agreement</i>	<i>Frequency (%)</i>	<i>Preference strength score</i>	<i>F statistics</i>
Druggist	Agreement	38 (47.5%)	$M = 4.00, SD = 1.71$	$F(1, 79) = 27.7$
	Disagreement	42 (52.5%)	$M = 2.05, SD = 1.61$	$p < .0001$
Trolley	Agreement	67 (83.8.0%)	$M = 2.48, SD = 1.96$	$F(1, 79) = 1.52$
	Disagreement	13 (16.2%)	$M = 1.77, SD = 1.48$	Not significant
Investment	Agreement	36 (45.0%)	$M = 2.19, SD = 1.45$	$F(1, 79) = 4.16$
	Disagreement	44 (55.0%)	$M = 1.77, SD = 1.48$	$p < .045$
Terrorist (save)	Agreement	46 (57.5%)	$M = 2.04, SD = 1.60$	$F(1, 79) = 6.55$
	Disagreement	34 (42.5%)	$M = 1.55, SD = 1.39$	$p < .012$
Terrorist (kill)	Agreement	39 (48.8%)	$M = 1.90, SD = 1.98$	$F(1, 79) = 6.02$
	Disagreement	41 (51.2%)	$M = 1.24, SD = 1.05$	$p < .016$
Disease (save)	Agreement	43 (53.8%)	$M = 2.07, SD = 1.70$	$F(1, 79) = 8.63$
	Disagreement	37 (46.3%)	$M = 1.05, SD = .90$	$p < .004$
Disease (die)	Agreement	53 (66.3%)	$M = 2.30, SD = 1.68$	$F(1, 79) = 12.9$
	Disagreement	27 (33.7%)	$M = 1.77, SD = 1.48$	$p < .001$
Money (gain)	Agreement	47 (58.8%)	$M = 2.64, SD = 1.45$	$F(1, 79) = 12.12$
	Disagreement	33 (41.2%)	$M = 1.77, SD = 1.48$	$p < .001$
Money (loss)	Agreement	48 (60.0%)	$M = 2.52, SD = 1.73$	$F(1, 79) = 7.56$
	Disagreement	32 (40.0%)	$M = 1.07, SD = .078$	$p < .007$

Note: Preference strength was measured by the absolute difference between the two overall preference (favourability) ratings for alternative options. For the druggist problem, the two options were “rob” and “keep trying”. “E-R Agreement” represents the grouping variable for the ANOVA tests where the respondents in the “agreement” group had the same emotional choice and rational choice and those in the “disagreement” group had different emotional choice and rational choice.

Table 2 represents the relationship between overall preference strength and the degree of agreement (or disagreement) between emotional and rational preferences. For each risk problem, the respondents were classified into two groups. In the “agreement” group, the participants’ emotional choice and rational choice were the same (either risk-seeking or risk-averse) whereas in the “disagreement” group, the emotional choice and the rational choice were different. A series of ANOVAs was then conducted using “agreement-disagreement” as the independent variable and preference strength as the dependent variable for each of the nine problems. A preference strength score was a measure of the absolute difference between the two favourability ratings of the sure (or lower variance) option and its gamble (higher variance) equivalent. For example, if one gave the sure option a favourability rating of 6 and the gamble option a rating of 2, the preference strength score would be 4. For the druggist problem the two options used were “rob” and “keep trying”. Given the 9 choice problems, there were 9 preference strength scores for each participant.

As shown in Table 2, for all the problems except the trolley problem, the overall preference strength was significantly higher when the emotional and rational choices agreed with each other. That is, the overall preference strength in the “agreement” group was significantly higher than that in the “disagreement” group.

These results suggest that participants not only experienced tensions between emotional preference and rational preference but also adjusted their preference strength accordingly. However, these results should be interpreted with caution for possible effects of demand characteristics. The respondents could give a higher overall favourability rating because they noticed that their emotional and rational choices were the same.

Another interesting result of the study was that emotional preference was more risk-seeking than rational preference (see Table 1). However, this link between emotional preference and risk-taking may depend on how risk is perceived. Risk-seeking preference can be promoted by either negative affects associated with perception of losses or positive affects associated with perception of opportunities. In contrast, risk-averse preference can be augmented by either positive affects associated with perception of gains or negative affects associated with perception of threats (see Kahneman & Tversky, 1979 for a discussion on gain-loss dependent risk preference; Staw, Sandelands, & Dutton, 1981 for a discussion on opportunity-threat perception dependent risk preference).

3. Another main question of this study concerned the effects of the two kinds of risk preference on final choices. When emotional and rational preferences disagree, different resolutions can be applied. The following analysis focuses on how people make up their mind when emotional reactions and rational assessment conflict.

The far right column of Table 1 summarises chi-square analyses comparing three kinds of choice frequency: emotional, rational, and overall. The overall choice for each participant was inferred from the participant’s favourability ratings for alternative choice options. For example, if the overall preference rating was 6 for the sure option and 4 for the gamble option of a choice problem, then the overall choice would be determined as being risk-averse. If the two ratings were identical, the overall choice would not be determined and would not be included in chi-square analysis.³

The results of the comparisons suggest different strategies for resolving conflicts between emotional and rational preferences. When emotional and

³ The frequencies of tied preference ratings for the druggist, trolley, investment, terrorist (save), terrorist (kill), disease (save), disease (die), money (gain), and money (loss) problems are listed, respectively, in the following: 8, 22, 13, 12, 21, 19, 14, 7, and 11. The total number in each case was 80.

rational preferences were significantly different, the overall choice was either in line with the rational choice or with the emotional choice. In particular, for the druggist problem, more than half of the participants preferred the risky, violent option (i.e., to rob the store) when making a choice based on gut feelings. This preference, however, was reversed when their choice was based on rational assessments ($\chi^2 = 47.08, p < .0001$). The overall choice very much resembled the rational choice.

The trolley problem resulted in a highly consistent choice preference for the "switch" option. The emotional, rational, and overall preferences were in agreement.

For the investment problem, the resolution heuristics appeared to be compromising and averaging. The risk-seeking percentage of the overall choice was higher than that of the rational choice ($\chi^2 = 5.19, p < .023$) but lower than that of emotional choice ($\chi^2 = 4.56, p < .033$).

Similarly, the terrorist problem framed positively led to consistent choice preferences where no significant difference between the emotional, rational and overall choice was found. In contrast, the terrorist problem framed negatively triggered conflicting choice preferences. The overall choice resembled the emotional choice with more participants in both cases preferring the risk-seeking option. The overall choice was significantly different from the risk-averse rational choice ($\chi^2 = 5.80, p < .016$).

The family disease problem when framed positively did not show significant difference between the overall choice and either the emotional choice or the rational choice, although the emotional choice was significantly more risk-seeking than the rational choice. Under the negative framing, the problem invoked a greater conflict between the emotional preference and rational preference. The overall choice was a balance between the two conflicting preferences: more risk-averse than the emotional preference ($\chi^2 = 4.07, p < .044$) and more risk-seeking than the rational preference ($\chi^2 = 6.44, p < .011$).

For the monetary problem, the overall choice closely resembled the rational choice under both framing conditions. The overall choice was risk averse and significantly different from the emotional choice under both the positive framing ($\chi^2 = 10.42, p < .001$) and negative framing ($\chi^2 = 6.46, p < .011$).

In sum, when the emotional preference and the rational preference were in conflict, the emotional preference was significantly more risk-seeking than the rational preference. The overall preference was a compromise in some risk domains (e.g., the investment problem), resembled the emotional preference in the terrorist (kill) problem, and aligned with the rational preference in other risk domains (e.g., the two money problems and the druggist problem).

4. As predicted, the overall choice preference in the domain of human lives (i.e., the two disease problems) was significantly more risk-seeking than that in the domain of money (i.e., the two money problems); $\chi^2 = 6.21$, $p < .013$. This result suggests that a higher emotional involvement augmented risk-seeking preference.

5. A final set of questions focused on the effects of risky choice framing. I first examined how framing effects were manifest in rational vs. emotional choice. As predicted, the results of Study 1 showed that framing effects were more prevalent in the emotional choices than rational choices.

Framing effects on the overall choices were significant in the terrorist scenario ($\chi^2 = 9.01$, $p < .003$) and the disease scenario ($\chi^2 = 6.44$, $p < .011$) but failed to reach the significance level of $p < .05$ in the monetary scenario ($\chi^2 = 3.00$, $p < .084$). Participants were more risk-averse under positive frames than negative frames, and vice versa.

Consistent with the prediction that emotional preferences would be more susceptible to the hedonic tone of risky choice framing, the framing effects were significant on emotional choice but not significant on rational choice. As Table 1 shows, in the terrorist scenario, the emotional choices under different framing conditions differed by a margin of 28.8% ($\chi^2 = 13.85$, $p < .0001$). The percentage difference for the rational choices under different framing conditions was much smaller (4.9%) and not significant. Similarly, in the disease scenario, the choice percentage difference due to framing was 21.3% ($\chi^2 = 8.94$, $p < .003$) for the emotional choices and 13.8% (not significant) for the rational choices. In the monetary gamble scenario, no framing effect was found in either emotional or rational choice.

Taking advantage of the within-subjects design, I also measured the number of preference reversals due to the framing of choice outcomes for each participant's emotional choice and rational choice separately in the three risk domains (i.e., terrorist, disease, and monetary gamble). A significant difference was found only in the monetary domain with a 46% reversal rate in emotional choice and 32% reversal rate in the rational choice, $\chi^2 = 3.88$, $p < .049$. The group data and individual data revealed different variance in risk preference under framing manipulations; but both suggest that emotional mode of decision making is more susceptible to framing. This result is consistent with a recent finding by McElroy and Seta (2004) showing that framing effects were found when the right hemisphere was selectively activated whereas they were not observed when the left hemisphere was selectively activated.

A final question concerned whether negative frames were more likely than positive frames to provoke conflicts between the two modes of decision making. The results showed that negative frames were not more conflict

provoking. The number of the conflicts between emotional choice and rational choice across the three framing problems ranged from 0 to 3. The average number of the conflicts under positive frames ($M = 1.22$, $SD = 1.12$) was about the same as that under negative frames ($M = 1.20$, $SD = 1.04$).

STUDY 2

Although the results of Study 1 showed that participants did not attempt to remain consistent across the emotional and rational choices, it remains in question whether the observed difference was a result of the influence of demand characteristics. That is, to what extent did participants respond differently because they felt that they would make different choices when asked to choose according to different decision preferences? To what extent did they react differently simply because they were asked to respond in two different ways?

Another potential problem in Study 1 was that the order of sequential choices was fixed in which the respondent always indicated his/her emotional choice before rational choice. Although unlikely, it still can be argued that the observed difference between emotional and rational choices in Study 1 was a result of the fixed-choice ordering and would be cancelled out if the orders were counterbalanced.

Given the above concerns, Study 2 adopted a between-subjects design to verify the results of Study 1. If a significant difference between emotional preference and rational preference also exist in Study 2, the choice order effects and the influence of demand characteristics would be ruled out.

Method

Participants

There were 213 volunteer students (131 women and 82 men) in psychology courses at the University of South Dakota, who took part in the study for extra course credit. They averaged 19.9 years of age.

Materials and procedure

In Study 2, the decision mode (emotional choice vs. rational choice) was a between-subjects variable. A general statement to all the participants read as: "You may have different reasons for choosing an option. Your emotional preference and rational preference may or may not be the same". Following the general statement, the participants in the *emotional* choice group were told to choose according to the emotional attractiveness of the options, whereas those in the *rational* choice group were instructed to choose an option based on their rational analysis.

TABLE 3
Choice preference differences between the emotional choice group and rational choice group in Study 2

Problems	Choice options	Experimental groups		Chi-square statistics
		Emotional choice (<i>N</i> = 109)	Rational choice (<i>N</i> = 104)	
Druggist	Rob	36 (33.0%)	16 (15.4%)	$\chi^2 = 12.63$ $p < .002$
	Try	70 (64.2%)	88 (84.6%)	
	Quit	3 (2.8%)	0 (0%)	
Investment	Risk-averse	37 (33.9%)	57 (54.8%)	$\chi^2 = 9.40$ $p < .002$
	Risk-seeking	72 (66.1%)	47 (45.2%)	

Each participant was presented with two choice problems in a random order. The two choice problems (the druggist problem and the investment problem) were selected because both resulted in significantly different emotional preference and rational preference in Study 1.⁴

Results and discussion

Table 3 summarises choice data from the two participant groups. In both the druggist problem and investment problem, the emotional choice was significantly more risk-seeking than the rational choice. As shown in Table 3, more participants in the emotional choice group chose the “rob” option for the druggist problem ($\chi^2 = 12.63$, $p < .002$) and the higher variance (risk-seeking) option for the investment problem ($\chi^2 = 9.40$, $p < .002$). The results from this between-subjects comparison confirmed that emotional preference and rational preference have differential effects on risky choice. The choice differences between the emotional mode and rational mode found in Study 1 thus was not only a result of demand characteristics nor a result of sequential order of choices.

It is interesting to note that the difference in choice frequency between the emotional choice and rational choice was smaller when tested using a between-subjects manipulation in Study 2 than when it was tested using a within-subjects manipulation in Study 1. For example, for the “rob” option of the druggist problem, the percentage difference between emotional choice and rational choice in Study 1 was 49% (52.5% – 3.8%) but reduced to 18% (33.0% – 15.4%) in Study 2. This difference suggests a contrast effect

⁴ To verify if emotional and rational preferences indeed differ in a between-subjects study, it was not necessary to include framing problems in Study 2. Of the 3 nonframing choice problems, the trolley problem was excluded because it did not elicit significantly different emotional and rational preferences in Study 1.

augmenting the difference between emotional choice and rational choice when choices are made side-by-side rather than sequentially.

GENERAL DISCUSSION

The present studies lend further evidence of constant interplay between emotional and rational choice preferences. Emotional preference and rational preference differentially and jointly contribute to a final choice. The conflicts between the two modes of decision making were common and were resolved in different fashions in different risk domains. Such conflicts affected the strength of choice preference and the degree of risk taking. In resolving the emotionality-rationality conflicts, risky choice framing served as one of the decision cues that differentially activated emotional and rational preferences. Hedonic framing of choice outcomes had a stronger influence on the emotional preference than rational preference.

Two systems of choice preference

According to Damasio (1994), evolutionarily older brain centers of emotions, the limbic system determines the direction of actions. Without emotions, decisions cannot be made. These emotions are initially triggered and conditioned by tangible and real consequences, such as feeling pain, detecting certain odours, touching, experiencing sex, eating, drinking, running, dancing, winning a race, losing social prestige, achieving familial recognition, and other outcomes important to the individual. Once being conditioned, these emotions then can be activated by cognitive anticipations and expectations and by hypothetical scenarios. The rational cognitive system takes into consideration not only immediate, isolated pay-offs but also future and joint pay-offs. However, rational assessments are often not sufficient for making a choice among alternatives. Anticipatory and anticipated emotions can then serve as tie breakers and enable us to choose among options none of which is rationally superior to the others (Damasio, 1994; Elster, 1996, 1998). The constant interaction between the two systems also enables us to resolve conflicts between concurrent emotions with opposite action tendencies, such as greed and fear.

It is interesting to note that the emotional and rational preferences elicited by the trolley problem were highly consistent in contrast to the different emotional and rational preferences found in another rescue scenario as depicted in the terrorist problem (positive framing). A moral consideration of righteousness induced by the trolley problem may be a factor that unites emotional and rational preferences. However, moral problems per se do not necessarily lead to high consistency between emotional and rational preferences, as demonstrated in the druggist problem

in Study 1, where the hypothetical decision recipient was a kin rather than strangers. These findings can be seen as a starting point to examine how moral choices differ from other risky choices.

Limitations and future studies

The present preliminary studies set a stage for further investigations of emotional and rational mechanisms of decision making. However, the decision problems used in the two studies were hypothetical, and participants were explicitly instructed to make an emotional or rational decision. Another way to address these same questions is to manipulate experimental factors that have shown to have some differential effects on emotional and rational processes, such as imaginability of risks and requirement to provide a rationale. In addition, future studies should try to verify the current results with individuals of different personalities in real-world situations.

The knowledge about risk-domain specific resolutions of emotional and rational conflicts in choice preference would be useful for the development of risk management theories and programmes. These resolutions should be examined in a step-by-step manner for further examinations.

Future studies should also explore differential roles of anticipated, consequential emotions and anticipatory, present emotions in shaping risky choices. The risk-as-feelings hypothesis emphasises the role of anticipatory emotions experienced at the time of making decisions (Loewenstein et al., 2001). Other researchers call for attention to the role of the anticipated affect and its relation to a choice (e.g., Loomes & Sugden, 1982; Mellers & McGraw, 2001). In the present study, it was not clear whether the emotional preferences reported by the participants were a result of anticipated emotions or anticipatory emotions. One way of disassociating the two kinds of emotions and their roles in decision making is to focus on the quality and specificity of these emotions. For example, regret and rejoicing are likely to be anticipated affects whereas fear and hope are likely to be anticipatory. Recent research on risk perception and risky choice demonstrates the importance of examining specific emotions rather than overall affective valence (DeSteno, Petty, Wegener, & Rucker, 2000; Fessler, Pillsworth, & Flamson, 2004; Keltner, Ellsworth, & Edwards, 1993; Lerner & Keltner, 2000, 2001; Tiedens & Linton, 2001). Future studies should investigate how different kinds of emotions interact with rational assessment in making decisions.

Recent developments in neuroscience shed light on the brain mechanisms underlying the interplay between emotional preference and rational preference. For example, Goldberg (2001) maintains that emotional preferences mainly derive from the amygdala and other brain areas associated with

emotion whereas rational preferences are largely a result of the activities of the prefrontal cortex. The ventral medial portion of the prefrontal cortices, as suggested by the somatic marker hypothesis (Damasio, 1994), may serve as a coordinator of the two brain systems. A recent study by Yurgekun-Todd and her colleagues (cited in Park, 2004) used functional magnetic resonance imaging (fMRI) to study brain mechanisms of risky choice. The study showed that children and young adolescents, when identifying facial emotions, rely heavily on the amygdala. Adults, in contrast, rely less on the amygdala and more on the frontal lobe. The delayed maturation of the prefrontal area may partially explain many emotion-driven, risky decisions of young adolescents. These findings suggest that young adolescents may lack rational brain power in resolving preference conflicts between emotional and rational preferences.

Sanfey, Rilling, Aronson, Nystrom, and Cohen (2003) used fMRI to study cognitive and emotional processes of the brain in making economic decisions. The researchers used a two-person ultimatum game where one party proposes a split of a certain amount of money and the other party chooses to either accept the proposal or reject it to have a zero pay-off for both parties. They found that unfair offers elicited activity in brain areas related to both emotion and cognition. However, it was the activity of the emotional areas of the brain that heightened for rejected unfair offers. These results suggest that anticipatory emotions experienced during decision making lead to the more risky and economically irrational choice of rejection. It appears to be a fruitful new approach to combine brain imaging research with behavioural measures of emotional and rational reactions to risks.

Future research may also focus on cultural specificity in the way of resolving conflicts in choice preferences. For instance, the Confucian doctrine of the mean requires a balance between emotional preference and rational preference. Chinese culture emphasises that a decision needs to be both sensible and reasonable (合情合理) which literally means to conform to both emotion and rationality. A study of allocation decisions by Zhang and Yang (1998) suggests that when asked to divide a certain amount of money between self and a partner, most of Chinese participants try to strike a balance between emotional and rational preference. Their participants were asked to make allocation decisions according to different social rules or norms, such as fairness, equity, sensibility, reasonability, righteousness, and being both sensible and reasonable. Each of these rule-based allocation decisions was compared to spontaneous allocation decisions with the same problem without experimental interventions. Only the decision based on the last rule (being sensible as well as reasonable) closely resembled the spontaneous allocation decisions. This cultural emphasis may promote

compromising resolutions rather than either rationalism or sentimentalism resolutions in coping with conflicts between choice preferences.

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APPENDIX

Choice problems used in the study

Druggist problem

Your mother is near death from a special kind of cancer. There is one drug the doctors think might save her. It has recently been discovered by a local druggist. The drug is expensive to make, and the druggist is charging ten times what it costs him.

You go to everyone you know to borrow the money, but can only get together \$1000, which is half of what the drug costs. You tell the druggist that your mother is dying and ask him to sell it cheaper or let you pay later. The druggist says, "No, I discovered the drug and I am going to make money from it".

You have three options to consider:

Option A: You break into the druggist's store and attempt to steal the drug.

Option B: You continue to look for money and return daily to the druggist hoping he will change his mind.

Option C: You allow your mother's illness to run its course without the help of the new drug.

(1) Which of the above options do you prefer based on your emotional reactions and feelings?

A or B or C

(2) Which of the above option do you prefer based on your rational analysis and thinking?

A or B or C

(3) Please indicate your overall preference for each of the choice options on a 7-point scale with 1 representing not preferable at all and 7 representing very preferable.

Option A: You break into the druggist's store and attempt to steal the drug.

1—2—3—4—5—6—7

Option B: You continue to look for money and return daily to the druggist hoping he will change his mind.

1—2—3—4—5—6—7

Option C: You allow your mother's illness to run its course without the help of the new drug.

1—2—3—4—5—6—7

Trolley problem

A trolley is hurtling down the tracks. The brakes of the trolley have failed. There are five innocent people on the track ahead, and they will be killed if the trolley continues going straight. There is a spur of track leading off to the side, with one innocent person standing on it. You are a bystander (not a railroad employee or public official, etc.), but you know there is a switch next to you that can be activated to cause the trolley to go to the side spur.

The consequences of the two options are as follows:

Option A: You do not throw the switch. The one innocent person on the spur will survive, but the five on the track ahead will not.

Option B: You throw the switch. The five innocent people on the track ahead will survive, and the one on the spur will not.

Investment problem

You have \$1000 dollars to invest. Your best friend is starting a small business to make money while in college, and offers you the chance to buy into the business. Your other option is to invest the money in a traditional mutual fund.

The consequences of the two options are as follows:

Option A: Invest in a mutual fund, which offers a 50% chance of making \$100 in a year, and a 50% chance of losing \$50 in that time.

Option B: Invest in your friend's business, which offers a 50% chance of making \$550 in a year, and a 50% chance of losing \$500 in that time.

Terrorist problem (positive framing)

Imagine that the US has been attacked by an unusual and deadly disease spread by terrorists. Without treatment 600 infected people will die. Two alternative rescue plans have been proposed. Assume that the exact scientific estimates of the consequences of the plans are as follows:

If plan A is adopted, 300 people will be saved.

If plan B is adopted, there is a 50% chance that all 600 people will be saved and 50% chance that none of them will be saved.

Terrorist problem (negative framing)

Imagine that the US has been attacked by an unusual and deadly disease spread by terrorists. Without treatment 600 infected people will die. Two alternative rescue plans have been proposed. Assume that the exact scientific estimates of the consequences of the plans are as follows:

If plan A is adopted, 300 people will be killed.

If plan B is adopted, there is a 50% chance that all 600 people will be killed and 50% chance that none of them will be killed.

Disease problem (positive framing)

Imagine that 6 of your family members (e.g., your parents, grandparents, siblings, and offspring) are infected by fatal bacteria; and without any treatment they will die. There are only two medical plans available:

If Plan A is adopted, 3 of them will be saved.

If Plan B is adopted, there is a 50% chance that all of them will be saved, and 50% chance that none of them will be saved.

Disease problem (negative framing)

Imagine that 6 of your family members (e.g., your parents, grandparents, siblings, and offspring) are infected by fatal bacteria; and without any treatment they will die. There are only two medical plans available:

If Plan A is adopted, 3 of them will die.

If Plan B is adopted, there is a 50% chance that no one will die and 50% chance that all of them will die.

Money problem (positive framing)

You are given \$200 and have to choose one of the following options:

Option A: You will receive an additional \$100.

Option B: A fair coin is tossed. If heads, you receive an additional \$200.

If tails, you receive no additional money.

Money problem (negative framing)

You are given \$400 and have to choose one of the following penalties:

Penalty Option A: You must return \$100.

Penalty Option B: A fair coin is tossed. If heads, you must return \$200. If tails, you may keep all money received.
