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Risk and relative social rank: positional concerns and risky shifts in probabilistic decision-making

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Abstract

Although research indicates that individuals generally favor certain prospects over those whose outcomes are more variable, risk-aversion does not characterize human decision-making across domains. Here, we use an evolutionary perspective to explore the role that concerns with relative position play on preferences for certain versus probabilistic outcomes. Our evolutionary-based hypothesis predicts that concern with relative position will lead to increased risk when (1) the higher variance outcome offers the potential to render one better off than social competitors, but the lower variance outcome would not, (2) the choice is in a decision domain affecting one's ability to solve adaptive problems reliably present in human social life, and (3) the decision is being made about a gain rather than a loss. The current study (N=239) found support for these predictions, demonstrating that such positional concerns reverse the well-documented certainty effect in domains predicted in advance by the theory. Our findings highlight the important role played by social comparisons in individual decision-making and preferences for risk.

Keywords: Social comparisons; Social judgment; Evolutionary psychology; Risk assessment; Certainty effect

1. Introduction

In their landmark 1979 article *Prospect theory: An analysis of decision-making under risk*, Kahneman and Tversky (1979) developed a model of decision-making that accounted for several pervasive effects characterizing human decision-making. Among these is the certainty effect, whereby people overweight the value associated with low variance (i.e., more certain) outcomes and underweight the value of high variance (i.e., less certain) outcomes. This effect yields the general prediction that when reasoning about gains, individuals should prefer those associated with the greater degree of certainty, even when the riskier option is more valuable. Conversely, when reasoning about losses, individuals should favor riskier options, even when the more certain outcome is smaller in magnitude. Since the development of this theory, a number of independent researchers have found support for these predictions in a variety of decision-making contexts (e.g., Barberis, Huang, & Santos, 2001; Betts & Taran, 2003; Verhoef, De Haan, & Van Daal, 1994).

Although the certainty effect is frequently observed in human choice behaviors, it does not characterize decision-making across domains. Gambling, buying stocks, and investing in 401Ks are but a few of the behaviors regularly observed in human social life that violate the tenets of the certainty effect. People, it seems, are sometimes willing to forgo certain gains to have a chance at acquiring outcomes whose payoffs are not guaranteed. This raises an important question: What are the conditions under which individuals are willing to take these risks? Here, we use an evolutionary psychological framework to explore the role that one specific contextual factor—relative position—plays in individuals' preferences for certain versus probabilistic outcomes. In particular, we use modified versions of well-established decision-making scenarios to test whether the desire to have greater gains than one's social competitors will increase individuals' preferences for less certain outcomes. Our hypothesis predicts that concern with relative position will

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lead to increased willingness to take risks when (1) the higher variance outcome offers the potential to render one better off than social competitors, but the lower variance outcome does not; (2) the choice is in a decision domain affecting one's ability to solve adaptive problems reliably present in human social life; and (3) the decision is being made about a gain rather than a loss.

1.1. An evolutionary account of risky decision-making

Although human decision-making was long believed to be guided by a single "utility maximization" algorithm, evolutionary theorists have begun to amass evidence suggesting that it may instead reflect the operation of numerous decision rules and cognitive heuristics shaped by selection to solve specific adaptive problems (see, e.g., Brandstätter, Gigerenzer & Hertwig, 2006; Gigerenzer & Selten, 2001). On this view, human decision-making is adaptively tuned such that individuals favor outcomes that have reliably increased fitness over evolutionary time (Cosmides & Tooby, 1996; Farthing, 2005; Wang, 1996a, b; Wang, Kruger, & Wilke, 2009). With regard to risk-taking specifically, this perspective predicts that preferences for safe versus risky behavioral alternatives should vary as a function of contextual variables that influence the potential fitness benefits associated with each. For instance, Wang and colleagues used this perspective to predict that risk-taking should vary between individuals as a function of differences in life-history variables, such as fertility and mortality risk, both of which have historically influenced the impact of any given outcome on one's reproductive success (Wang et al., 2009). Others have used this perspective to predict that men's greater reproductive variance will correspond to men being riskier than women, especially when they are young and when mating goals are made salient (Arnett, 1995; Baker & Maner, 2008, 2009; Wilson & Daly, 1985). This perspective has also been applied to the development of process-oriented models of probabilistic decision-making, demonstrating that individuals' risk preferences often reflect the utilization of fast and frugal decision-making heuristics shaped in our evolutionary past (Brandstätter et al., 2006). Taken together, such research supports the view that risk preferences are contextually-dependent, changing as a function of factors both internal and external to the individual that influence the marginal fitness returns associated with safe versus risky behavioral alternatives (see also Farthing, 2005; Kelly & Dunbar, 2001).

What additional contextual factors influence the potential fitness returns associated with risky versus safe behaviors? Although there are likely many, according to risk-sensitive foraging theory, one such factor is whether one's current level of need can be met by choosing safer options. This theory—originally developed to predict animal's foraging behaviors—predicts that an organism's decision-making will be modulated in favor of pursuing riskier (i.e., more variable) food patches when their physiological needs exceed the outcomes available from choosing less variable patches. This prediction has been confirmed empirically in a variety of animals (e.g., Caraco, 1981, 1983; Caraco, Martindale, & Witam, 1980; Houston, Kacelnik, & McNamera, 1982; Real, 1991) and has more recently been extended to predict choice behavior in humans in non-foraging contexts (e.g., Ermer, Cosmides, & Tooby, 2008; Rode, Cosmides, Hell, & Tooby, 1999; Wang, 1996a). For instance, one study used this model to predict that the ambiguity effect (i.e., the finding that people tend to avoid outcomes with missing probability information) would disappear when an individual's need level— designated in advance by an experimenter—was greater than the known option's expected mean outcome (Rode et al., 1999). This prediction was empirically verified in multiple studies, suggesting that human decision-making, too, may shift to favor risky outcomes when more certain outcomes are not sufficient to meet baseline need levels.

The application of a risk-sensitive foraging model to predict outcome preferences in humans seems relatively straightforward: first ascertain an individual's physiological needs and then determine whether the low variance (i.e., safe) option is sufficient to meet this need. If the safe option is sufficient, the individual should choose that option. If it is not, the individual should shift his preferences in favor of the more variable outcome. However, as others have noted, in some domains, one's need level depends not only on one's own physiological state (e.g., hunger, thirst), but also on how one stacks up to direct social competitors (Ermer et al., 2008; Frank, 1991,1999; Hill & Buss, 2006). In domains where the fitness benefits associated with personal outcomes are contingent on those available to others, need depends on one's ability to outperform relevant social competitors *in addition* to meeting baseline levels required for survival. Given the inherently competitive nature of the evolutionary process, adaptive goal-setting behaviors should reflect a desire to be better than rivals with whom one is competing for access to resources rather than a desire to better oneself in general. Once achieved, the individual can go on to solve adaptive problems in other domains.

Humans appear to employ such relativistic decision-rules in determining their own needs with respect to certain fitness-relevant outcomes. Researchers have demonstrated, for instance, that worker satisfaction is correlated with relative, rather than absolute income levels (Clark & Oswald, 1996; Groot & Van den Brink, 1999) and that Americans tend to be happier when they are richer than their neighbors (Blanchflower & Oswald, 2004; Frank, 1999; Luttmer, 2005). Others have found that individuals would rather live in an absolutely smaller house if it would mean that their house was larger than their neighbors (Frank, 1999). The relationship between relative position in determining one's own needs is further supported by research in neuroscience demonstrating a link between relative social status and serotonin levels in both humans (Zizzo, 2008) and other

primates (McGuire, Raleigh, & Brammer, 1984). These and related findings provide convergent evidence for relative position playing an important role in individuals' perceptions of their current resource acquisition needs in domains where fitness payoffs are relativistic.

Given that human perceptions of resource acquisition needs appear to be at least partially calibrated to how relevant social competitors are doing, might these concerns be sufficiently great to shift preferences to favor risky outcomes? Here we seek to test this possibility. Specifically, we seek to test the hypothesis that concern with relative position will lead to increased willingness to take risks when the higher variance outcome offers the potential to render one better off than social competitors, but the lower variance outcome would not.

1.2. Reasoning about positional versus non-positional gains

In its most general form, our hypothesis predicts that individuals will experience risky shifts when outcomes obtained with certainty are not sufficient to render one better off than competitors. However, this hypothesis is predicated on the outcomes in question having an impact on fitness and this impact being at least partially dependent on how one compares to social competitors. What happens, then, when an individual is reasoning about resources whose impact on fitness is minimal or less dependent on the outcomes of others? Being motivated by relative rather than absolute outcomes comes at a real cost to the individual. Exhibiting a preference for an absolutely lesser income, for example, in favor of having an income higher than one's competitors would render one better able to acquire scarce resources that play a critical role in fitness (e.g., mates, status). However, this preference comes at the cost of the individual having access to an absolutely smaller amount of monetary resources with which to purchase items one may desire. When reasoning about resources whose impact on fitness is less direct and less dependent on the outcomes available to others (e.g., days off from work, happiness) it is unlikely that the benefits associated with being positionally better off would outweigh the costs. Thus, it is predicted that individuals should be inclined to prefer more certain outcomes, regardless of the outcomes available to social competitors when reasoning about outcomes whose fitness impact potential is minimal or less dependent on that of others.

The evolutionary logic detailed above also predicts that concern with relative position should not influence individuals' risk preferences when reasoning about losses. In general, when an organism realizes a gain in a domain critical to survival and reproductive success, it increases the probability that it will survive and reproduce successfully. However, the often cascading nature of losses renders the fitness impact of losses asymmetrically negative. For instance, if a man loses a given amount of financial resources, he not only loses the resources, per se. He also faces an increased risk of losing his mate, his position in a status hierarchy, and endangering the health and welfare of himself and his dependents (e.g., mates, kin, and children). Additionally, for our hunter-gatherer ancestors for whom resource scarcity was a significant concern, incurring a loss in one of these critical domains may have caused death or made them more susceptible to death (see, e.g., Aktipis & Kurzban, 2004; Ketelaar & Todd, 2001; Stephens & Krebs, 1986). Given the asymmetrical influence that gains and losses have had on fitness over evolutionary time, individuals are predicted to favor the high variance outcome when choosing between two losses, as this outcome offers the possibility of the individual meeting their need level in this domain.

1.3. The current study

We examined the influence of positional concerns on men's and women's preferences for certain versus high-variance social outcomes. To do this, we used a modified version of an established decision-making methodology wherein individuals are asked to choose between two outcomes: one whose outcome is probable and one whose outcome could be obtained with a greater degree of certainty (e.g., Kahneman & Tversky, 1979). We chose this method because similar forced-choice methodologies are used in a large number of studies on reasoning about certain versus probabilistic outcomes (for an overview of many of these studies, see, e.g., Brandstätter et al., 2006), rendering our results maximally relevant to existing literature. Additionally, modifying these existing scenarios allowed us to test three key predictions about the influence of relative position on individuals' interest in certain versus probabilistic outcomes.

Prediction 1. Individuals will exhibit a heightened preference for risky monetary gains when (a) the risky alternative has the potential of rendering oneself better off than social competitors and (b) the certain outcome renders them worse off than competitors. Although cash economies were not present throughout most of human evolutionary history, money is the ultimate fungible resource, easily converted into an astonishing variety of resources relevant to reproductive success. Monetary holdings have a direct influence on one's access to proper nutrition (deOnis, Frongillo, & Blossner, 2000; Frongillo, deOnis, & Hanson, 1997), health care (Case, Lubotsky, & Paxson, 2002; Chen, Martin, & Matthews, 2006; Ettner, 1996), resources necessary to care for children (Berntsson, Köhler, & Vuille, 2006; Spernak, Schottenbauer, & Ramey, 2006), and, for men, mates (Buss, 1989, 1994/2003). Further, the impact of money in the marketplace for each of these resources is dependent on how much one has relative to one's social competitors. An individual's preference for high- versus low-variance monetary outcomes should thus be modulated by outcomes available to social competitors.

Prediction 2. Individuals' preferences for a high- versus low-variance vacation prize will not be influenced by information about the outcomes available to relevant social competitors. Instead, we predict that individuals will favor

the low variance outcome even when their choice entails social competitors' vacation prizes being more desirable than their own. The potential fitness benefits associated with taking a vacation (e.g., increased health from reduced stress levels, increased access to novel mates) are less direct than those potentially available from monetary resources and also less dependent on how one compares to one's social competitors. Accordingly, positional concerns should be less salient such decisions. This item will serve as a control, allowing us to test for the contextually dependent nature of positionally motivated risky shifts.

Prediction 3. Individuals' preferences for high-variance losses will also persevere, even at the expense of the loss being positionally greater than those incurred by rivals. An individuals' need level is calibrated to their current state, rendering high variance loss outcomes more desirable than those that will be incurred with certainty, regardless of the losses incurred by rivals. Over the course of evolutionary time, those individuals who were more concerned with minimizing absolute loss amounts would have likely fared better than those whose preferences reflected positional concerns. Those individuals who were more concerned with the losses of their rivals would have risked incurring cascading resource losses and put themselves at greater risk of dropping below survival-level needs.

2. Method

2.1. Participants

One hundred seven male and 132 female undergraduates (n=239) completed the experimental instrument, and 40 male and 55 female undergraduates (n=95) completed the control instrument. Participants' ages ranged between 17 and 25 (M=18.65, S.D.=1.10). All participants were students at a large state university for whom participation partially fulfilled an experiment requirement for course credit.

2.2. Materials and procedure

We created a computer-based forced-choice testing instrument that contained 13 items used to test the predictions outlined above. Participants came to a research laboratory in groups of two to four and filled out their responses at individual computer terminals to which they were assigned. They read the following instruction set before answering the questions: In the questions below, there are two states of the world, State A and State B. You are asked to select the letter (A or B) corresponding to the world you would prefer to live in. Treat each question independently from the others (i.e., State A in question 1 is different from State A in question 2, which is different from State A in question 3, and so on). There are no "correct" answers, so please be completely honest when choosing which of the two states you would prefer to live in.

The control group was asked to choose between options used in the original Kahneman & Tversky (1979) paper in addition to seven similar items created by the researchers to test the predictions on a wider range of decision-making scenarios. The experimental group was given the same questions, but with one important difference. In the experimental condition, each of the items was modified such that the outcome shown to be favored by participants in the original Kahnemen & Tversky study would now render them worse off than their social competitors on that outcome. That is, in cases of gains, individuals preferring the modal response under prospect theory would do so at the expense of acquiring a positionally *smaller* gain than their peers. In cases of monetary losses, individuals preferring the modal response under prospect theory would do so at the expense of incurring a positionally *larger* loss than their peers. Below are examples of the original questions posed by Kahneman & Tversky (1979) along with the percentage of individuals choosing each outcome.

(Resource Gain) Choose between:	
A. 2500 with probability .33 2400 with probability .66 0 with probability .01	B. 2400 with certainty
(18%)	(82%)
(Resource Loss) Choose between:	
A. Losing 3000 with probability .9	B. Losing 6000 with probability .45
(8%)	(92%)

We modified these questions given to participants in the experimental condition by making the originally preferred outcomes positionally worse-off and the lesser preferred outcomes positionally better off. The questions were also reworded such that they would be more likely to activate decision-making procedures designed to reason about social competition for access to resources (i.e., be more ecologically valid). Here are examples of questions used to test the influence of social comparison information on the certainty effect in the context of monetary gains and losses.

(Resource Gain) You are allowed to choose one of the following schemes for your new job's salary. Which income would you most prefer?

A. You have a:
   - ○ 66% chance of getting paid $2400 a month
   - ○ 33% chance of getting paid $2500 a month

   Your coworkers get paid:
   - ○ $1000 a month with certainty

B. You get paid:
   - ○ $2400 a month with certainty

   Your coworkers get paid:
   - ○ $3000 a month with certainty

(Resource Loss) Due to downsizing at your place of employment, you may have to take a new job and a salary

cut. There are two plans being debated by management to handle this situation. Choose the plan that you most prefer:

A. You receive a:
   - ○ 45% chance of losing $6000 from your yearly salary.
   - ○ 65% chance of not losing anything from your yearly salary.
   - ○ 1% chance of getting paid $1000 a month

   Your coworkers receive:
   - ○ 5% chance of losing $5000 from their yearly salary
   - ○ 95% chance of not losing anything from their yearly salary.

B. You receive a:
   - ○ 90% chance of losing $3000 from your yearly salary.
   - ○ 10% chance of not losing anything from your yearly salary.

   Your coworkers receive a:
   - ○ 95% chance of losing $6000 from their salary
   - ○ 5% chance of not losing anything

In addition to risk aversion, Kahneman and Tversky (1979) also documented that individuals tend to exhibit a preference for higher valued, less probable outcome when reasoning about uncertain outcomes with very similar probabilities. For instance 83% of participants asked to choose between the following options preferred option A: Option (A) 2500 with probability .33, or Option (B) 2400 with probability .34. Our hypothesis predicts that concerns with relative position should have the effect of reversing the modal decision-making response to this type of probabilistic outcome. Below, is the question used to test this possibility:

You recently found out that an old teacher from high school has passed away and left you and other students from your class some money in his will. You can choose between the following ways of dividing up their money. Choose the option that you would most prefer:

A. You have a:
   - ○ 33% chance of getting $2500
   - ○ 67% chance of not getting anything ($0)

   The rest of your class has a:
   - ○ 75% chance of getting $3000
   - ○ 25% chance of not getting anything ($0)

B. You have a:
   - ○ 34% chance of getting $2400
   - ○ 66% chance of getting $0

   The rest of your class has a:
   - ○ 10% chance of receiving $2400
   - ○ 90% chance of receiving $0

Here, it is predicted that individuals will prefer option B. A full set of the questions used can be found in Appendix A.

3. Results

Because we tested multiple predictions derived from our model, α=.01 to control for Type I error. Mann–Whitney *U* tests revealed that including social comparison information significantly detracted from the certainty effect on individuals' preferences for probabilistic outcomes in eight of the ten predicted domains (see Table 1). Participants in the experimental group (i.e., the group given social comparison information) were significantly more risk-seeking than the control group when choosing between two games with monetary payoffs; 34% of the control group and 70% of the experimental group chose the high-risk, positionally greater option (Z=6.28, p<.001). Participants in the experimental group were also significantly more risk seeking than controls

Table 1
Testing for contextually-specific reversal of the certainty effect

Item	Prediction	Risk preferences with and without social comparison information		*Z*
		With social comparison information	No social comparison information	
Game with risk monetary gain	Experiment>control	70%	34%	6.28**
Holiday bonus with risk	Experiment>control	23%	0%	5.14**
Inheritance with risk	Experiment>control	64%	51%	2.39
Pay raise with Risk I	Experiment>control	70%	51%	3.30**
Pay raise with Risk II	Experiment>control	66%	21%	7.43**
Pay raise with Risk III	Experiment>control	57%	11%	7.67**
Salary with Risk I	Experiment>control	54%	24%	4.89**
Salary with Risk II	Experiment>control	51%	25%	4.38**
Salary with Risk III	Experiment>control	90%	84%	1.35
Salary with Risk IV	Experiment>control	70%	25%	7.37**
Game with risk monetary loss	Experiment=control	63%	76%	2.34
Salary cut with risk	Experiment=control	77%	83%	1.32
Vacation prize with risk	Experiment=control	29%	13%	3.15*

Questions with positional information were framed such that individuals would be positionally better off choosing the outcomes not favored in the original Kahneman and Tversky (1979) study (i.e., on items testing risk preferences for gains, individuals would be positionally better off choosing the high-risk outcome; on items testing risk-preferences for losses, individuals would be positionally better off choosing the low-risk outcome). Control group: n=95; Experimental group: n=239).

* $p \leq .01$.

** $p \leq .001$.

when choosing between two potential pay-raises in all three questions testing risk preferences in this domain. These results are summarized in Table 1.

Participants in the experimental group were significantly more risk-seeking than controls when choosing between two monetary holiday bonuses (0% of controls and 23% of experimental group choosing the high-risk option in this domain, (Z=5.14, p<.001) and in three out of four questions pertaining to preferring a positionally or absolutely larger salary (question 1: Z=4.89, p<.001; question 2: Z=4.38, p<.001; and question 3: Z=7.37, p<.001) (see Table 1). No significant differences were found between the experimental and control groups on the two remaining items (inheritance associated with risk and one question assessing risk preferences associated with salary).

Social comparison information was not predicted to influence risk preferences when reasoning about probabilistic monetary losses (i.e., risk preferences exhibited by the experimental group were predicted to equal those exhibited by the control group), and no significant differences were found (Table 1). Decision-making in these domains was personal outcome-myopic, with the modal response both the experimental and control conditions reflecting a preference for risk-seeking in the face of monetary losses. This was true whether individuals were reasoning about their preference for a pay-cut or choosing between games that yield a monetary loss. For the remaining item, vacation prize with risk, it was predicted that social comparison information would have no effect on risk aversion. However, whereas 13% of the control group chose the high-risk option in this domain, 29% of the experimental group chose the high risk option (Z=3.15, p=.002). Although the majority of respondents preferred the certain vacation prize to the risky one, the experimental group was significantly more risk-seeking than the control group in this domain, suggesting that concern with relative position may also play a role in risk-seeking behavior, even in domains not linked to fitness in a direct way.

4. Discussion

The current research examined whether concern with relative position can lead to increased interest in risky social outcomes. Drawing on risk sensitive foraging theory, as well as theory and research on the importance of relative position in determining an organisms' need levels in specific domains, we hypothesized that concern with relative position will lead to increased risk-taking when (1) the higher variance outcome offers the potential to render one better off than social competitors, but the lower variance outcome would not, (2) the choice is in a decision domain affecting one's ability to solve adaptive problems reliably present in human social life, and (3) the decision is being made about a gain rather than a loss. We tested our hypothesis using modified versions of established decision-making scenarios whereby individuals were asked to choose between being better off in an absolute sense, but worse off than their social competitors *or* worse off in an absolute sense, but better off than their social competitors. The results of our study demonstrated that individuals are increasingly willing to choose risky outcomes when doing so offers the possibility of outperforming their social competitors when choosing between alternative monetary gains.

Individuals' preferences for positionally greater monetary outcomes had the effect of overriding modal monetary gain preferences when these gains were presented without social comparison information. This difference was found on eight of the 10 items on which it was tested. This pattern of results was predicted because the potential fitness benefits available from an individual's financial resources are partially dependent on the outcomes available to social competitors (e.g., Frank, 1999; Hill & Buss, 2006). Although no significant differences between the experimental and control groups were detected for two of the items for which we predicted them (*Inheritance with risk* and *Salary with Risk III*), this lack of difference appears to result from the test items in the control group failing to elicit the certainty effect rather than a failure of the social comparison effect to decrease risk aversion (see Table 1).

Also as predicted, positional concerns did not influence individuals' preferences for being risk-seeking in the face of a loss. Men and women ignored social comparison information about the losses of others when judging the relative desirability of two potential losses (i.e., they preferred the uncertain, but larger loss to the certain, but smaller loss), a pattern of results predicted because of the asymmetrically negative effect of losses on fitness (Aktipis & Kurzban, 2004; Ketelaar & Todd, 2001; Stephens & Krebs, 1986). The prediction that preferences for a safe or risky vacation prize would not be modulated by the performance of relevant social competitors was not supported, however. Although the modal preference for choice of vacation prize was the certain, but positionally worse-off option, individuals were significantly riskier in their choices than they were in the control condition. Although this difference was relatively small, it does suggest that positional concerns may play a role in influencing risk preferences for gains whose fitness impact is less dependent on the outcomes of others. Despite this unanticipated effect, our findings are consistent with the evolutionarily informed hypothesis derived above and contribute to the growing literature demonstrating that risk-taking in humans is contextually dependent, varying according to the fitness benefits associated with the safe versus the risky alternatives (Cosmides & Tooby, 1996; Farthing, 2005; Wang, 1996a,b; Wang et al, 2009).

In addition to lending support to the specific hypotheses under investigation, these findings lend support for the utility of a risk-sensitive foraging model as a general model of probabilistic decision-making in humans. The current findings suggest that the axiom of risk-sensitive foraging can be applied to predict decision-making in a wide range of

decision domains when need is properly defined according to the current decision-domain. This is consistent with other recent research that supports the link between relative position and risk-seeking. Researchers have found that men tend to be more risk-seeking when they think they are being observed and evaluated by others of similar or higher status when reasoning about status-relevant outcomes than they are when being evaluated by lower-status peers (Ermer et al., 2008). Taken together with the current findings, these findings suggest that preferences for risky paths to success may reflect contextually-specific risky shifts occurring in response to the threat of being out-competed. This insight has important implications for understanding risk in a variety of domains, especially in domains related to mating success. Although behaviors such as sun tanning and steroid use are undesirable and dangerous, they may perpetuate in the face of fierce competition for access to mates (see, e.g., Saad & Peng, 2006). It is difficult to convince a single, college-aged woman that the long-term costs of tanning outweigh the benefits she receives from staying competitive on the mating market at an age when the effects of her behavior on fitness are greatest.

The current study contained a number of important limitations that must be addressed in future research before definitive conclusions can be drawn about the role played by social comparisons in risk preferences. First, it is possible that the pattern of results obtained resulted from general framing effects rather than adaptive risky shifts, per se. That is, due to the way that questions were asked, it is possible that participants were framing outcomes in which they were being out-competed by social rivals as losses, rather than gains. For instance, when participants were given an option to earn $2400 a month when their coworkers earn $3000 a month, this outcome may be framed as a loss, since their own outcome is lower than the status quo. On this view, the demonstrated risky shift could simply be a manifestation of risk seeking in the face of losses. Although this alternative explanation may account for the risky shifts demonstrated when individuals were choosing between alternative monetary gains, it does not explain why this effect was not demonstrated when individuals were choosing between competing vacation prizes. Although, positional concerns were found to influence individuals' preferences for a vacation prize, the majority of participants in both conditions preferred the safe outcome. Future research is necessary to determine whether the demonstrated risky shifts would still occur with monetary outcomes when controlling for such framing effects. However, the pattern of results demonstrated in the studies above are more consistent with the evolutionary hypotheses developed than they are with a generalized framing effect.

The current studies tested participants' responses to forced-choice questions about a relatively small number of hypothetical probabilistic outcomes. Although this method and the questions used were chosen based on precedent (Kahneman & Tversky, 1979; Solnick & Hemenway, 1998), it is possible that these results do not accurately reflect decisions about real social and economic outcomes. Future research is needed to draw definitive conclusions about the role played by social comparisons and the desire to engage in risky behaviors in contexts with real rather than hypothetical outcomes using additional research methodologies. Additionally, future research would benefit from asking questions about a wider variety of outcomes, not merely those used in Kahneman and Tversky's 1979 article. In the current study, for instance, only one question was used to test the hypothesis that concerns with relative position would not influence preferences for "want" outcomes (i.e., the desirability of two vacation prizes). Future research would benefit from asking questions about a larger variety of both want and need outcomes, framed as both losses and gains.

Despite the limitations of the current research, it provides important initial evidence that concerns with relative position may play an important role in modulating risk preferences in humans. The certainty effect is viewed by researchers as a robust rule governing human decision-making across domains of social reasoning (with some notable exceptions, e.g., Brase, Cosmides, & Tooby, 1998; Cosmides & Tooby, 1996; Rode et al., 1999; Wang, 1996a,b). The empirical study presented above provided preliminary evidence that concern with relative position can moderate and even completely reverses this effect when reasoning about monetary gains. Risk-seeking in the face of being outperformed by rivals is cogently understood as a functional response to social competitive forces (Maynard Smith, 1982; Maynard Smith & Price, 1973; Rode et al., 1999; Stephens & Krebs, 1986). These results add to the growing body of evidence supporting the view that many of the decision-rules that characterize human decision-making can be best understood in terms of the adaptive problems they were designed to solve (see, e.g., Cosmides, 1989; Cosmides & Tooby, 1994, 1996; Ermer et al., 2008; Gigerenzer, Todd, & the ABC research group, 1999; Rode et al., 1999; Wang, 1996a, b).

Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version, at 10.1016/j.evolhumbehav.2010.01.002.

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