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Original Article

Competitive disadvantage facilitates risk taking

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ABSTRACT

Risk-sensitivity theory predicts that organisms are more likely to take risks when they are unlikely to achieve their goals through safer, low-risk means. Those who are competitively disadvantaged are less likely to succeed in social competition and should consequently show elevated risk taking. We experimentally tested this hypothesis by exposing participants to cues of relative competitive disadvantage or relative competitive advantage via feedback from a purported reaction time based intelligence test. Participants then made a number of high-risk or low-risk economic decisions (Experiment 1). Experiment 2 built on this design by either maintaining or ameliorating cues of relative competitive (dis)advantage. Results indicate that cues of relative competitive disadvantage leads to increased risk taking, and that risk taking can be reduced when cues of disadvantage are ameliorated. Since risk taking tends to generalize across domains, these results can potentially apply to a number of problematic risky behaviors.

1. Introduction

Some decisions involve more risk than others, where "risker" decisions are those involving greater variance in potential outcomes (e.g. flipping a coin to get either $0 or $20 instead of choosing a guaranteed $10; Daly & Wilson, 2001; Friedman & Savage, 1948; Real & Caraco, 1986; Weber, Shafir, & Blais, 2004). Within most species, some individuals take more risks than others (reviewed in Mishra, Logue, Abiola, & Cade, 2011). Among humans, those who are risk-prone tend to engage in a wide variety of risky behaviors, including substance use, dangerous driving, promiscuous sex, gambling, and criminal conduct, which suggests some degree of domain generality (e.g., Donovan & Jessor, 1985; Hirschi & Gottfredson, 1994; Jones & Quisenberry, 2004; Mishra, Lalumière, & Williams, 2010; Mishra, Lalumière, Morgan, & Williams, 2011; Osgood, Johnston, O'Malley, & Bachman, 1988; reviewed in Mishra & Lalumière, 2009, 2011; Mishra, 2013). In non-human animals, behavioral syndromes (i.e., animal "personalities") have been identified describing individual differences in risk propensity across multiple domains (e.g., exploration, foraging, recovery after disturbance; Mishra, Lalumière, et al., 2011; Mishra, Logue, et al., 2011).

1.1. Risk-sensitivity theory, embodied capital, and competitive (dis)advantage

Why do individual differences in risk taking persist? Risk-sensitivity theory predicts that organisms will engage in riskier behavior whenever they are unlikely to achieve their goals through "safe," low-risk means. For example, birds are more likely to forage in predator-prone patches when starving than when satiated (Caraco, Martindale, & Whittam, 1980; Stephens, 1981; Stephens & Krebs, 1986). Succumbing to a predator is evolutionarily no worse than starving to death, so the risky patch is worth foraging in when starving but not when satiated. A large body of evidence suggests that both non-human and human animals make decisions consistent with risk-sensitivity theory (reviewed in Mishra, 2013; Mishra & Fiddick, 2012; Mishra, Gregson, & Lalumière, 2012; Kacelnik & Bateson, 1996, 1997; Stephens & Krebs, 1986).

In social competition, relative performance matters more than absolute performance. Each individual needs to not just do well, but to beat its competitors for mates, territories, status, and other evolutionarily relevant resources (e.g., Daly & Wilson, 2001; Frank, 2000; Luttmer, 2005). To do so, it could compete by using safe low-variance strategies or risky high-variance strategies. If an organism finds itself in a situation where it is unlikely to succeed at competition through safe, low-risk means, then it would pay to take risks in order to have some chance at winning the competition. This is well known in sports: teams who are losing a game are well known for being more likely to attempt risky plays such as "pulling the goalie" in hockey or throwing "Hail Mary" passes in American football. In other forms of social competition, people are more likely to engage in risky aggressive and criminal conduct if they are unsuccessful at economic competition (i.e., if they are unemployed, or victims of inequality; Raphael & Winter-Ebmer, 2001; Wilson & Daly, 1997) or at mating competition (i.e. if they are single, or less attractive; Campbell, 1995; Daly & Wilson, 1990; Harris, Rice, & Lalumière, 2001; Mishra & Lalumière, 2008, Moffitt, 1993; Wilson & Daly, 1985).

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Risk-sensitivity theory thus predicts that those who are competitively disadvantaged should be more likely to take risks because they are less likely to succeed through safer, low-risk means. For example, people who possess lower embodied capital (e.g. health, intelligence, attractiveness) or are lower in social status—both necessary for successful social and reproductive competition—should be more willing to take risks than people with high embodied capital. Someone who is competitively disadvantaged may be unable to meet their interpersonal, social, romantic, or economic needs using low-risk options, and may thus have much to gain and little to lose from engaging in risky conduct. These risky strategies may often fail, but this failure is no worse than what would have likely happened to disadvantaged individuals who take no risks. A loss is a loss, dead is dead, and it does not matter to natural selection whether it occurs in adolescence or in a celibate centenarian.

1.2. Previous research on competitive dis(advantage) and risk

Although correlational evidence links competitive disadvantage with increased risk taking (almost exclusively in the domain of delinquent and criminal conduct; e.g., Campbell, 1995; Daly & Wilson, 1990; Harris et al., 2001; Wilson & Daly, 1985), relatively little experimental research has examined whether cues of competitive advantage or disadvantage are associated with more general behavioral risk taking in both men and women. Two experimental studies, however, are suggestive. Hill and Buss (2010) showed that people engage in greater economic risk taking when it offers a chance at rendering themselves in a better financial position compared to others. However, this study confounded risk acceptance with a high valuation of relative outcomes: risky personal options were associated with worse outcomes for others, so it is unclear whether participants preferred risky options or tolerated risk in order to be better off than others.

Ermer, Cosmides, and Tooby (2008) showed that men who thought they were being observed by someone of equal status (but not someone of lower or higher status) preferred high-risk means of recouping economic losses. This study did not directly investigate the effects of competitive disadvantage on risk taking *per se*, but rather social effects of observation. The authors found no effects of observer status when resources could be gained instead of lost, nor did they find any consistent effects in women; the latter possibly because they used manipulations involving a domain that should be more important to men than to women (i.e., social status). Finally, neither the study by Hill and Buss (2010) or the study by Ermer et al. (2008) involved paying participants based on their actual decisions (or paying participants at all), which may have influenced the salience of the decisions made (e.g., Ferrey & Mishra, 2013).

1.3. Overview

In the present study, we sought to experimentally examine whether exposing participants to cues of relative competitive disadvantage would result in them taking more risks. Our hypothesis does not suggest that people explicitly calculate the costs and benefits of risk taking. Instead, we argue that human psychology has evolved to use social cues of competitive (dis)advantage as an input to up-regulate or down-regulate one's risk preferences. As such, we are investigating how features of the environment affect behavior in adaptive ways, rather than which specific psychological processes are involved (for the distinction between proximate and ultimate causation, see Tinbergen, 1963; Scott-Phillips, Dickins, & West, 2011).

We tested the effects of competitive disadvantage on risk taking by either inducing (Experiment 1) or inducing and then ameliorating (Experiment 2) cues of competitive disadvantage in intelligence, followed by a measure of economic risk taking (The Choice Task; Mishra & Lalumière, 2010; adapted from Fessler, Pillsworth, & Flamson, 2004). Intelligence is important for social competition: all else being equal, both men and women are more likely to hire, befriend, and mate with intelligent people (e.g., Li, Bailey, Kenrick, & Linsenmeier, 2002; Prokosch, Coss, Scheib, & Blozis, 2009), and intelligence is associated with greater academic performance, career potential, creativity, and job performance (for a meta-analysis, see Kuncel, Hezlett, & Ones, 2004). Intelligence is even associated with better health and longevity (Gottfredson & Deary, 2004).

Because of its importance, we predict that people exposed to cues indicating that they are competitively disadvantaged relative to others with regard to intelligence will take more risks. Furthermore, we predict that ameliorating these cues of competitive disadvantage will return risk taking to normal levels, given that unnecessary risk taking is costly. Notably, we do not predict sex differences in risk taking in response to cues of competitive disadvantage. Risk-sensitivity theory applies equally to both sexes (Mishra & Lalumière, 2010), although the domains that matter for each sex may differ on average (e.g. relative concerns over status versus attractiveness; Buss, 1989; Ermer et al., 2008; Hill & Buss, 2010; but see Campbell, 1995). Because intelligence is a key component of embodied capital and overall quality for both men and women, competitive disadvantage in this trait should affect both men's and women's risk taking.

This study extends previous research in several ways. First, we examine risk taking in response to cues of competitive advantage and disadvantage in a domain that should be important to both men and women (i.e., intelligence). Second, we use a measure of risk taking—the Choice Task (Mishra & Lalumière, 2010)—that measures preference for high variance over low-variance economic outcomes (i.e., canonical economic risk taking). Third, we paid participants based on their actual choices, making their decisions more salient than if we had just offered course credit. Finally, we demonstrate that the effect of competitive disadvantage on risk taking is plastic by showing that people are sensitive to changes in cues indicating their relative competitive (dis)advantage compared to others.

2. Experiment 1

2.1. Method

Sixty-eight participants (34 women, 34 men; $M_{age} = 20.6$) were run individually at computers. The experiment was advertised as a personality study offering bonus marks. Participants were randomly assigned to a control ($n = 22$), competitive advantage ($n = 23$), or competitive disadvantage condition ($n = 23$).

All participants completed a purported intelligence test. This task comprised a blank screen with a black square that would appear in a random location. Participants were told that their goal was to click on the square as quickly as possible, which resulted in the start of another trial and the square moving to another randomly determined location on the screen. Participants completed 30 trials of this task. The task description provided information indicating that speed of response is highly correlated with intelligence[1].

Participants received feedback after completing the purported intelligence test both in the form of a written description of the results and a diagram consisting of a bar summarizing the full range of purported scores from 0 to 100. On this bar, the participant's score was shown, as was the purported average of 46/100. In the competitive advantage condition, participants were told they obtained an above-average score of 71/100. In the competitive disadvantage condition, participants were told they obtained a below-average score of 21/100. In the control condition, participants

[1] We had intended this to be a false-feedback manipulation, but empirical evidence actually reliably links reaction time to intelligence (e.g., Jensen & Munro, 1979; reviewed in Nissan, Liewald, & Deary, 2013).

did not receive any feedback on their performance. In all conditions, it was made explicit that participant's purported scores were being compared to a peer average, thus reflecting relative competitive (dis) advantage in the intelligence domain.

After the competitive (dis)advantage manipulation, participants completed the dependent measure of risk taking, the Choice Task (CT). In the CT, participants made six risk-sensitive decisions, each between two monetary options (Mishra & Lalumière, 2010). For all six decisions, both options had equal mean expected values ($3), but differed in payoff outcome variance (e.g., "Would you rather choose [A] $3 guaranteed, or [B] a 10% chance of earning $30?"). The six decisions were presented in random order for each participant. At the end of the task, one of the participant's six responses was randomly chosen for payout. The choice made was then simulated and the participant received the value of the choice they made in cash. During the introduction, participants were asked to make their choices as honestly as possible because one of their choices would be actually be simulated and paid out. Payments ranged from $0 to $30. A total score of number of risky choices was computed. The CT has been associated with various forms of real-world risk taking, including general gambling involvement, problem gambling, and antisocial conduct (Mishra, Lalumière, Williams, & Daly, 2012). The CT has also been shown to be sensitive to experimental manipulations (Fessler et al., 2004).

2.2. Results and discussion

A sex (male, female) × disadvantage condition (control, competitive advantage, competitive disadvantage) between-subjects ANOVA was conducted on a number of risky choices made in the CT. A main effect of disadvantage condition on risky choices made in the CT was observed, $F(2, 62) = 6.10$, $p = .004$. Follow-up simple contrasts indicated that participants in the competitive disadvantage condition engaged in significantly higher risk taking than participants in the competitive advantage and control conditions (both $ps < .03$; $M_{disadvantage} = 3.13$, $M_{advantage} = 1.56$, $M_{control} = 2.09$). No significant difference in risk taking was observed between the competitive advantage condition and the control condition ($p = .46$). No main effect of sex was observed, $F(1, 62) = 0.37$, $p = .55$ ($M_{men} = 2.38$, $M_{women} = 2.15$). The sex by disadvantage condition interaction was also not significant, $F(2, 62) = 0.18$, $p = .84$. These results are summarized in Fig. 1.

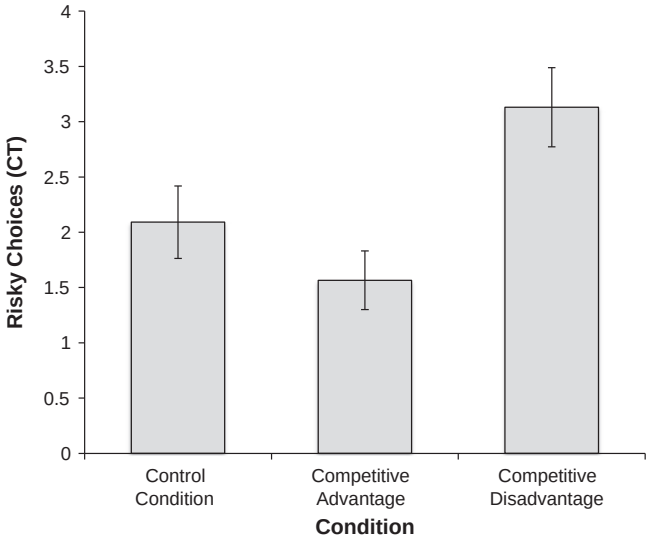

Fig. 1. Number of risky choices on the Choice Task (CT) ($M \pm SE$) as a function of competitive (dis)advantage in Experiment 1.

In other studies that have used the Choice Task among similar participants who did not experience any experimental manipulation, the mean number of risky choices was approximately two (e.g., Mishra et al., 2010). These findings suggest that in the present study, risk taking was elevated in the competitive disadvantage condition, and somewhat suppressed or unaffected in the competitive advantage condition. Together, the results of Experiment 1 suggest that cues of competitive disadvantage lead to elevated risk taking.

3. Experiment 2

The results of Experiment 1 showed that cues of relative competitive disadvantage in an important domain (intelligence) leads to increased risk taking. Experiment 2 sought to replicate and extend these findings by examining whether patterns of risk taking were affected by (1) amelioration of the perception of competitive disadvantage, (2) repeated feedback indicating competitive disadvantage, or (3) inconsistent feedback regarding competitive advantage or disadvantage. Risk taking carries high potential costs and decision makers should avoid such costs when possible. As consequence, we predicted that participants would increase risk taking when under the perception that they are at competitive disadvantage relative to others, but would engage in decreased risk taking if this perception was ameliorated.

3.1. Methods

One-hundred ten participants (54 women, 56 men, $M_{age} = 20.9$) were run at individual computer stations. The experiment was advertised as a two-part personality study offering bonus marks. Each experimental condition had the following structure. First, participants were exposed to cues indicating that they were either competitively disadvantaged or competitive advantaged relative to peers using a purported intelligence test (as in Experiment 1). Following this manipulation of disadvantage, participants completed the Choice Task (CT).

Participants then completed a second administration of the purported intelligence test. Participants were told before completing the second purported intelligence test that the test was prone to error, and only through repeated administration of the test could an accurate measure of intelligence be acquired. They were also told that the second test provided more accurate results because of this effect. Participants were then given feedback indicating that they were either competitively disadvantaged or competitive advantaged relative to others (except in the disadvantage–control condition; see below). Participants then completed the CT for a second time using new choices.

Participants were randomly assigned to one of four conditions: disadvantage–control ($n = 27$), disadvantage–advantage ($n = 28$), disadvantage–disadvantage ($n = 27$), or advantage–disadvantage ($n = 28$). In the disadvantage–control condition, participants were initially exposed to cues indicating themselves to be competitively disadvantaged. A second manipulation was not used. Rather, participants in this condition completed the same task purported to measure intelligence, but were not given any feedback. The disadvantage–control condition allowed for the examination of whether the effects of cues of competitive disadvantage faded with time.

In the disadvantage–advantage condition, participants were first exposed to cues of competitive disadvantage indicating poor relative performance, then exposed to cues of competitive advantage indicating strong relative performance (i.e., participants were provided reason to discount initial cues of relative competitive disadvantage). In the disadvantage–disadvantage condition, participants were exposed to cues of relative competitive disadvantage twice (i.e., indicating strong relative performance twice). In the advantage–

disadvantage condition, participants were first exposed to cues of competitive advantage (high relative performance), then to cues of competitive disadvantage (low relative performance).

In all conditions, after completing the purported intelligence test the second time, participants also completed the choice task (CT) a second time. Participants received the amount of their earnings from one of their choices across both the first and second administrations of the CT (randomly determined).

3.2. Results and discussion

We first examined whether we replicated the findings of Experiment 1 by examining decisions in the first administration of the CT. Participants exposed to cues of competitive disadvantage prior to the first administration of the CT engaged in higher risk taking compared to those exposed to cues of competitive advantage, $t(108) = 2.01$, $p = .047$ ($M_{\text{disadvantage}} = 2.73$, $M_{\text{advantage}} = 2.04$). This result replicates the findings of Experiment 1.

We then examined whether changes in cues of competitive advantage or disadvantage affected risk taking. A sex (male, female) × disadvantage condition (disadvantage–control, disadvantage–advantage, disadvantage–disadvantage, advantage–disadvantage) × CT administration (first risky choice, second risky choice) mixed ANOVA was conducted on risky choices made in the CT. No significant main effects of sex, CT administration, or condition were observed (all $Fs < 1.25$, $ps > .29$). As predicted, a significant interaction between CT administration and disadvantage condition was observed, $F(3, 102) = 4.15$, $p = .008$. No other significant two-way or three-way interactions were observed (all $Fs < 0.92$, $ps > .43$).

Participants in the disadvantage–control condition did not exhibit a significant difference in risk taking among the two administrations of the CT, paired $t(26) = 0.86$, $p = .40$ ($M_{\text{choice1}} = 2.70$, $M_{\text{choice2}} = 2.48$). These results suggest that the effects of competitive disadvantage on risk taking did not fade with the passage of time in the experimental session.

Participants in the disadvantage–advantage condition exhibited significantly less risk taking following presentation of feedback indicating that they were competitively advantaged, $t(27) = 2.73$, $p = .011$ ($M_{\text{choice1}} = 2.96$, $M_{\text{choice2}} = 2.25$). This result suggests that ameliorating cues of competitive disadvantage may eliminate effects of competitive disadvantage on risk taking.

Participants in the disadvantage–disadvantage condition exhibited marginally higher risk taking after receiving feedback confirming that they were competitively disadvantaged, $t(26) = 1.89$, $p = .071$ ($M_{\text{choice1}} = 2.52$, $M_{\text{choice2}} = 3.15$). This result suggests that confirmation of competitive disadvantage may lead to further increases in risk taking, although this result must be interpreted with caution because it was not statistically significant.

Participants in the advantage–disadvantage condition did not exhibit a significant difference in risk taking across the two administrations of the CT, $t(27) = 0.72$, $p = .48$ ($M_{\text{choice1}} = 2.04$, $M_{\text{choice2}} = 2.21$). This result suggests that participants may have discounted later feedback of competitive disadvantage after already having received feedback indicating that they were competitively advantaged. The results of Experiment 2 are summarized in Fig. 2.

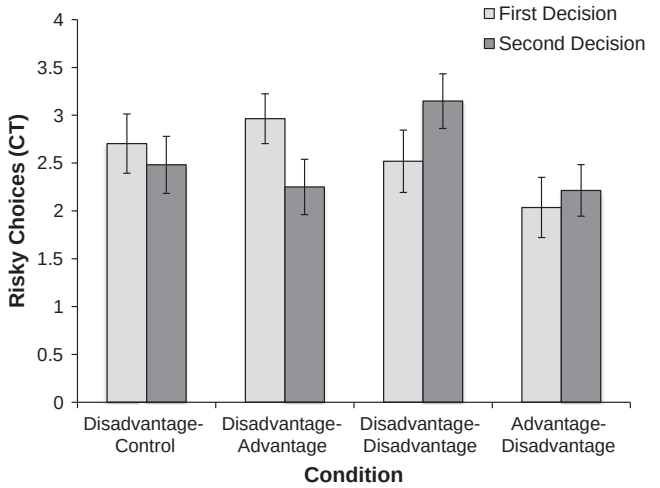

Fig. 2. Number of risky choices on the Choice Task (CT) ($M \pm SE$) among individuals in the four conditions in Experiment 2.

4. General discussion

Risk taking is adaptive when one is unlikely to succeed in social competition through safe means: Taking risks may represent one's only hope of achieving some success. Organisms should therefore take more risks when at a competitive disadvantage. This study demonstrated that people respond to cues of competitive disadvantage by taking more risks. These results support previous correlational work showing that people who are competitively disadvantaged in economic competition (Wilson & Daly, 1997; Raphael & Winter-Ebmer, 2001) or in reproductive competition (Wilson & Daly, 1985; Daly & Wilson, 1990; Moffitt, 1993; Campbell, 1995; Harris et al., 2001, Mishra & Lalumière, 2008) are more likely to engage in risk-taking behavior. The results also support previous experimental research linking social status and risk taking (Ermer et al., 2008; Hill & Buss, 2010).

Importantly, the current experiments allow us to make causal conclusions. People who were randomly exposed to cues of competitive disadvantage took more risks than those assigned to experience no cues of disadvantage, and removing these cues of disadvantage caused risk taking to decrease. Together, our results support risk-sensitivity theory (Stephens, 1981; Stephens & Krebs, 1986; Mishra & Lalumière, 2010), which suggests that organisms in situations of high need should engage in higher risk taking when safe options are less likely to fulfill their needs.

4.1. Power and risk taking

At first glance, our findings appear to be at odds with a literature linking higher power with greater risk taking (e.g., Anderson & Galinsky, 2006; Maner, Gailliot, Butz, & Peruche, 2007; Jordan, Sivanathan, & Galinsky, 2012). Those who find themselves in positions of power likely perceive themselves to be competitively advantaged relative to others (all else being equal) so risk taking by the powerful seems to contrast with our findings. However, a closer inspection of previous findings suggests that this is not necessarily the case.

Jordan et al. (2012) and Maner et al. (2007) showed that the link between power and risk taking is contingent on the nature of power held by someone. They found that the unstable powerful (Jordan et al., 2012; Maner et al., 2007) and the stable powerless (Jordan et al., 2012) engaged in greater risk taking compared to the stable powerful and the unstable powerless. In all of these studies, those who engaged in higher risk taking were in some condition of need, which should motivate risk taking according to risk-sensitivity theory. The unstable powerful likely perceive a need to maintain their position in the face of potential loss. The stable powerless likely perceive a need to escape their disadvantaged position. That the unstable powerless did not engage in risk taking is somewhat puzzling, however, especially if such individuals had the means to engage in risk taking to escape their present positions. It is important that future research into risk-sensitive decision making carefully examines what conditions of need are motivating of risky behavior (see Mishra, 2013, for a review of when need should motivate risk taking).

More generally, being competitively disadvantaged is not the only cause of risk taking. Power and competitive disadvantage may represent two different pathways leading to elevated risk taking. Another potential pathway to elevated risk taking is honest signaling: Those who have certain positive qualities may engage in greater risk taking because they personally experience lower downside costs with larger upside opportunities (e.g., Bliege Bird, Smith, & Bird, 2001). Future work should disentangle the different causal pathways that lead to individual differences in risk taking (e.g., Mishra & Barclay, 2013).

4.2. Sex differences

In the present study, females made as many risky choices as males. On the surface, this seems to contradict past studies in which men are consistently riskier than women (for a meta-analysis, see Byrnes, Miller, & Schafer, 1999). However, research has shown that when men and women are in a similar situation of need, women engage in as much risk taking as men (e.g., Campbell, 1995; Mishra & Lalumière, 2010). The likely reason for commonly found sex differences in baseline risk taking is that men are more often in a position of need because of mating competition (Wilson & Daly, 1985; Daly & Wilson, 1990). The present study deliberately used feedback about intelligence because it is a key component of embodied capital for both males and females and thus important to both sexes. In domains that affect social competition and status attainment in one sex but not the other, being at a competitive disadvantage should more significantly affect the sex for whom that domain is more important. For example, since wealth matters more for male reproductive success (Nettle & Pollet, 2008), having low social status should affect men more than women (e.g., Ermer et al., 2008). Future research should examine whether risk taking is most affected by competitive disadvantage in the domains that matter most for social and reproductive success.

4.3. Ultimate and proximate explanations

The current study investigated an aspect of the ultimate *function* of risk preferences. That is, why risk taking arises, when it is adaptive, and under what circumstances. As such, we are agnostic about the specific proximate psychological mechanisms underlying these effects (e.g. negative emotions, lowered self-esteem, threatened self-identity) and their corresponding neural pathways. Identifying the specific proximate mechanisms mediating the relationship between competitive disadvantage and risk taking is an interesting question, but is beyond the scope of this study. Psychological states are proximate mechanisms that cause people to respond adaptively to various circumstances (Scott-Phillips et al., 2011). If a behavior is adaptive in a situation, then *some* proximate psychological mechanism will necessarily arise to trigger that behavior. By understanding the adaptive function of risk taking, we can understand what circumstances will trigger those psychological mechanisms (and thus cause risk taking), which allows us to better ameliorate those situations.

4.4. Domain specificity of risk taking

Substantial evidence suggests that various forms of risky behavior, including crime, gambling, substance use, dangerous driving, sexual risk taking, and antisocial behavior co-occur within individuals, suggesting that risk taking is domain general (reviewed in Mishra, 2013). Our results appear to support this interpretation, in that a manipulation of competitive disadvantage in the intelligence domain led to risk taking in the economic domain. However, another body of evidence suggests that risk taking is domain specific, in that individuals report engaging in greater risk taking in some domains than others (e.g., Weber, Blais, & Betz, 2002; Hanoch, Johnson, & Wilke, 2006; Kruger, Wang, & Wilke, 2007; Wang, Kruger, & Wilke, 2009; Weller & Tikir, 2011). How can the domain-general and domain-specific viewpoints be reconciled?

Domain specificity of risk taking is typically understood using the risk-return framework (e.g., Weber & Milliman, 1997). This framework posits that individuals vary in their perceptions of the costs and benefits of risks in different domains (e.g., financial vs. recreational; Weber et al., 2002) and thus exhibit domain-specific patterns of risk taking (Hanoch et al., 2006). The risk-return argument for domain-specific risk taking can be reconciled with empirical evidence suggesting risk taking is domain general by considering the role of competitive disadvantage. Low embodied capital may lead to competitive disadvantage (or the perception thereof) in multiple domains, facilitating what appears to be domain-general risk taking (Mishra & Lalumière, 2008; Mishra, 2013). In support of this hypothesis, various domains of embodied capital are both empirically and perceptually associated (e.g., intelligence and attractiveness; Kanazawa, 2011; Langlois et al., 2000).

Domain-general risk taking can also be explained through linked perceptions in different domains without invoking embodied capital as a mediator. For example, intelligence is widely perceived to be associated with economic outcomes (Ceci & Williams, 1997). Perceived competitive disadvantage in intelligence may therefore lead to elevated risk taking in the perceptually linked economic domain. Further research is necessary to better examine the domain-specific or domain-general nature of competitive disadvantage and risk taking.

4.5. Limitations

Despite the results of this study, it is necessary to note some limitations. The samples used in this study comprised undergraduate university students. Competitive disadvantage was manipulated in a domain that is likely particularly important to university students (intelligence), and as such, participants may have been disproportionately sensitive to feedback indicating they scored below average in intelligence. Replication of these findings is necessary among more diverse populations to demonstrate their generality. Other domains of competitive disadvantage may be more salient to other populations. It is likely, however, that regardless of economic or educational background, most people would be sensitive to cues of personal competitive disadvantage due to the broadly relevant effects of social comparison (Frank, 2000; Wilkinson & Pickett, 2009).

We did not include a manipulation check in this study. We argue that being at a competitive disadvantage triggers some proximate mechanisms (e.g. negative emotions, frustration, feelings of relative deprivation, and/or lowered self-esteem) which then up-regulate risk taking (e.g., relative deprivation and negative emotions facilitate risk taking; Callan, Ellard, Shead, & Hodgins, 2008; Leith & Baumeister, 1996). Indeed, self-esteem itself may be best interpreted as a psychological meter of one's relative social standing (Leary, Tambor, Terdal, & Downs, 1995), such that cues of competitive disadvantage may have their effects via self-esteem and negative emotions. However, in the absence of a manipulation check or additional measures, our study cannot specify what specific underlying proximate mechanisms link competitive disadvantage and risk taking. However, we note that our goal in this study was not to examine proximate mechanisms linking competitive disadvantage and risk taking, but rather demonstrate the functional link between competitive disadvantage and risk taking (see above).

Participants may have discounted or disbelieved manipulations involving competitive (dis)advantage. That these manipulations affected risky behavior in a manner consistent with our predictions (and a large theoretical framework), however, suggests that our manipulations worked as intended. However, the inclusion of a manipulation check and testing for participant disbelief in future research would facilitate greater confidence in the manipulations

used and would also allow for an examination of proximate mechanisms linking competitive disadvantage and risk taking.

This study utilized a single dependent measure of risk taking measured as variance preference (the Choice Task). Risk as variance is the most widely acknowledged definition of risk (reviewed in Mishra, 2013). The Choice Task has been previously associated with general gambling involvement, problem gambling, and antisocial tendencies in a broad community sample, suggesting that the measure has external validity (Mishra, Gregson, et al., 2012; Mishra, Lalumière, et al., 2012). Other studies on decision making have used future discounting—the preference of smaller, immediate rewards over later, larger rewards—to measure what is purported to be risk taking. Some research has linked future discounting to risk taking in risk-persistent populations (e.g., gamblers, drug addicts; reviewed in Reynolds, 2006). However, in student populations, measures of future discounting have been not been consistently associated with other measures of risk taking, and it has been argued that future discounting may represent a phenomenon somewhat separate from risk taking (Mishra & Lalumière, 2011). It would be interesting to examine whether perceptions of competitive disadvantage facilitate increased discounting of the future. Some evidence suggests that competitively disadvantaged populations (e.g., slum-dwelling youth; Ramos, Victor, Seidel-de-Moura, & Daly, 2013) engage in greater future discounting, although this relationship appears to be inconsistent (e.g., Wilson & Daly, 2006).

4.6. Conclusions

The results of this study provide experimental evidence that cues of competitive disadvantage lead to increased risk taking. Furthermore, we show that amelioration of cues of competitive disadvantage leads to concomitant reductions in risk taking. These results have important implications for devising social policy that leads to reductions in rates of such societally harmful behaviors as crime, delinquency, gambling, and other harmful risky conduct. Aiming to address modifiable situations that motivate increased competition (e.g., inequality, scarcity of resources) may lead to accompanying changes in risky behavior.

Supplementary Materials

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.evolhumbehav.2013.11.006.

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