

Gender Differences in Risk Assessment: Why do Women Take Fewer Risks than Men?

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Abstract

Across many real-world domains, men engage in more risky behaviors than do women. To examine some of the beliefs and preferences that underlie this difference, 657 participants assessed their likelihood of engaging in various risky activities relating to four different domains (gambling, health, recreation, and social), and reported their perceptions of (1) probability of negative outcomes, (2) severity of potential negative outcomes, and (3) enjoyment expected from the risky activities. Women's greater perceived likelihood of negative outcomes and lesser expectation of enjoyment partially mediated their lower propensity toward risky choices in gambling, recreation, and health domains. Perceptions of severity of potential outcomes was a partial mediator in the gambling and health domains. The genders did not differ in their propensity towards taking social risks. A fifth domain of activities associated with high potential payoffs and fixed minor costs was also assessed. In contrast to other domains, women reported being more likely to engage in behaviors in this domain. This gender difference was partially mediated by women's more optimistic judgments of the probability of good outcomes and of outcomes being more intensely positive.

Keywords: sex differences, gender differences, risk perception

1 Introduction

Accidents are a very frequent cause of death, particularly among young adults and teenagers (U.S. Center for Disease Control [CDC], 2004), and men are more often the victims of accidents than are women (CDC, 2004; Waldron, McCloskey, & Earle, 2005). For example, for every 100,000 US drivers, men are three times as likely as women to be involved in fatal car accidents (U.S. Department of Transportation, 2004). While some of this well-known difference in automobile death rates probably reflects differences in the average amount of time men and women spend driving, it seems likely that another important cause is that males voluntarily engage in risky behaviors more often than do females. For example, US women report usually using seat belts substantially more often than men (Waldron, et al., 2005), and men have been shown to run yellow lights more often than women (Konecni, Ebbesen, & Konecni, 1976). Furthermore, similar differences are seen in a wide variety of other forms of accident statistics. Male pedestrians in the UK are involved in accidents about 80% more often than female pedestrians, and men die much more often from

drowning or accidental poisoning throughout the Western world (Waldron, et al., 2005). Thus, there seems little doubt that men must be engaging in more risky behaviors across a broad range of domains.

Despite its obvious practical importance, some key aspects of the psychological underpinnings of gender differences in risk taking have not been examined. The present article seeks to shed new light on these underpinnings, by asking a substantial sample of college men and women to report various perceptions and preferences related to a wide range of risk-taking scenarios.

1.1 Gender differences in risk taking and risk perception

The existence of gender differences in propensity to take risks has been documented in a large number of questionnaire and experimental studies. For example, a meta-analysis by Byrnes, Miller, and Schafer (1999) reviewed over 150 papers on gender differences in risk perception. They concluded that the literature "clearly" indicated that "male participants are more likely to take risks than female participants" (p. 377).

Recent work has begun to examine the generality and cognitive underpinnings of these differences in greater detail (Slovic, 1997). In one important study that provides a backdrop for the present investigation, Weber,

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Blais, and Betz (2002) assessed the risks that men and women perceived in behaviors spanning five different content domains (financial, health/safety, recreational, ethical, and social decisions). Gender differences were found in four of the five domains — social decision-making being the exception — with males perceiving less risk and indicating a greater likelihood of engaging in risky behaviors. Similar gender differences have been found in these domains in a large German sample (Johnson, Wilke, & Weber, 2004). Across studies, the social domain is unique in that either no gender differences are found or when they are found, it is women who report greater propensity to engage in risky behaviors and perceive overall greater benefit and less risk in doing so (Johnson et al., 2004; Weber et al., 2002). Of interest, these authors also found great variability in an individual's willingness to engage in risk across domains, suggesting that risk taking is not simply the product of some general personality trait that promotes risk seeking. Instead, individual and group differences are substantially due to differing perceptions of risk in different domains.

For the most part, previous research has relied on a unitary and subject-defined notion of "risk" (e.g., "how risky is the behavior or situation?"). A number of researchers have examined the role of various affect dimensions in determining overall perceptions of riskiness. Slovic (1997) proposes that several psychological risk dimensions (including dread, control, and knowledge) contribute to perceived riskiness. Follow-up research has shown the material as well as emotional factors also impact overall risk judgments (Holtgrave & Weber, 1993).

Any global assessment of perceived risk combines elements of a belief ("how likely is it that something bad will happen?") and a subjective valuation of that outcome ("how bad would that be?"). Thus, in common parlance a given behavior might be said to be riskier than another behavior if the former has more severe potential consequences, or if it has a higher risk of potential negative consequences, or both. For example, leaving one's bike unattended for a day in a busy city, and bungee jumping could both be described as risky behaviors, and yet the probabilities and potential bad outcomes are enormously different in the two cases. Past research shows that decomposing these elements can shed important light on individual and group differences in responses to risky situations. Gurmankin Levy and Baron (2005) had subjects assess badness of unfortunate medical outcomes associated with a defined probability (e.g., 32% chance of loss of a big toe). Different groups (men vs. women; physicians vs. non-physicians) were differentially sensitive to probability as against severity. The present article pursues a similar approach to explore the determinants of men's and women's willingness to engage in different risky activities.

Note that in the field of finance, where distribution of potential outcomes is obviously continuous, risk is often conceptualized as the variability of the returns offered by a choice. Following that approach, some theorists have found it useful to conceive of people's generalized risk preferences in terms of how this variability affects an individual's disposition to choose an option (see Weber, 1999, for a discussion). While this seems quite reasonable, in many real world risky choice scenarios (e.g., riding motorcycle without helmet; not using sunscreen; etc.), it would seem to be a reasonable simplification to view the potential negative outcomes as a unitary event, having a probability and some degree of (un-)desirability. This approach will be followed here, although in the General Discussion we will point out the potential for follow-up work that would consider risks involving more than a single discrete negative outcome.

Remarkably, the literature with adults does not seem to contain any studies that seek to decompose the perceptions of risk involved in real-world risky behaviors, in order to determine whether the genders differ in their evaluations of the likelihoods and costs of negative outcomes. A number of plausible hypotheses immediately present themselves. One such hypothesis is that women do not evaluate the probability of negative outcomes differently than men; they simply assume (perhaps rightly; perhaps not) that they would be more emotionally upset or harmed by negative outcomes, should these occur. Alternatively, one may hypothesize that women assess as greater the probability of unfavorable outcomes, without projecting any stronger negative reactions to these outcomes than do men.

While studies of gender effects in adult risk preferences — with the exception of Gurmankin Levy and Baron (2005) — have not addressed this issue, there is one study within the developmental literature that explored this question. Hillier and Morrongiello (1998) examined gender differences in perceptions involved in physical risk taking in children. Using pictorial descriptions (e.g., riding bicycle with no helmet in street) and an interview to determine how children assessed risks, they found that girls appraised more general risk (i.e., judged the situations as more unsafe) than boys. The genders also differed in the factors that contributed to their overall risk judgments. Boys' risk judgments were significantly predicted by their ratings of injury severity while girls' risk judgments were better predicted by their ratings of vulnerability to any type of injury. This suggests that girls may avoid risky situations with any likelihood of perceived injury and boys may avoid risky situations only if the possible perceived injuries are judged as being severe.

As noted above, the literature with adults has not examined whether the genders differ in their evaluations of (1)

the likelihood of potential negative outcomes and (2) their appraisals of the severity of these potential outcomes. In adults, either or both of these aspects of risk may mediate gender differences in engaging in “risky” behaviors. A third factor may also be responsible for the gender differences in propensity to engage in risky behaviors: the genders may differ in their estimates of the enjoyment offered by the activity, assuming that negative outcomes do not take place. This last possibility finds some support from Weber et al. (2002) and Johnson et al. (2004), who found that relative to women, men judged they would obtain greater benefits from engaging in risky behaviors in all domains except social.¹ Using a risk-return framework, Weber and colleagues have suggested that risky decision making can be seen as a trade-off between fear (risk) and hope (expected returns).

1.2 Present study

The present study had two major goals. The first was to separately assess gender differences in the three kinds of assessments just mentioned. To put it in simple terms, the present study asks: do women tend, for example, to engage in dangerous recreational activities less often because (a) they think the likelihood of injury is greater, (b) they think the severity of an injury, were it to occur, would be greater, and/or (c) because they simply do not find the positive aspects of such activities as attractive as men do? In addition, we examined whether such assessments vary depending upon the domain of behavior and compared patterns of risk perception with individuals' reports of engaging in risky behaviors in the past.

A second aim was to explore an important category of choices (popularly referred to as “taking a chance”) that have not, to our knowledge, been examined in previous studies of individual differences in risk: decisions to engage or not engage in behaviors that offer a small probability of a large positive reward in return for some small but certain cost. An example is trying to be the 12th caller to a radio station in order to win a large sum of money. This type of scenario will be referred to as the “positive domain”. One possible explanation for why women engage in fewer risky activities is that they are relatively pessimistic and feel themselves relatively “unlucky” (i.e., prone to experience the least desirable possible outcome more often than would be expected based on overall frequencies). If this is so, then women should also show less interest than men in options offering a low probability of positive reward. Another possibility is that women see

low-frequency outcomes (whether good or bad) as more likely to occur, in which cases they should show greater attraction to choices in the positive domain.

2 Method

2.1 Participants

A sample of 657 subjects (389 female and 268 male) from undergraduate psychology classes at the University of California, San Diego participated in the study for course credit. Their average age was 18.5 years. Three additional subjects participated but were excluded because they did not indicate their gender.

2.2 Survey design

Sixteen of the risk behavior scenarios consisted of a subset of those used by Weber et al. (2002). These fell into 4 domains: gambling (e.g., betting at a race track), health (e.g., deciding whether or not to use sunscreen), recreational (e.g., engaging in an extreme sport such as mountain climbing), and social decisions (e.g., discussing opposing viewpoints with a friend). For each domain, we chose the four items that had the highest risk perception factor loadings in Weber et al. (2002). Given the mixed results regarding gender differences in the social domain reported by Weber et al. (2002) and Johnson et al. (2004), two additional social domain scenarios were created for the current work to further examine potential gender differences in this domain. These items were designed to include behaviors that while having potential social risk also had potential social benefit. For each scenario (listed in Appendix A), subjects rated (1) their likelihood of engaging in the activity, (2) the probability of a risky behavior incurring negative consequences, (3) the severity of these potential consequences, should they occur, and (4) how positive or enjoyable the given activity would be, if there were no bad outcomes. Following Weber et al. (2002), subjects responded to the likelihood of engaging question with a 5-pt. scale (1 = very unlikely; 5 = very likely). The three additional questions were also answered on a 5-pt. scale (1 = not at all; 5 = extremely).

An additional set of questions assessed possible gender differences in relation to choices associated with high potential payoffs and relatively minor but certain costs, referred to as the “positive domain”. An example would be calling a radio station to win money. For each scenario (see Appendix B), subjects rated (1) their likelihood of engaging in the activity, (2) the likelihood of the behavior incurring positive outcomes, (3) the intensity of these potential positive consequences, should they occur, and (4)

¹It should be noted that Weber et al. (2002) did not ask subjects to assess the benefits of risky behaviors conditionalized on the absence of any negative outcomes; hence, it is possible that in giving their judgments about positive benefits, respondents were “folding in” the risks, thus potentially explaining why females might have given lower scores on this.

the degree of unpleasantness of the activity, if there were no good outcomes.²

Finally, additional questions dealing with risky past behaviors were created for the present study, including some that were adapted from Gibbons and Gerrard (1995) (see Appendix C). Subjects were asked how frequently they had actually engaged in behaviors that correspond to the four negative domains of gambling, recreation, health, and social.

2.3 Procedures

Subjects were recruited from the UCSD psychology subject pool and completed questionnaires through a specially created web program that was generated using PHP.

The scenarios listed in Appendix A were presented in a random order and subjects assessed their likelihood of engaging in each described behavior. These scenarios were then presented a second time in a random order and subjects answered the three additional risk questions (probability of negative outcomes, severity of negative outcomes, and enjoyment). Two practice scenarios appeared before the actual stimuli to familiarize the subjects with the types of scenarios and the response scales. The positive domain scenarios were presented next and followed the same procedures as the negative domain (e.g., likelihood of engaging in the activity was first assessed and then the scenarios were presented a second time with the three additional questions about outcomes). Lastly, subjects answered questions regarding past risky behavior.

3 Results

3.1 Basic gender differences

For each type of question (willingness to engage in behavior, perceived benefits, etc.), an individual's responses to the scenarios composing each domain were averaged together to form a composite score for that domain. As noted above, the categorization followed Weber et al. (2002). All the analyses described below were performed on these mean responses. For each negative risk domain (gambling, health, recreation, and social), four separate t-tests were performed to determine the existence of gender differences in perceptions of (1) likelihood of engaging; (2) probability of negative consequences due to engaging; (3) severity of potential negative consequences; and (4) enjoyment. The overall mean responses for each type of question in each domain by gender are shown in Table 1. T-tests were also performed on the positive domain for each question type and are shown in Table 1.

² Subjects also completed additional questions on other topics not reported here.

Relative to women, men reported a greater overall likelihood of engaging in risky behaviors in the gambling, health, and recreational domains. In all three domains, women judged potential negative consequences as more likely to occur and they judged the potential negative consequences as significantly more severe in two of these domains (gambling and health). The genders also significantly differed in their ratings of the enjoyment of engaging in risky behaviors (assuming no negative outcome) in all three domains, with men rating the scenarios as more enjoyable.

The social domain showed a very different pattern of responses than the three domains just described. There was no overall gender difference in reports of likelihood of engaging in behaviors carrying social risks. An examination of individual items suggested that the gender differences were not consistent in direction. For example, women reported significantly greater propensity for taking risks on two scenarios (admitting tastes are different than friends'; disagreeing with parent on a major issue) while men reported significantly greater propensity on two different scenarios (defending unpopular issue; asking someone on a date) as well as a significant trend ($p = .06$) on a third scenario (arguing with a friend). There were also no gender differences in overall ratings of likelihood of negative consequences or enjoyment of the behaviors. However, women did rate the severity of possible negative consequences as greater than men for this domain as a whole.³

The positive domain — behavioral choices offering a chance of substantial gain and imposing a relatively small but certain cost — is one that has not to our knowledge been examined in any previous studies of gender differences and risk. In contrast to the findings from the domains described above, women reported being more likely to engage in these behaviors. They also gave significantly higher probability estimates for positive consequences occurring and showed a trend towards reporting that the potential favorable consequences would be more positive. The genders did not significantly differ in their assessments of degree of unpleasantness associated with the costs incurred by these behaviors.

3.2 Gender differences in reports of past risky behaviors

The frequency of reporting engaging in specific risky behaviors as a function of gender is shown in Table 2. Every

³Results from analyses using just the four original items from Weber et al. revealed the same pattern of results with the exception that the gender difference in predictions of severity of outcome no longer remained significant.

Table 1: Means (SD) of gender differences in risk perceptions by domain and question type.

| Judgments | Males | Females | Analysis |
|----------------------------------------------|-------------|-------------|------------------------|
| Gambling | | | |
| Likelihood of engaging in risky behavior | 1.84 (0.94) | 1.45 (0.67) | $t(654) = 6.18***$ |
| Probability of negative consequences | 3.66 (0.74) | 3.88 (0.73) | $t(654) = 3.69***$ |
| Severity of potential negative consequences | 3.62 (0.88) | 3.77 (0.81) | $t(654) = 2.33*$ |
| Enjoyment of experience | 3.88 (1.04) | 3.41 (1.24) | $t(654) = 5.14***$ |
| Health | | | |
| Likelihood of engaging in risky behavior | 2.58 (0.66) | 2.25 (0.63) | $t(654) = 6.40***$ |
| Probability of negative consequences | 2.99 (0.74) | 3.50 (0.73) | $t(654) = 8.80***$ |
| Severity of potential negative consequences | 4.24 (0.61) | 4.48 (0.50) | $t(654) = 5.52***$ |
| Enjoyment of experience | 2.44 (0.83) | 2.31 (0.73) | $t(654) = 2.01*$ |
| Recreation | | | |
| Likelihood of engaging in risky behavior | 2.96 (0.91) | 2.54 (0.91) | $t(654) = 5.75***$ |
| Probability of negative consequences | 3.07 (0.72) | 3.37 (0.65) | $t(654) = 5.67***$ |
| Severity of potential negative consequences | 4.37 (0.67) | 4.42 (0.62) | $t(654) = 1.09$ |
| Enjoyment of experience | 4.17 (0.85) | 3.98 (0.91) | $t(654) = 2.78**$ |
| Social | | | |
| Likelihood of engaging in risky behavior | 3.53 (0.61) | 3.45 (0.59) | $t(654) = 1.81\dagger$ |
| Probability of negative consequences | 2.46 (0.63) | 2.54 (0.60) | $t(654) = 1.58$ |
| Severity of potential negative consequences | 2.58 (0.69) | 2.69 (0.65) | $t(654) = 2.05*$ |
| Enjoyment of experience | 3.31 (0.69) | 3.28 (0.70) | $t(654) = 0.40$ |
| Positive | | | |
| Likelihood of engaging in behavior | 2.94 (0.86) | 3.23 (0.83) | $t(655) = 4.34***$ |
| Probability of positive consequences | 3.23 (0.58) | 3.40 (0.60) | $t(655) = 3.57***$ |
| Intensity of potential positive consequences | 4.48 (0.57) | 4.56 (0.50) | $t(655) = 1.84\dagger$ |
| Unpleasantness of experience | 2.72 (0.74) | 2.68 (0.77) | $t(655) = 0.69$ |

 $\dagger p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 2: Gender differences in reports of actual past risky behaviors.

| Risk Behavior Questions | Males Means (SDs) | Females Means (SDs) | Gender Difference |
|-----------------------------------------------------------------------|-------------------|---------------------|---------------------------|
| Do you smoke? | 1.30 (0.73) | 1.17 (0.55) | t(654) = 2.48, p < .013* |
| How many alcoholic beverages do you typically drink in a week? | 1.99 (1.16) | 1.67 (0.80) | t(652) = 4.13, p < .001** |
| How often have you had too much to drink or gotten drunk? | 2.72 (1.51) | 2.40 (1.35) | t(654) = 2.90, p < .004** |
| How often do you drive over the speed limit? | 3.91 (1.08) | 3.65 (1.15) | t(653) = 2.90, p < .004** |
| How often do you "bend" or break traffic laws? | 3.13 (1.14) | 2.85 (1.08) | t(654) = 3.30, p < .001** |
| How often do you gamble? | 2.18 (1.12) | 1.47 (0.81) | t(653) = 9.53, p < .001** |
| How often do you engage in risky recreational activities? | 2.21 (1.11) | 1.73 (0.92) | t(655) = 5.99, p < .001** |
| How often do you get into arguments with friends or family? | 2.48 (1.00) | 2.36 (0.95) | t(655) = 1.58, p < .115 |
| How often do you raise your hand to answer or ask questions in class? | 2.28 (1.12) | 2.02 (1.00) | t(655) = 3.22, p < .001** |

*p < .05, **p < .01.

Note. Some n's may be slightly reduced for some individual analyses due to missing data points.

category of behavior showed a significant gender difference with the exception of one question associated with the social domain.

3.3 Correlations of risk perceptions and past risky behaviors

How are subjects' assessments of likelihood of engaging in risky behaviors in a given domain related to the frequency with which they have actually engaged in risky behaviors in that domain? Judgments of the likelihood of engaging in risky behaviors in the recreational domain were significantly related to the responses on an actual risk behavior question in the same domain, $r(656) = .588$, $p < .001$, as were responses regarding likelihood of engage in risky gambling behavior and reports of past gambling risk behavior, $r(654) = 0.582$, $p < .001$. Significant associations between predicted and actual behavior also were found in the health domain, as shown in Table 3. Reports of likelihood of engaging in risky behavior in the social domain were significantly associated with past socially risky behaviors: $r(656) = .41$, $p < .001$ for the question regarding raising ones hand in class and $r(656) = .25$, $p < .001$ for the question regarding getting into arguments.

3.4 Correlations between different judgments of risk

How are perceptions of the likelihood of and the severity of negative outcomes related? This can be addressed by examining a correlation computed across subjects, asking "do people who rate a behavior as risking a severe outcome rate this outcome as more — or less — likely to occur?" As shown in Table 4, those rating the bad outcomes as severe also rated them as more probable. Across different domain scales, all 18 correlations were positive (all but one being statistically significant), with an average correlation of .40. These positive correlations were present both in the sample as a whole, and within the male and female subsets of the population considered separately. We also examined the relationship between evaluations of the enjoyment associated with an activity and the probability and the severity of potential negative outcomes. There was a weak negative relationship between enjoyment and probability (across items, correlations ranged between -.23 and .02, averaging -.10; of these, 10 were significant, all in a negative direction). There was no discernible consistent relationship between pleasure and severity (across items, correlations ranged from -.21 and .12, averaging 0; of these, 6 were significant, 4 in a positive direction, 2 in a negative direc-

Table 3: Health domain: correlation between reports of actual past risk behavior and likelihood of engaging in risky behavior

| Past risk behavior | Average likelihood of engaging |
|----------------------------------------------------------------|--------------------------------|
| Do you smoke? | 0.11* |
| How many alcoholic beverages do you typically drink in a week? | 0.26** |
| How often have you had too much to drink or gotten drunk? | 0.23** |
| How often do you drive over the speed limit? | 0.18** |
| How often do you bend or break traffic laws? | 0.34** |

* p < 0.01, ** p < 0.001.

tion). In summary, people who evaluate potential harms as likely also have a marked tendency to also evaluate them as being severe; however, assessing the activities as enjoyable says little or nothing about whether a person will view the potential negative outcomes as likely or severe.

Similar questions can be posed in the positive domain. First, do those viewing the positive rewards as greater also think them more probable? Here, the answer varied (see Table 5), with the correlations between judgments of probability of good outcomes and intensity ranging from -.07 to .47, averaging .20. Ratings of the anticipated unpleasantness (costs) were not correlated with probability of positive outcomes (average correlation = .02, none significant). Anticipated unpleasantness was significantly negatively correlated with intensity of positive consequences for only one of the four scenarios, and the average correlation for the four scenarios was -.05.

3.5 Mediation analysis

The analyses reported above show that in regard to gambling, health, and recreational domains — but not social domains — women tend to judge negative outcomes associated with risky behaviors as both more likely and more severe; they also indicate a lower likelihood of engaging in these risky behaviors and judge the activities as less enjoyable than do men (assuming that the negative outcomes do not occur). Do these perceptions mediate the gender differences in reported likelihood of engaging in risky behaviors?

To test for mediational effects, we began with the commonly used approach laid out by Baron and Kenny (1986). Each mediational analysis requires three regression equations. The first tests for a significant relationship between the independent variable and the mediator. The second looks at the relationship between the mediator and the outcome variable. If both of these correlations are significant, a third equation is computed in which both

the independent variable and the mediator variable are included as predictors of the outcome variable. Evidence of mediation exists, if the effect of the independent variable is reduced in this third equation, a reduction that can be tested by Sobel's test. We applied this strategy to each of the domains described here for each of the potential mediators separately. For simplicity sake, we only present the Sobel test statistic for these analyses as well as correlations and partial correlations between likelihood in engaging in risky behavior, gender, and mediators for each domain (see Table 6).

For both the gambling and health domains, separate analyses of each mediator revealed that perceptions of probability of negative consequences, severity of potential negative consequences, and enjoyment each partially mediated the gender effect in risky gambling behavior. In the recreational domain, the gender difference in risk taking was partially mediated by perceptions of likelihood of negative consequences and partially mediated by perceptions of enjoyment from engaging in such behaviors. Perceptions of severity of negative consequences were not analyzed since they were not significantly correlated with gender. The genders did not significantly differ in their average willingness to engage in social risk, therefore mediational analyses were not performed in this domain.

Next we examined mediation in the positive domain, where potential payoffs were high but uncertain, and costs were low. Unlike the most of the negative domains, women reported being more likely to engage in these types of behaviors. This difference was partially mediated by perceptions of probability of positive consequences. Intensity of positive consequences was also a partial mediator, although only marginally so. Perceptions of unpleasantness were not analyzed since they were not significantly correlated with gender.

Table 4: Correlations of judgments of probability of negative consequences, severity of negative consequences, and enjoyment of activity for each item within each risky domain.

| Items: | Probability and severity | Probability and enjoyment | Severity and enjoyment |
|------------------------|--------------------------|---------------------------|------------------------|
| Gambling domain | | | |
| 1 (sport event) | .427*** | -.092* | .036 |
| 2 (horse races) | .398*** | -.025 | .018 |
| 3 (poker) | .407*** | -.095* | .003 |
| 4 (casino) | .513*** | .019 | .060 |
| Health | | | |
| 1 (walking home) | .344*** | -.137*** | -.201*** |
| 2 (seatbelt) | .125** | -.109** | -.211*** |
| 3 (helmet) | .230*** | -.183*** | -.044 |
| 4 (sun exposure) | .411*** | -.018 | .021 |
| Recreational | | | |
| 1 (rafting) | .336*** | -.208*** | .047 |
| 2 (sport) | .171*** | -.218*** | .121** |
| 3 (plane) | .063 | -.233*** | .106** |
| 4 (tornado) | .356*** | -.189*** | .025 |
| Social | | | |
| 1 (tastes) | .572*** | .009 | .021 |
| 2 (disagreeing) | .645*** | -.045 | -.019 |
| 3 (defending) | .574*** | -.033 | -.038 |
| 4 (arguing) | .551*** | -.148*** | -.107** |
| 5 (date) | .488*** | -.028 | .066† |
| 6 (raising hand) | .508*** | -.043 | .124** |

† p < .10, *p < .05, **p < .01, ***p < .001

Table 5: Correlations of judgments of probability of good outcomes, intensity of good outcomes, and unpleasantness of activity for each item within the positive domain.

| Items: | Probability with | Probability of Good Outcomes | Intensity of Good Outcomes |
|-------------------|----------------------------|------------------------------|----------------------------|
| | Intensity of Good Outcomes | with Unpleasantness | with Unpleasantness |
| 1 (screenplay) | .044 | .002 | -.011 |
| 2 (radio station) | -.069† | .068† | -.196*** |
| 3 (applications) | .343*** | .063 | .026 |
| 4 (visiting) | .465*** | -.050 | -.007 |

† p < .10, ***p < .001.

Table 6: Analyses of mediators of risk taking for each domain, with zero-order and partial correlations.

| | Zero-order correlations | | Partial correlations | | Sobel's Test |
|-----------------------|-------------------------|----------------------|----------------------|----------------------|-----------------------|
| | Risk taking | Mediator | Risk taking | Mediator | |
| Gambling | | | | | |
| Gender Risk taking | | Negative probability | | Negative probability | |
| | -.235*** | .143*** -.279*** | -.205*** | -.255*** | $z = -3.08, p < .003$ |
| Gender Risk taking | | Severity | | Severity | |
| | | .091* -.315*** | -.218*** | -.303*** | $z = -2.23, p < .03$ |
| Gender Risk taking | | Enjoyment | | Enjoyment | |
| | | -.197*** .289*** | -.190*** | .254*** | $z = -4.08, p < .001$ |
| Health | | | | | |
| Gender Risk taking | | Negative probability | | Negative probability | |
| | -.243*** | .325*** -.283*** | -.166*** | -.222*** | $z = -4.81, p < .001$ |
| Gender Risk taking | | Severity | | Severity | |
| | | .211*** -.154*** | -.218*** | -.108** | $z = -2.51, p < .02$ |
| Gender Risk taking | | Enjoyment | | Enjoyment | |
| | | -.078* .264*** | -.231*** | .254*** | $z = -1.92, p = .055$ |
| Recreational | | | | | |
| Gender Risk taking | | Negative probability | | Negative probability | |
| | -.219*** | .216*** -.304*** | -.165*** | -.269*** | $z = -4.45, p < .001$ |
| Gender Risk taking | | Severity | | Severity | |
| | | .042 -.031 | -- | -- | -- |
| Gender Risk taking | | Enjoyment | | Enjoyment | |
| | | -.108** .534*** | -.192*** | .526*** | $z = -2.76, p = .01$ |
| Social | | | | | |
| Gender Risk taking | | Negative probability | | Negative probability | |
| | -.07† | .062 -.233** | -- | -- | -- |
| Gender Risk taking | | Severity | | Severity | |
| | | .08* -.247*** | -- | -- | -- |
| Gender Risk taking | | Enjoyment | | Enjoyment | |
| | | -.016 .322*** | -- | -- | -- |
| Positive | | | | | |
| Gender Risk taking | | Positive probability | | Positive probability | |
| | .167*** | .138*** .323*** | .131** | .307*** | $z = 3.30, p < .001$ |
| Gender Risk taking | | Positive intensity | | Positive intensity | |
| | | .072† .186*** | .157*** | .177*** | $z = 1.70, p = .09$ |
| Gender Risk taking | | Unpleasantness | | Unpleasantness | |
| | | -.027 -.074† | -- | -- | -- |

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$, -- criteria for mediational analyses not met, for gender $M = 1$ $F = 2$.

3.6 Exploratory path analysis

As a further check on the conclusions just described regarding mediation, we utilized a path analysis (SEM using LISREL 8.54) to test a model in which perceptions of probability of negative outcomes, severity of negative outcomes, and perceived enjoyment are assessed as potential mediators of gender differences in risk taking for each of the four different content domains. This framework assumes that the variables combine additively with each other to determine the target variables. However, there is no decision-theoretic model that we are aware of that would predict that probability would combine additively with severity to determine an individual's propensity to engage in a behavior.⁴ Thus, a path analytic approach is perhaps best viewed as exploratory (Raykov & Marcoulides, 2000). Nonetheless, the results mirrored the individual Sobel mediation tests described above quite closely.

3.7 Full model regression analyses

The final analyses focused on full regression models where likelihood in engaging in risky behaviors was regressed on gender, probability, severity and enjoyment for each domain. These results are presented in Table 7. When included together, all four variables significantly predicted risk taking in the gambling and recreational domains. In the health domain, all variables except severity were significant predictors of risk taking. Social risk taking was only significantly predicted by severity and enjoyment. Finally, all variables except unpleasantness significantly predicted behavioral inclinations in the positive domain.

4 Discussion

4.1 Summary of Findings

In the health, recreational, and gambling domains, women reported a lower likelihood of engaging in risky behaviors. In all three domains, there were significant gender differences in perceptions of probabilities of negative consequences from engaging in risky behaviors, with women reporting greater probabilities. In addition, women expected to obtain less enjoyment from these behaviors than did men in each of these three domains, assuming that the potential negative outcomes did not occur. The mediational analyses revealed that perceptions of negative consequences and enjoyment significantly partially mediated gender differences in likelihood

⁴However, it is not unprecedented to find additive models fitting data of this sort reasonably well (Mellers & Chang, 1994).

of engaging in risky behaviors. Judged severity of potential negative consequences was an additional partial mediator of the gender differences in engaging in risky behaviors in the health and gambling domains.

The social domain showed more mixed results, as was the case in the data of Weber et al. (2002). In one study, they found that women reported greater propensity towards taking social risks but in a second study this difference was not significant. In a German sample, Johnson et al. (2004) also did not find a sex difference in social risk taking, although women did perceive such activities as providing greater benefits. It is interesting that the genders do not show consistent differences with respect to social risks, as they do in the other domains. Looking over the individual items, it appeared that men tended more often to describe themselves as likely to engage in behaviors that could be perceived as 'defending' ideas (e.g., "Defending an unpopular issue that you believe in at a social occasion") whereas women appeared to respond more positively than men to behaviors that involved social risks, but which were not phrased in this way (e.g., "Admitting that your tastes are different from those of your friends"). Indeed, men scored significantly higher on the former while women scored significantly higher on the latter question in the social domain. This suggestion is obviously tentative, however; a more fine-grained analysis of the particular risks and benefits at issue in "risky" social decisions is plainly needed in order to better characterize gender differences. What is clear is that the social domain, as assessed here, did not show homogenous gender effects, which is quite different from the other domains of risky behavior.

One category of risky choice examined in the present data set that apparently has not been previously investigated is what was termed the "positive domain": behavioral choices affording a small chance of a large benefit for a fixed small cost. Interestingly, women reported greater willingness to engage in the behaviors surveyed. These results suggest that when there is no risk of severe negative consequences, but rather a possibility of predominantly positive consequences in exchange for some small fixed cost, women more than men will engage in such behaviors. Mediational analyses suggest that the difference arises because women judge that these consequences are more likely to occur, and to a lesser extent, because they judge the consequences as more worthwhile than do men. The results clearly speak against the suggestion that women engage in risky behaviors less often because they are pessimistic and "feel unlucky" in some global sense.

One category of real-world behavior that mirrors our definition of the positive domain quite closely is the purchasing of lottery tickets. One recent survey disclosed that while somewhat more men (56%) than women (43%)

Table 7: Full model regression analyses of risk taking in each domain

| Variable | Standardized coefficients | t | Significance |
|----------------------|---------------------------|--------|--------------|
| Gambling domain | | | |
| (Constant) | | 13.572 | .001 |
| Gender | -.142 | -3.983 | .001 |
| Negative probability | -.120 | -2.945 | .003 |
| Severity | -.253 | -6.226 | .001 |
| Enjoyment | .270 | 7.655 | .001 |
| Health domain | | | |
| (Constant) | | 13.661 | .001 |
| Gender | -.153 | -3.982 | .001 |
| Negative probability | -.202 | -5.108 | .001 |
| Severity | -.031 | -0.804 | .422 |
| Enjoyment | .230 | 6.342 | .001 |
| Recreational domain | | | |
| (Constant) | | 7.898 | .001 |
| Gender | -.130 | -3.989 | .001 |
| Negative probability | -.145 | -4.189 | .001 |
| Severity | -.085 | -2.532 | .012 |
| Enjoyment | .503 | 14.938 | .001 |
| Social domain | | | |
| (Constant) | | 21.500 | .001 |
| Gender | -.044 | -1.238 | .216 |
| Negative probability | -.072 | -1.494 | .136 |
| Severity | -.210 | -4.334 | .001 |
| Enjoyment | .327 | 9.139 | .001 |
| Positive domain | | | |
| (Constant) | | 2.470 | .014 |
| Gender | .119 | 3.236 | .001 |
| Positive probability | .281 | 7.470 | .001 |
| Positive intensity | .110 | 2.934 | .003 |
| Unpleasantness | -.054 | -1.476 | .141 |

report ever having purchased a lottery ticket, the total spending by women as a whole (\$9.89/month) was considerably greater than that of men (\$8.40/month) (Gallup Organization, 2004). At first blush, our interpretation of this fact and our findings in the positive domain may appear at odds with our other findings that men endorsed greater willingness to engage in gambling than women. However, the gambling scenarios presented to our subjects involved fairly high potential costs (i.e., the possibility of losing a full day's or week's worth of income). Therefore, women may be more willing to pay a small cost for the chance of a very positive outcome but may be reluctant to do so when the potential cost is high. We are currently conducting research to further explore the genders' reactions to financial gambles involving various levels of potential loss and gain, which may shed further light on this issue.

As described above, our results indicate that for risky choices, those subjects assigning higher probabilities to negative outcomes also assess the outcomes as more severe. This positive correlation appears separately within each gender as well as when participants are pooled. These results seem broadly congenial to the view described as "risk as feelings" (Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, Finucane, Peters & MacGregor, 2002). According to this thesis, people tend to have a rather global affective representation of behavioral choices as more or less risky. As Slovic et al. (2002) put it, "if they like an activity, they are moved toward judging the risks as low and the benefits as high; if they dislike it, they tend to judge the opposite — high risk and low benefit. Under this model, affect comes prior to, and directs, judgments of risk and benefit..." (p. 5), a conception that also fits with evidence that sociopolitical factors play a role in gender differences in perceptions of risks associated with technologies (see Slovic, 1997, for an interesting discussion of these).⁵

At a global level, at least, this seems to fit nicely with the finding reported above that people who view an activity as having a severe potential negative outcome also tend to view the potential negative outcome as more probable. In that regard, a global judgment of negativism — varying across subjects and greater, on average, in women — might seem to be at work. The effect is similar to what Jervis (1976) has termed "belief overkill", which is the tendency to believe that all good arguments rest on the

same side of any dispute (for discussion, see Baron, 2000, p. 212). On the other hand, we did not find any notable relationship between ratings of enjoyment and ratings of either severity or probability of potential negative outcomes.

Interestingly, some of the strongest support for the affect as feeling viewpoint has come from findings of a negative correlation between people's assessments of the benefits associated with an activity or investment and the risks of that activity (Alhakami & Slovic, 1994; Finucane, Alhakami, Slovic & Johnson, 2000; Ganzach, 2001). For investments, at least, this reflects an erroneous belief, since one of the most elementary facts uncovered in the field of finance is a positive relationship between the riskiness of an investment and its expected return — not a negative one. It should be noted, however, that the correlations examined in the present study were computed over individuals, whereas the papers just cited reported correlations across situations. It is conceivable that if one sampled broadly from the universe of potential activities that people commonly engage in, our subjects too might have rated as more enjoyable whichever activities they viewed as having potential bad outcomes low in severity and probability. If so, this too might be erroneous, since it stands to reason that just as investments must offer a high expected return as compensation for risk, risky activities must, to attract participants, offer some form of pleasure and/or aesthetic experience as compensation (thus, few people seem inclined to engage in night-time bungee jumping or playing catch with live munitions).

The present results also have an interesting but perhaps misleading resemblance to findings in the older decision making literature by Irwin (1953) and Pruitt and Hoge (1965). These investigators — and others around the same time — exposed participants to events in the laboratory (such as lights turning on) associated by with various outcome values (rewards or losses for the participants) and various probabilities of occurrence. A common finding was that events associated with greater gains (or smaller losses) were often rated as more probable. This finding differs in a number of ways from the phenomenon described in the present paper. The most obvious difference is in the direction of the effect. Another difference is that, in the older literature, participants came by their impressions of the probability and value of the events in question exclusively through direct experience within the experiment; by contrast, in the present study, few subjects would have any direct experience to fall back upon in estimating the likelihood of a bad outcome from activities such as motorcycle riding or piloting their own planes.

⁵ We should note that our mediational analyses were based on the assumption that the causal arrows run from beliefs about the risks associated with a behavior to the decision about willingness to engage in the behavior. However, as with all correlational data, causal arrows operating in the reverse direction are not eliminated by our findings. Indeed, one way to construe the notion of "belief overkill" — discussed below — would involve just such a reversed causal direction.

4.2 Why are there gender differences in risk taking?

Although the present data cannot address the question of why gender differences exist in risky behaviors across many domains, it is perhaps of some interest to attempt to relate our findings to some lines of speculation on this topic. One possible interpretation, suggested by Buss (2003), extends Trivers' (1972) Darwinian analysis of parental investment. For physiological reasons, the minimal investment required to produce an offspring is generally much greater for a female than for a male (in humans, 9 months of gestation time vs. a few minutes). Thus, a male potentially can greatly increase his Darwinian fitness by having sex with multiple partners, whereas a female cannot. One potential consequence of this is much greater variability in male reproductive success than female. This difference may make it adaptive for males to be willing to take great risks for a chance of raising their attractiveness to mates (Buss, 2003). For example, suppose that running a 5% risk of death can move an organism's fertility from the 50th percentile for their sex to the 90th. For a male, this might pay a Darwinian dividend, whereas for females the cost would be more likely to outweigh the benefits.

It should be noted that this account could potentially explain risk-taking even in domains that are ostensibly unrelated to mate-seeking per se, if taking risks allows a man to acquire greater resources, and thereby attract more mates. Thus, one might suppose that men are innately inclined to take risks in many domains due to the large reproductive benefits available in the ancestral environment for those males most successful at obtaining access to many mates. While many of the results here might be consistent with this theory, our findings in the social domain do not obviously fit. Men seemed no more likely to take social risks than women, according to our results as well as those of Weber et al., (2002) and Johnson et al., (2004).

There is another possible evolutionary explanation for gender differences in risk that might also be worth considering, which we will term the "offspring risk hypothesis". Perhaps women have a tendency to see greater risks than men see, not because of different selection pressure relating to mate seeking, but rather because if one perceives more risks in the world, one will be more effective at keeping safe any offspring under one's care. Human infants are exceptionally helpless for an unusually long developmental period, as compared to most animals. The reader may be skeptical that the diverse kinds of risk attitudes assessed in the present study — which are admittedly far removed from childrearing context — would have any bearing on the risks imposed on children. But consider the following thought experiment:

Suppose you were interviewing a potential babysitter for your child and learned through an interview that an applicant loved dangerous sports, rarely took precautions like wearing a seatbelt, and liked to gamble large sums of money, judging the risks associated with all these behaviors to be slight. Would you still want to hire this person as a babysitter? An informal sample suggests that the near-universal reaction is an emphatic no, suggesting that many of us tacitly assume that such attitudes would indeed affect the sort of risks a person would impose upon children entrusted to their care. It seems conceivable that natural selection validated this common hunch over many generations in human prehistory, and responded by wiring in a very general tendency for females to perceive greater risks than do males. Of course, these kinds of evolutionary/functional accounts are notoriously difficult to test, and the point of the present discussion is merely to suggest that any possible innate biological differences in risk perception are as likely to reflect selection pressures related to child-rearing as those related to mate-seeking.

A very different sort of explanation for gender differences is suggested by work of Slovic and colleagues (Slovic, Fischhoff, & Lichtenstein, 2000). They found that greater familiarity with a risk was generally associated with reduced risk-perceptions. One possibility is that women have greater familiarity with social risks, thus they engage in them as often or more often than men.

4.3 Implications for further research

One interesting question raised by the present results relates to the nature of the risk scale used. It would be interesting to assess whether the tendency of women to evaluate as more likely the potential negative consequences associated with risky choices examined here would hold up if perceptions of the likelihood of discrete and well-defined negative outcomes (e.g., dying in a motorcycle crash per 10,000 miles driven without a helmet) were assessed using a probability or frequency scale — rather than, as in the present study, assessing the likelihood of negative outcomes using a Likert-type scale. It might be the case that estimating likelihood in a Likert scale, and referring to the negative outcomes globally, promotes a relatively associative or impressionistic mode of analysis, causing the judgments of severity and likelihood to "bleed into" each other.

There are also several interesting approaches for potential follow-ups which could be devised on the basis of an analysis of risk attitude in terms of the negative value that people place upon outcome variability (Weber, 1999; Weber & Millman, 1997). One such approach would ask subjects to specify what range of outcomes they would anticipate as a consequence of given risky choices, and what probabilities they would place on these. Another ap-

proach would be to compare men and women's responses to "artificial" options in which the probabilities and outcomes are both fully specified (presumably in monetary terms). Such an investigation might help to further pin down the reason why women's perceptions and preferences seem to be shifted relative to men's in the direction of promoting less risky choices across many domains. While the results of the present study show that men and women differ in their assessments of the likelihood and severity of negative outcomes — both apparently contributing to their different propensities for engaging in such behaviors — it is possible that men and women also differ in their reactions to risk (i.e., outcome variability) per se.

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Appendix A

All scenarios are from Weber, Blais, and Betz (2002), except those marked “additional.” For each scenario, participants were asked four questions using the 5-point scales listed below.

Gambling

1. Betting a day's income on the outcome of a sporting event (e.g. baseball, soccer, or football).
2. Betting a day's income at the horse races.
3. Betting a day's income at a high stake poker game.
4. Gambling a week's income at a casino.

Health

1. Walking home alone at night in a somewhat unsafe area of town.
2. Not wearing a seatbelt when being a passenger in the front seat.
3. Not wearing a helmet when riding a motorcycle.
4. Exposing yourself to the sun without using sunscreen.

Recreational

1. Going whitewater rafting during rapid water flows in the spring.
2. Periodically engaging in a dangerous sport (e.g., mountain climbing or sky diving).
3. Piloting your own small plane, if you could.
4. Chasing a tornado or hurricane by car to take dramatic photos.

Social

1. Admitting that your tastes are different from those of your friends.
2. Disagreeing with your father on a major issue.
3. Defending an unpopular issue that you believe in at a social occasion.
4. Arguing with a friend about an issue on which he or she has a very different opinion.
5. Asking someone you like out on a date, whose feelings about you are unknown. (Additional)
6. Raising your hand to answer a question that a teacher has asked in class. (Additional)

For each scenario, subjects answered the following four questions:

- a. Please indicate your likelihood of engaging in this activity or behavior? [5-pt scale: 1 = very unlikely, 5 = very likely]
- b. If you engaged in this activity, what is the likelihood (probability) that it would have negative consequences for you? [5-pt scale: 1 = not at all likely, 5 = extremely likely]
- c. If you engaged in this activity, how bad would the potential negative consequences be if they were to happen? [5-pt scale: 1 = not at all bad, 5 = extremely bad]

- d. Assuming that there were no bad outcomes, how enjoyable/positive would this experience be for you? [5-pt scale: 1 = not at all enjoyable, 5 = extremely enjoyable]

Appendix B

Positive domain scenarios created for the present study:

1. Trying to sell a screenplay, which you have already written, to a Hollywood film studio.
2. Calling a radio station where the 12th caller will win a month's worth of income.
3. Sending out 30 applications for high paying jobs after graduating from college.
4. Regularly visiting a professor in her office hours and then asking her for a letter of recommendation.

For each scenario, subjects answered the following four questions:

- a. Please indicate your likelihood of engaging in this activity or behavior? [5-pt scale: 1 = very unlikely, 5 = very likely]
- b. If you engaged in this activity, what is the likelihood (probability) that it would have positive consequences for you? [5-pt scale: 1 = not at all likely, 5 = extremely likely]
- c. If you engaged in this activity, how good would the potential positive consequences be if they were to happen? [5-pt scale: 1 = not at all good, 5 = extremely good]
- d. Assuming that there were no good outcomes, how unpleasant/negative would this experience be for you? [5-pt scale: 1 = not at all unpleasant, 5 = very unpleasant]

Appendix C

Actual past risk behavior questions created for the present study, including some adapted from Gibbons and Gerrard (1995). Each question's association with a domain is indicated with the first letter of the domain.

1. Do you smoke? [H] [5-pt scale: 1 = no, 2 = no, I used to but quit, 3 = yes, less than 1/2 pack a day, 4 = yes, 1/2 – 1 pack a day, 5 = yes, more than a pack per day]
2. How many alcoholic beverages do you typically drink in a week? [H] [5-pt scale: 1 = none, 2 = 1–4, 3 = 5–8, 4 = 9–12, 5 = 13 or more]
3. How often in the last 6 months have you had too much to drink or gotten drunk? [H] [5-pt scale: 1 = never, 2 = once, 3 = 2–4 times, 4 = 5–7 times, 5 = 8 or more times]
4. How often do you drive over the speed limit? [H] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]
5. How often do you get into arguments with friends or family? [S] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]
6. How often do you gamble (e.g., betting on sports events, gambling at casinos, playing the lottery, playing games for money with friends)? [G] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]
7. How often do you engage in risky recreational activities (e.g. scuba diving, hang gliding, motorcycle riding)? [R] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]
8. How often do you "bend" or break traffic laws? (e.g., jay walking, rolling through stop signs, running lights that have just turned red, not wearing a seatbelt)? [H] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]
9. How often do you raise your hand to answer or ask questions in class? [S] [5-pt scale: 1 = almost never, 2 = rarely, 3 = sometimes, 4 = often, 5 = almost always]