The Evolution of the Napoleon Complex: The Influence of Relative Height Disadvantage and Mating Motivation on Male Risk-Taking Behavior

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Abstract

Based on sexual selection theory, the present research investigated the influence of relative height disadvantage vis-à-vis same-sex competitors and mating motivation on male risk-taking behavior. Four studies consistently demonstrated that height disadvantage relative to same-sex competitors engendered elevated risk-taking propensity in men; furthermore, men with high mating motivation levels displayed this compensatory behavior to a greater extent. These findings indicate that the Napoleon complex possesses an evolutionary foundation, and that men' s employment of risk-taking behavior as compensation when their height is disadvantaged relative to competitors constitutes an adaptation for addressing issues of intrasexual and intersexual competition.

Full Text

Preamble

Evolution of the Napoleon Complex: Relative Height Disadvantage, Mating Motivation, and Risk-Taking Behavior in Men

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Abstract

Grounded in sexual selection theory, this research investigated how relative height disadvantage compared to same-sex competitors and mating motivation influence male risk-taking behavior. Four studies consistently demonstrated that height disadvantage relative to same-sex competitors leads men to increase their risk-taking propensity, with this compensatory behavior being more pronounced among men with higher mating motivation. These findings suggest that the Napoleon complex has an evolutionary basis: when men' s height places them at a disadvantage relative to competitors, employing risk-taking behavior as a compensatory strategy represents an adaptation for solving problems of intrasexual competition and intersexual selection.

Keywords: Napoleon complex; sexual selection theory; risk-taking behavior; height; mating motivation
Classification Code: B849:C91

Introduction

A subordinate once told Napoleon, "Your Majesty, I find it embarrassing that I appear taller than you." Napoleon replied, "I am short but great. If you mock me for this, I will cut off your head to shorten the gap between us." This diminutive French emperor ultimately swept across Europe, becoming a veritable "giant" in history. Adler summarized this phenomenon as the "Napoleon Complex" —shorter men compensating for height deficiencies through certain behaviors (Adler, 1956). Evolutionary psychology provides a scientifically grounded biological framework for examining the validity of the Napoleon Complex.

Sexual selection theory posits that individuals' physical and psychological traits are jointly shaped by intrasexual and intersexual selection processes (Buss, 2015). Intrasexual selection involves competition among same-sex individuals for reproductive opportunities, while intersexual selection primarily involves female choice of males. Height represents a classic "good genes" trait (Lu et al., 2015; McCarrick et al., 2020), signaling genetic quality and important characteristics such as health, strength, and courage. Height holds significant meaning for both intrasexual and intersexual selection in men. In intrasexual competition, larger-bodied men possess physical advantages and are more likely to emerge victorious (Buss, 2015; Fessler et al., 2014; Stulp et al., 2015). In intersexual selection, women prefer taller men (e.g., Qian et al., 2003; Polo et al., 2018; Stulp & Barrett, 2016; Yancey & Emerson, 2016). This preference arises because taller men possess better physical condition and greater strength, enabling them to deter rivals, gain advantages in combat, and provide greater physical protection and material resources for women and their offspring (Judge & Cable, 2004; Zilioli et al., 2015). Additionally, choosing a tall male partner means a woman' s offspring can inherit superior genes for height, health, and strength, as well as access to wealth, power, and status associated with tall men (e.g., Sorokowski et al., 2012; Stulp et al., 2015; Tyrrell et al., 2016), thereby enhancing offspring survival. For women, however, height carries far less significance for survival competition and does not serve as an important signal of good genes or reproductive fitness (Buss, 2015; Yancey & Emerson, 2016).

Are relatively shorter men destined to be at a disadvantage in survival competition? Some researchers propose that men may possess a flexible psychological mechanism that allows them to adjust behavioral characteristics when physically outmatched by competitors (exercise behavioral flexibility; Just & Morris, 2003; Knapen et al., 2018), thereby maximizing competitive success. A small body of research has tested this theory—the evolutionary theory of the Napoleon Complex. Studies have found that men can enhance their fitness by acquiring more resources, increasing indirect aggression, and heightening sensitivity to competitors. For example, Knapen et al. (2018) first examined how relative height influences male intrasexual competitive behavior. Their research showed that shorter men exhibit stronger resource acquisition tendencies and non-physical aggression when facing taller same-sex competitors—potential compensatory strategies for height disadvantage and adaptive tactics in male intrasexual competition. McCarrick et al. (2020) similarly found that shorter male soccer referees issue more yellow and red cards to players, compensating for deficits in dominance. Additionally, research indicates that shorter men in intimate relationships experience greater jealousy, possibly serving as a mate retention strategy to compensate for height disadvantage (Brewer & Riley, 2009). Beyond these mechanisms, can men facing height disadvantage relative to competitors employ other methods to enhance their fitness? This study proposes that men who perceive height disadvantage in competition may also compensate through risk-taking behavior.

Risk-taking behavior involves actions taken despite known costs or failure risks, but such choices may yield more desirable rewards—the high risk, high return principle (Shan et al., 2010; Barclay et al., 2018; Mishra et al., 2017). Risk-taking manifests in everyday life through activities such as bungee jumping, free solo climbing, bullfighting, speeding, unprotected sex, gambling, or refusing to wear masks during respiratory disease pandemics. Extensive research demonstrates clear gender differences in risk-taking, with men exhibiting greater risk-taking than women (e.g., Shan et al., 2010; Apicella et al., 2017; Barclay et al., 2018; Mao et al., 2018; Mishra et al., 2017). For men, risk-taking is more likely to yield inclusive fitness benefits. First, research shows that male risk-taking plays a crucial role in intrasexual competition, serving as a signal to same-sex rivals of important qualities such as bravery, health, strength, reliability, and aggressiveness, thereby deterring competitors and attracting allies (e.g., Shan et al., 2010; Xing et al., 2015; Barclay et al., 2018; Fessler et al., 2014; Mishra et al., 2017; Silva et al., 2016). Second, risk-taking helps men attract women in intersexual selection. Studies indicate that risk-taking functions as a "decorative trait" in male courtship, allowing men to display good genes characteristics such as health, bravery, and strength to potential mates, thereby gaining reproductive opportunities (Shan et al., 2010; Li & Zhang, 2010; Su & Su, 2017; Xing et al., 2015; Baker & Maner, 2009; Barclay et al., 2018; Buss, 2015; Herbert, 2018; Mishra et al., 2017; Shan et al., 2012). However, due to women' s substantial parental investment, excessive risk-taking does not enhance women' s inclusive fitness and may instead place women and their offspring in greater danger. Consequently, women typically exhibit pronounced risk aversion (Li &

Zhang, 2010; Buss, 2015; Barclay et al., 2018; Mishra et al., 2017; Wang et al., 2009).

From the aforementioned research, both height and risk-taking serve as important cues signaling male good genes traits and hold significant importance for male intrasexual competition and mate selection. However, previous studies have not clearly articulated the relationship between height and risk-taking. In contrast, life history theory suggests that both tall and short men should engage in risk-taking behavior. Tall men, possessing better genetic quality, can afford greater risks and thus adopt more risk-taking behaviors. Short men, more likely to employ a "fast" life history strategy, should also attempt to obtain greater benefits through risk-taking (Fessler et al., 2014). Consistent with this theory, some researchers have examined the relationship between absolute height and risk-taking in non-competitive contexts, but most studies have found no significant association between absolute height and risk-taking (e.g., Ball et al., 2010; Fessler et al., 2014; Ruedl et al., 2010).

Research related to life history theory focuses on relationships between life history variables reflecting individual developmental trajectories (e.g., absolute height) and risk-taking behavior. However, past research on risk-taking shows that risk-taking behavior is not only related to life history strategies but is also context-sensitive—individuals can flexibly adjust their risk-taking levels based on current situational costs and benefits to maximize inclusive fitness (e.g., Shan et al., 2010; Li & Zhang, 2010; Xing et al., 2015; Baker & Maner, 2009; Barclay et al., 2018; Buss, 2015; Herbert, 2018; Mishra et al., 2017; Prokosch et al., 2019; Shan et al., 2012). The evolutionary theory of the Napoleon Complex also posits that men' s compensatory responses to competitive disadvantage should be regulated based on relative differences between men and their competitors (Just & Morris, 2003; Knapen et al., 2018), rather than solely influenced by life history variables. This suggests that although men' s absolute height may not affect risk-taking in non-competitive contexts, when men face height-advantaged same-sex competitors, they should display risk-taking to signal "I still possess good genes," thereby compensating for relative height disadvantage and enhancing fitness in both intrasexual and intersexual selection processes. However, no research has yet examined this possibility. In fact, previous studies hint that such compensatory strategies are plausible. For example, research shows that both men and women perceive higher risk-taking men as taller and more physically formidable (Fessler et al., 2014), and individuals exhibit more risk-taking when their intelligence is disadvantaged (Mishra et al., 2014). Men can offset facial attractiveness deficits by displaying creativity (Watkins, 2017). Investigating this question will deepen researchers' understanding of the adaptive functions of male height and risk-taking, provide new theoretical perspectives on the relationship between male height and risk-taking, and help systematically test the evolutionary theory of the Napoleon Complex, holding significant theoretical and practical value.

Therefore, based on sexual selection theory and the evolutionary theory of the

Napoleon Complex, this study proposes the following hypotheses: Because both height and risk-taking serve as important signals conveying good genes in male intrasexual competition, when facing taller same-sex competitors, men will attempt to compensate for height disadvantage by increasing their risk-taking propensity. Since height and risk-taking are not primary targets of natural selection for women, height differences should not affect women' s risk-taking behavior. Additionally, because male height and risk-taking are shaped by both intrasexual and intersexual selection processes, the effect of height disadvantage on male risk-taking should also serve mate acquisition functions. Specifically, for men with higher mating motivation, the effect of height disadvantage on risk-taking should be further enhanced.

In this study, we employed methods consistent with previous research (Knapen et al., 2018), examining how relative height disadvantage and mating motivation influence male risk-taking by having participants perceive height differences from competitors in same-sex competitive contexts. Specifically, we conducted four distinct studies to systematically test our hypotheses. Studies 1 and 2 examined the effect of relative height differences on male risk-taking in same-sex competitive contexts. Studies 3 and 4 further investigated the moderating role of male mating motivation. Across all four studies, we used the Balloon Analogue Risk Task (BART) to measure risk-taking behavior. This experimental paradigm is widely used in risk-taking research and is considered to reflect general risk-taking tendencies. Previous research has also shown that the BART can detect changes in risk-taking resulting from activation of evolutionarily fundamental social motives (e.g., mating, disease avoidance, self-protection; Neel et al., 2016) such as mate seeking (Baker & Maner, 2009; Barclay et al., 2018; Fukunaga et al., 2012; Gamble & Walker, 2016; Lejuez et al., 2002; Mao et al., 2018; Mishra et al., 2017; Prokosch et al., 2019; Rao et al., 2014; Shan et al., 2012).

Knapen et al. (2018) first examined the effect of relative height differences on male intrasexual competitive behavior by having participants paired for competitive games. In Study 1, we tested our hypotheses using the same method as Knapen et al. (2018). We predicted that because both height and risk-taking serve as important signals conveying good genes in male intrasexual competition, men would exhibit greater risk-taking when facing taller same-sex competitors. Due to gender differences in risk-taking and women's role in parental investment, this phenomenon would not be observed in women.

Study 1

2.1.1 Participants

We used G*Power 3.1.9.2 software to conduct a priori power analysis. Using the average effect size in social psychology, f = 0.21481 (Richard et al., 2003), we determined that 176 participants were needed to achieve 80% statistical power ($\alpha = 0.05$). We ultimately recruited 176 Chinese university undergraduates and graduate students (88 men, 88 women) aged 18-25. All participants completed the Kinsey scale (Kinsey et al., 1949) before the study, and all scored $ $2, self-reporting as heterosexual.

2.1.2 Design

Study 1 employed a 2 (gender: male, female) × 2 (relative height difference: shorter than opponent, taller than opponent) between-subjects design. Gender and relative height difference were between-subjects variables. The dependent variable was participants' BART score—the average number of pumps per unexploded balloon, with higher BART scores indicating greater risk-taking (Baker & Maner, 2009; Cazzell et al., 2012; Fukunaga et al., 2012; Gamble & Walker, 2016; Mao et al., 2018; Prokosch et al., 2019; Rao et al., 2014; Shan et al., 2012).

2.1.3 Balloon Analogue Risk Task

The Balloon Analogue Risk Task is a computer-based balloon inflation game. Participants inflate simulated balloons using a keyboard or mouse (Baker & Maner, 2009; Fukunaga et al., 2012; Lejuez et al., 2002; Mao et al., 2018; Prokosch et al., 2019; Rao et al., 2014; Shan et al., 2012). Each inflation earns points (1 point per inflation in this study); larger balloons yield higher scores, but explosion probability increases with each inflation. Once a balloon explodes, all points for that balloon are lost. Participants can choose to stop inflating at any time and bank accumulated points.

In most BART studies, each balloon' s explosion threshold is randomly determined, ranging from the first inflation to full inflation—meaning explosion can occur on any inflation. To encourage active inflation and prevent early explosions from discouraging participants, we modified the BART such that each balloon could be inflated a maximum of 32 times. The first two inflations were completely safe (0% explosion probability); from the third inflation onward, explosion probability increased cumulatively, reaching 100% on the 32nd inflation. Previous research has used similar settings (e.g., Cazzell et al., 2012; Fukunaga et al., 2012; Rao et al., 2014). The BART in this study included 3 practice balloons and 30 experimental balloons. Given our research purposes, competitive context, inflation parameters, and explosion probability settings, the average number of pumps per unexploded balloon most validly represents real-world risk-taking (Lejuez et al., 2002; Gamble & Walker, 2016; Prokosch et al., 2019). Therefore, we recorded only the average number of pumps per unexploded balloon (the BART score) as our dependent variable reflecting risk-taking level.

2.1.4 Procedure

Upon arrival, participants were told they would complete two unrelated tasks and would interact with a same-sex stranger during the experiment. Two unacquainted same-sex participants were led into the laboratory. The experimenter first measured each participant' s actual height (absolute height) using a stadiometer and announced the measurements in front of both participants. The two participants then stood face-to-face, looking at each other, during which they stated their heights and identified who was taller and shorter, ensuring they knew whether they were in the taller or shorter group. Participants who identified as shorter were assigned to the "shorter than opponent" group, while those who identified as taller were assigned to the "taller than opponent" group. The experimenter then introduced: "Next, you will play a computer game. The person standing opposite you is your game opponent. We will compare your scores, and the better performer will be recorded as the winner" (Knapen et al., 2018). Participants then completed the BART on separate computers.

2.2 Results and Discussion

A 2 × 2 ANOVA on BART scores revealed no significant main effect of gender, $F(1, 172) = 0.05$, $p = 0.82$. The main effect of relative height difference was significant, $F(1, 172) = 12.72$, $p < 0.001$, $p^2 = 0.07$, with participants shorter than their opponents showing greater risk-taking than those taller than their opponents. The gender × relative height difference interaction was significant, $F(1, 172) = 5.21$, $p = 0.02$, $p^2 = 0.03$. Simple effects analysis showed that men shorter than same-sex competitors exhibited greater risk-taking than men taller than competitors, $F(1, 172) = 17.11$, $p < 0.001$, $p^2 = 0.09$, 95% CI = [1.36, 3.83] (see Figure 1 [Figure 1: see original paper]). This effect was not observed in women, $F(1, 172) = 0.82$, $p = 0.37$, 95% CI = [−1.81, 0.67]. Additionally, men and women showed equivalent risk-taking in both taller-than-opponent ($F(1, 172) = 3.14$, $p = 0.08$, 95% CI = [−2.35, 0.13]) and shorter-than-opponent conditions ($F(1, 172) = 2.12$, $p = 0.15$, 95% CI = [−0.33, 2.15]).

However, analysis of between-group differences in absolute height revealed a significant main effect of relative height difference, $F(1, 172) = 83.32$, $p < 0.001$, $p^2 = 0.33$, 95% CI = [3.57, 8.43], with participants in the taller-than-opponent group (M = 170.1 cm, SD = 7.92 cm) being significantly taller than those in the shorter-than-opponent group (M = 164.1 cm, SD = 8.39 cm). The main effect of gender was significant, $F(1, 172) = 436.14$, $p < 0.001$, $p^2 = 0.72$, 95% CI = [12.15, 15.3], with male participants (M = 174 cm, SD = 5.26 cm) significantly taller than female participants (M = 160.2 cm, SD = 5.33 cm). The gender × relative height difference interaction was not significant, $F(1, 172) = 1.55$, $p = 0.22$. These results suggest that the effect of relative height difference on male risk-taking might be attributable to absolute height differences between groups.

To rule out the influence of absolute height, we conducted an ANCOVA controlling for participants' absolute height. Results showed that after controlling for absolute height (which showed no significant main effect, $F(1, 171) = 0.43$, $p = 0.51$), the main effect of gender remained non-significant ($F(1, 171) = 0.191$, $p = 0.66$), while the main effect of relative height difference ($F(1, 171) = 6.49$, $p = 0.01$, $p^2 = 0.04$) and the gender × relative height difference interaction ($F(1, 171) = 5.44$, $p = 0.02$, $p^2 = 0.03$) remained significant. Further analysis revealed that after controlling for absolute height, men in the shorter-than-opponent group still showed significantly greater risk-taking than men in the taller-than-opponent group, $F(1, 171) = 12.56$, $p < 0.001$, $p^2 = 0.07$, 95% CI = [1.07, 3.767]. For women, the effect of relative height difference remained non-significant, $F(1, 171) = 0.221$, $p = 0.64$, 95% CI = [−1.08, 1.76]. Additionally, gender effects remained non-significant in both taller-than-opponent and shorter-than-opponent conditions, $Fs < 0.56$, $ps > 0.14$.

In Study 1, using the same-sex paired competition method employed in previous research (Knapen et al., 2018), we examined the effect of relative height differences on risk-taking. Results showed that when men faced taller same-sex competitors, they exhibited greater risk-taking, while this phenomenon did not occur in women, supporting our hypotheses. However, Study 1 also revealed that the paired competition manipulation created absolute height differences between groups. Although ANCOVA suggested this confound did not substantially affect results, statistical control cannot completely eliminate the influence of between-group height differences. Furthermore, while Study 1 demonstrated that relatively shorter men showed higher risk-taking than relatively taller men in same-sex competition, this does not necessarily indicate that the difference was caused by shorter men increasing their risk-taking propensity. The results could also be explained by taller men decreasing their risk-taking. Therefore, Study 2 employed stricter controls to further examine the effect of relative height differences on male risk-taking and to determine whether the observed differences in Study 1 were indeed caused by shorter men increasing their risk-taking propensity.

Study 2

Study 2 further examined the effect of relative height differences on male risk-taking using more rigorous controls. Unlike Study 1, Study 2 had participants complete the experiment individually, paired with artificially created virtual opponents, thereby eliminating between-group height differences and further investigating whether the effect of relative height disadvantage on male risk-taking was caused by shorter men increasing their risk-taking propensity.

3.1.1 Participants

Using G*Power 3.1.9.2 software, we conducted a priori power analysis. Based on the average effect size in social psychology, $f = 0.2148$ (Richard et al., 2003), we determined that 240 participants were needed to achieve 85% statistical power ($\alpha = 0.05$). We ultimately recruited 246 Chinese university undergraduates and graduate students (123 men, 123 women) aged 18-25. All participants completed the Kinsey scale (Kinsey et al., 1949) before the study, and all scored $ $2, self-reporting as heterosexual.

3.1.2 Design

Study 2 employed a 2 (gender: male, female) × 3 (relative height difference: shorter than opponent, taller than opponent, control) between-subjects design. Gender and relative height difference were between-subjects variables. The dependent variable was participants' BART score.

3.1.3 Manipulation of Relative Height Difference

In Study 2, participants were told they would be randomly matched with a same-sex stranger from a database, and their game scores would be compared with this opponent' s score. A face image would then randomly appear on the computer screen to represent the opponent. However, this opponent would not actually play the game, and no real score comparison would occur—the opponent was virtual.

Study 2 used 16 virtual opponent images: 8 neutral-expression faces of Chinese male university students and 8 neutral-expression faces of Chinese female university students, each presented against a black background. These images had been used in previous research (Wu et al., 2019). The attractiveness of male and female images did not differ significantly, and all images were unfamiliar to Study 2 participants. Twenty individuals who did not participate in the main experiment rated the facial attractiveness of male and female image sets on a 1-10 scale (1 = not at all attractive, 10 = extremely attractive). Paired-samples t-tests revealed no significant difference in attractiveness ratings between male images ($M = 3.81$, $SD = 0.62$) and female images ($M = 3.93$, $SD = 0.82$), $t(19) = -0.73$, $p = 0.47$, 95% CI = [−0.69, 0.45].

In Study 2, participants were randomly assigned to different relative height difference conditions. In the shorter-than-opponent condition, participants were shorter than the virtual opponent. In the taller-than-opponent condition, participants were taller than the virtual opponent. Virtual opponent heights were randomly generated based on height differences from all paired participants in Study 1 ($M = 6.00$ cm, $SE = 0.45$, 95% CI = [5.10, 6.90]). From this data, we generated 12 normally distributed height differences: 5.4, 5.7, 5.7, 5.9, 6.2, 6.3, 6.4, 6.6, 6.6, 6.6, 6.8, and 6.8 cm. In Study 2, participants were asked to enter their height as measured by the stadiometer. This value was randomly combined with one of the 12 height difference values to generate a virtual opponent height. In the shorter-than-opponent condition, virtual opponent height = participant height + random height difference. In the taller-than-opponent condition, virtual opponent height = participant height − random height difference.

In each relative height difference condition, the computer presented a virtual opponent face image at the center of the screen (randomly selected from the 8 same-sex virtual opponent images). The virtual opponent' s height information appeared directly below the face image, the participant' s own height appeared at the bottom left of the screen, and the height difference between participant and opponent appeared at the bottom right. The control group saw only the opponent image without any height information (see Figure 2 [Figure 2: see original paper]).

3.1.4 Procedure

Upon entering the laboratory, participants were told they would play a computer game and their scores would be compared with a stranger from a database, with the better performer recorded as the winner. The experimenter then measured the participant' s height using a stadiometer and informed them of the result. Participants were seated at computers and began the experiment. First, they were asked to enter their measured height. The computer then displayed "Matching in progress, please wait," followed by rapid sequential presentation of 8 same-sex virtual opponent face images in random order. The final image presented was identified as the matched opponent. The computer then displayed detailed information about the matched opponent (see Section 3.1.3) and reminded participants that their performance would be compared with this opponent, with the better performer declared winner. Participants then completed the same BART used in Study 1.

3.2 Results and Discussion

Analysis of between-group differences in absolute height revealed that the improved manipulation of relative height difference in Study 2 achieved its intended goal and no longer created between-group height differences (main effect of relative height difference: $F(2, 240) = 0.54$, $p = 0.58$; gender × relative height difference interaction: $F(2, 240) = 1.02$, $p = 0.36$). Consistent with Study 1, male participants ($M = 175$ cm, $SD = 6.09$ cm) were significantly taller than female participants ($M = 161$ cm, $SD = 5.43$ cm), $F(1, 240) = 349.25$, $p < 0.001$, $p^2 = 0.59$, 95% CI = [12.33, 15.23].

A 2 × 3 ANOVA on BART scores revealed no significant main effect of gender, $F(1, 240) = 0.07$, $p = 0.79$. The main effect of relative height difference was marginally significant, $F(2, 240) = 2.86$, $p = 0.06$. The gender × relative height difference interaction was significant, $F(2, 240) = 4.47$, $p = 0.01$, $p^2 = 0.04$. Simple effects analysis showed that relative height differences significantly affected male risk-taking, $F(2, 240) = 7.17$, $p < 0.001$, $p^2 = 0.06$, but this effect was not observed in women, $F(2, 240) = 0.16$, $p = 0.85$. Further Bonferroni comparisons revealed that men in the shorter-than-opponent condition exhibited greater risk-taking than men in the taller-than-opponent condition ($t(240) = 3.70$, $p < 0.001$, $d = 0.86$, 95% CI = [1.01, 4.8]) and men in the control condition ($t(240) = 2.57$, $p = 0.03$, $d = 0.64$, 95% CI = [0.13, 3.9]) (see Figure 3 [Figure 3: see original paper]). BART scores did not differ significantly between control and taller-than-opponent conditions, $t(240) = 1.12$, $p = 0.79$, 95% CI = [−1.01, 2.78].

Additional analyses revealed that in the shorter-than-opponent condition, men exhibited greater risk-taking than women, F(1, 240) = 4.99, p = 0.03, p^2 = 0.02, 95% CI = [0.21, 3.3]. However, gender effects were not significant in taller-than-opponent or control conditions, Fs < 3.22, ps > 0.07.

Consistent with Study 1, Study 2 results showed that relative height differences significantly affected male risk-taking but not female risk-taking. When facing taller same-sex competitors, men exhibited greater risk-taking. This effect was not due to between-group height differences created by the manipulation but was indeed caused by shorter men increasing their risk-taking propensity. These results support our hypotheses, suggesting that because both height and risk-taking serve as important signals conveying good genes in intrasexual competition, men compensate for height disadvantage by increasing risk-taking. These findings align with previous research (e.g., Brewer & Riley, 2009; Just & Morris, 2003; Knapen et al., 2018; McCarrick et al., 2020), indicating that when men face physical disadvantages, they adjust behavioral strategies to win intrasexual competition, thereby supporting the evolutionary theory of the Napoleon Complex (Just & Morris, 2003; Knapen et al., 2018).

Studies 1 and 2 suggest that men' s strategy of compensating for height disadvantage through increased risk-taking holds important adaptive value for solving problems of same-sex competition. However, according to our hypotheses, this adaptive behavioral strategy is shaped by both intrasexual and intersexual selection processes and should therefore serve mate acquisition functions. Consequently, male risk-taking should be influenced not only by height differences from same-sex competitors but also moderated by mating motivation. Specifically, when men' s mating motivation is situationally activated, the enhancing effect of height disadvantage on male risk-taking should be further amplified. In Study 3, we tested this possibility by situationally activating participants' mating motivation.

Extensive research shows that exposing men to mating-related cues (e.g., images and videos of highly attractive women, imagining or recalling dating scenarios) can situationally activate mating motivation (e.g., Li & Zhang, 2010; Xing et al., 2015; Baker & Maner, 2009; Shan et al., 2012; see review by Su & Su, 2017). Therefore, in Study 3, we activated men' s mating motivation by having them watch videos of highly attractive women. To ensure that any effects were specifically due to mating-related cues, Study 3 also included a control condition in which male participants watched videos depicting high-reward-value items (e.g., large sums of money, luxury cars, mansions; Li & Zhang, 2010). Since Studies 1 and 2 found no significant effects of relative height differences on women' s risk-taking, Study 3 examined only men.

Study 3

4.1.1 Participants

Using G*Power 3.1.9.2 software, we conducted a priori power analysis. Based on the average effect size in social psychology, f = 0.2148 (Richard et al., 2003), we determined that 276 participants were needed to achieve 90% statistical power ($\alpha = 0.05$). Due to limited participant availability at the end of the semester, we ultimately recruited 255 Chinese male university undergraduates and graduate students aged 18-25. All participants completed the Kinsey scale (Kinsey et al., 1949) before the study, and all scored $ $2, self-reporting as heterosexual. Sensitivity analysis indicated that this sample could detect a minimal effect size of f = 0.20 at 80% power.

4.1.2 Design

Study 3 employed a 2 (prime: mating, reward) × 3 (relative height difference: shorter than opponent, taller than opponent, control) between-subjects design. Prime and relative height difference were between-subjects variables. The dependent variable was participants' BART score.

4.1.3 Materials and Procedure

The experimenter measured participants' height using a stadiometer and informed them of the result. Participants were told they would complete two unrelated tasks. First, they completed a video evaluation task, watching a computer-presented video carefully and then rating their emotional responses (7-point scale rating sexual arousal after video viewing; 1 = no sexual arousal, 7 = very strong sexual arousal; Su & Su, 2017; Baker & Maner, 2009). Participants assigned to the mating condition watched a 5-minute video of Asian female models. The video consisted primarily of sexually suggestive, highly attractive clips in which Asian female models displayed important high reproductive value cues through body language, including youth, beauty, tall stature, smooth skin, and lustrous hair. Participants in the reward condition watched a 5-minute video depicting high-value items for men, such as money, luxury cars, mansions, and male luxury goods. Twenty men who did not participate in the main experiment rated the attractiveness of both video contents (7-point scale; 1 = not at all attractive, 7 = extremely attractive). Paired t-tests showed that both mating videos (M = 5.1, SD = 2.26) and reward videos (M = 5.2, SD = 1.7) were highly attractive to men, with no significant difference between them, $t(19) = -0.33$, $p = 0.75$, 95% CI = [−1.12, 0.83].

Afterward, participants were told they would play a computer game and their scores would be compared with a stranger from a database, with the better performer recorded as the winner. Participants then received the same relative height difference manipulation as in Study 2 and completed the same BART used in Study 1.

4.2 Results and Discussion

Manipulation check: A 2 × 3 ANOVA on sexual arousal levels revealed a significant main effect of prime, $F(1, 249) = 149.87$, $p < 0.001$, $p^2 = 0.38$, 95% CI = [1.63, 2.25], with participants experiencing higher sexual arousal after watching mating videos ($M = 3.78$, $SD = 1.43$) than reward videos ($M = 1.84$, $SD = 1.1$). Neither the main effect of relative height difference ($F(2, 249) = 1.86$, $p = 0.16$) nor the prime × relative height difference interaction ($F(2, 249) = 2.31$, $p = 0.1$) was significant. These results confirm that our mating motivation manipulation was effective, successfully activating greater mating motivation. Analysis of between-group absolute height differences showed that, consistent with Study 2, the relative height difference manipulation in Study 3 did not create absolute height differences across groups ($M = 173.3$ cm, $SD = 6.18$ cm); main effects of prime and relative height difference, and their interaction, were all non-significant, $Fs < 1.87$, $ps > 0.16$.

A 2 × 3 ANOVA on BART scores revealed significant main effects of prime, $F(1, 249) = 4.86$, $p = 0.03$, $p^2 = 0.02$, and relative height difference, $F(2, 249) = 25.51$, $p < 0.001$, $p^2 = 0.17$, and a significant prime × relative height difference interaction, $F(2, 249) = 3.54$, $p = 0.03$, $p^2 = 0.03$. Simple effects analysis showed that under mating prime conditions, relative height difference significantly affected risk-taking, $F(2, 249) = 23.26$, $p < 0.001$, $p^2 = 0.16$. Bonferroni comparisons revealed that under mating prime conditions, men in the shorter-than-opponent condition exhibited greater risk-taking than men in the taller-than-opponent condition ($t(249) = 4.05$, $p < 0.001$, $d = 0.75$, 95% CI = [1.35, 5.31]) and control condition ($t(249) = 6.77$, $p < 0.001$, $d = 1.28$, 95% CI = [3.59, 7.55]). Men in the taller-than-opponent condition also showed significantly greater risk-taking than controls, $t(249) = 2.72$, $p = 0.02$, $d = 0.6$, 95% CI = [0.259, 4.22] (see Figure 4 [Figure 4: see original paper]). Under reward prime conditions, relative height differences also significantly affected risk-taking, $F(2, 249) = 5.99$, $p = 0.003$, $p^2 = 0.05$. Men in the shorter-than-opponent condition showed significantly greater risk-taking than men in the taller-than-opponent condition ($t(249) = 2.93$, $p = 0.01$, $d = 0.72$, 95% CI = [0.43, 4.43]) and control condition ($t(249) = 3.06$, $p = 0.01$, $d = 0.75$, 95% CI = [0.54, 4.55]), but taller-than-opponent and control conditions did not differ significantly, $t(249) = 0.13$, $p > 0.99$, 95% CI = [−1.54, 4.55].

Further analyses revealed that, as hypothesized, activating mating motivation significantly enhanced the effect of height disadvantage on male risk-taking (compared to controls). Specifically, the increase in risk-taking from control to shorter-than-opponent conditions was significantly greater under mating prime than reward prime, $F(1, 249) = 6.7$, $p = 0.01$, $Mdiff = 3.02$, $SE = 1.17$, 95% CI = [0.72, 5.32]. Activating mating motivation did not alter the effect of height advantage on risk-taking (compared to controls); the difference between taller-than-opponent and control conditions did not differ significantly between mating and reward primes ($F(1, 249) = 2.13$, $p = 0.07$, $Mdiff = 2.13$, $SE = 1.17$, 95% CI = [−0.17, 4.43]). Additionally, the difference between shorter-than-opponent and taller-than-opponent conditions did not differ between mating and reward primes ($F(1, 249) = 0.59$, $p = 0.45$, $Mdiff = 0.89$, $SE = 1.17$, 95% CI = [−1.4, 3.2]).

Simple effects analysis also showed that for shorter-than-opponent men, the priming effect was significant, $F(1, 249) = 8.14$, $p = 0.01$, $p^2 = 0.03$, 95% CI = [0.73, 3.99], with shorter men under mating prime showing significantly elevated risk-taking. However, for taller-than-opponent men ($F(1, 249) = 3.14$, $p = 0.08$, 95% CI = [−0.16, 3.09]) and control men ($F(1, 249) = 0.65$, $p = 0.42$, 95% CI = [−2.29, 0.96]), priming effects were non-significant.

Consistent with Study 3 hypotheses, results showed that activating mating motivation significantly enhanced the effect of height disadvantage on male risk-taking (compared to controls), but this effect did not appear in men taller than their competitors. These findings support evolutionary theories of male height (e.g., Fessler et al., 2014; Polo et al., 2018; Stulp & Barrett, 2016; Yancey & Emerson, 2016) and risk-taking (e.g., Shan et al., 2010; Li & Zhang, 2010; Su & Su, 2017; Xing et al., 2015; Baker & Maner, 2009; Barclay et al., 2018; Buss, 2015; Fessler et al., 2014; Herbert, 2018; Mishra et al., 2017; Shan et al., 2012; Silva et al., 2016), as well as the evolutionary theory of the Napoleon Complex (Brewer & Riley, 2009; Just & Morris, 2003; Knapen et al., 2018; McCarrick et al., 2020). These results suggest that male height and risk-taking are important adaptations for solving problems of intrasexual competition and intersexual selection, and that men' s compensatory risk-taking when height-disadvantaged serves dual functions in competition and mate acquisition. This further supports our hypothesis that men compensate for disadvantages in both intrasexual and intersexual selection through risk-taking when shorter than same-sex competitors.

Studies 1 and 2 suggest that men' s compensatory risk-taking strategy holds important adaptive value for solving same-sex competition problems. However, according to our hypotheses, this adaptive behavioral strategy is shaped by both intrasexual and intersexual selection processes and should therefore serve mate acquisition functions. Consequently, male risk-taking should be influenced not only by height differences from same-sex competitors but also moderated by mating motivation. Specifically, when men' s mating motivation is situationally activated, the enhancing effect of height disadvantage on male risk-taking should be further amplified. In Study 3, we tested this possibility by situationally activating participants' mating motivation.

Extensive research shows that exposing men to mating-related cues (e.g., images and videos of highly attractive women, imagining or recalling dating scenarios) can situationally activate mating motivation (e.g., Li & Zhang, 2010; Xing et al., 2015; Baker & Maner, 2009; Shan et al., 2012; see review by Su & Su, 2017). Therefore, in Study 3, we activated men' s mating motivation by having them watch videos of highly attractive women. To ensure that any effects were specifically due to mating-related cues, Study 3 also included a control condition in which male participants watched videos depicting high-reward-value items (e.g., large sums of money, luxury cars, mansions; Li & Zhang, 2010). Since Studies 1 and 2 found no significant effects of relative height differences on women' s risk-taking, Study 3 examined only men.

In Study 3, we used situational activation to manipulate mating motivation.

However, mating motivation, as a fundamental social motive evolved in humans (Neel et al., 2016), is not solely controlled by external environmental cues. Due to individual differences in life history strategies, people also exhibit chronic, trait-level differences in mating motivation activation (Neel et al., 2016). This suggests that if men' s compensatory risk-taking in response to height disadvantage is an adaptation shaped by both intrasexual and intersexual selection, it should also be moderated by trait-level mating motivation. Specifically, when men have higher trait mating motivation, the effect of height disadvantage on risk-taking should be enhanced. In Study 4, we examined this possibility to further test our hypotheses. In this study, we measured men' s trait mating motivation using the Mate Seeking subscale of the Fundamental Social Motives Inventory (Neel et al., 2016). Like Study 3, Study 4 examined only men.

Study 4

5.1.1 Participants

Using G*Power 3.1.9.2 software, we conducted a priori power analysis. Using a medium effect size of $f^2 = 0.153$ (medium effect size; Cooper, 1982; Sawilowsky, 2009), we determined that 90 participants were needed to achieve 90% statistical power ($\alpha = 0.05$). We ultimately recruited 90 Chinese male university undergraduates and graduate students aged 18-25. All participants completed the Kinsey scale (Kinsey et al., 1949) before the study, and all scored $ $2, self-reporting as heterosexual.

5.1.2 Materials and Procedure

Participants were told they would complete two unrelated tasks. First, they were told they would complete a social survey, which included the Mate Seeking subscale of the Fundamental Social Motives Inventory. This subscale measures chronic activation of mating motivation on a 7-point scale (Neel et al., 2016) and includes 6 items (Cronbach' s $\alpha = 0.75$ in this study), such as "Starting a romantic or passionate relationship is not a priority for me" (3 items reverse-scored). Higher scores indicate higher chronic activation of mating motivation.

Afterward, participants were told they would play a computer game and their scores would be compared with a stranger from a database, with the better performer recorded as the winner. The experimenter measured participants' height using a stadiometer and informed them of the result. Participants then received the same relative height difference manipulation as in Study 2 and completed the same BART used in Study 1 (recording BART scores).

5.2 Results and Discussion

A one-way ANOVA on between-group height differences showed no significant differences in absolute height across relative height difference conditions, $F(2, 87) = 0.28$, $p = 0.77$.

We used PROCESS Model 1 (Hayes, 2017) to examine relationships among trait mating motivation, relative height difference, and their interaction with BART scores. We dummy-coded relative height difference with the control group as reference, creating two variables: shorter vs. control and taller vs. control. Shorter-than-opponent was coded as (0, 1) and taller-than-opponent as (1, 0). Interaction terms were mean-centered. Results showed that trait mating motivation, taller vs. control, and their interaction did not significantly predict male risk-taking, but shorter vs. control and its interaction with trait mating motivation significantly predicted risk-taking. Specifically, men in the shorter-than-opponent condition exhibited greater risk-taking than control men (see Table 1).

Table 1 Prediction of male risk-taking by trait mating motivation, relative height difference, and their interaction

Variable	b	SE	95% CI
Trait Mating Motivation (V1)	−0.03	0.11	[−0.24, 0.17]
Shorter vs. Control (V2)	2.04	0.96	[0.14, 3.94]
Taller vs. Control (V3)	−0.35	0.96	[−2.25, 1.55]
V1 × V2	0.45	0.15	[0.15, 0.75]
V1 × V3	−0.31	0.23	[−0.24, 0.34]

To clarify the interaction between shorter vs. control and trait mating motivation, we conducted simple slopes analysis (Hayes, 2017). Results showed that when men had low trait mating motivation (−1 SD), shorter-than-opponent and control men did not differ significantly in risk-taking, b = −0.92, SE = 1.32, t(84) = −0.69, p = 0.49, 95% CI = [−3.56, 1.72]. However, when men had high trait mating motivation (+1 SD), shorter-than-opponent men exhibited significantly greater risk-taking than control men, b = 5.01, SE = 1.4, t(84) = 3.58, $p < 0.001$, 95% CI = [2.23, 7.8] (see Figure 5 [Figure 5: see original paper]). Additionally, simple slopes analysis showed that for shorter-than-opponent men, trait mating motivation significantly and positively predicted BART scores (b = 0.42, SE = 0.11, t(84) = 3.92, $p < 0.001$, 95% CI = [0.21, 0.63]), meaning that when height-disadvantaged, higher trait mating motivation activation was associated with greater risk-taking. However, trait mating motivation did not significantly predict BART scores for taller-than-opponent men (b = 0.01, SE = 0.1, t(84) = 0.15, p = 0.88, 95% CI = [−0.19, 0.21]) or control men (b = −0.03, SE = 0.1, t(84) = −0.31, p = 0.75, 95% CI = [−0.24, 0.17]).

Because individual absolute height (M = 172.8 cm, SD = 6.35 cm) may covary with trait mating motivation to influence risk-taking, we further controlled for absolute height. Results showed that even after controlling for absolute height (which showed no significant effect: b = −0.02, SE = 0.06, t(83) = −0.28, p = 0.78, 95% CI = [−0.14, 0.11]), the pattern remained unchanged. Trait mating motivation, taller vs. control, and their interaction still did not significantly predict male risk-taking, $|t|s < 0.04$, $ps > 0.72$. However, shorter vs. control and its interaction with trait mating motivation remained significant predictors, $bs > 0.45$, $ts > 2.14$, $ps < 0.04$. Simple slopes analysis continued to show that when men had high trait mating motivation (+1 SD), shorter-than-opponent men exhibited significantly greater risk-taking than control men, $b = 5.05$, $SE = 1.42$, $t(83) = 3.57$, $p < 0.001$, 95% CI = [2.24, 7.88]. When men had low trait mating motivation (−1 SD), shorter-than-opponent and control men did not differ, $b = -0.93$, $SE = 1.34$, $t(83) = -0.69$, $p = 0.49$, 95% CI = [−3.58, 1.73]. Trait mating motivation continued to significantly and positively predict BART scores for height-disadvantaged men, $b = 0.43$, $SE = 0.11$, $t(83) = 3.92$, $p < 0.001$, 95% CI = [0.21, 0.64], but not for taller-than-opponent or control men, $|t|s < 0.15$, $ps > 0.88$.

Consistent with Study 3, Study 4 results showed that trait mating motivation moderates the effect of relative height disadvantage on male risk-taking. Specifically, men with higher trait mating motivation increased their risk-taking when facing taller competitors, while men with low trait mating motivation did not. These findings align with our hypotheses and further suggest that men’ s compensatory risk-taking in response to height disadvantage serves mate acquisition functions.

General Discussion

6.1 Relationships Among Height Disadvantage, Mating Motivation, and Risk-Taking

Previous research has not clearly articulated the relationship between male height and risk-taking. This study is the first to propose, from an evolutionary perspective, that men possess an adaptive behavioral strategy of using risk-taking to compensate for height disadvantage relative to same-sex competitors. Through four distinct behavioral studies, we systematically tested this hypothesis by having participants perceive height differences from competitors in same-sex competitive contexts. Studies 1 and 2 showed that in both real paired competition and virtual competition contexts, height disadvantage relative to same-sex competitors led men to increase their risk-taking, while this effect was not observed in women. Studies 3 and 4 demonstrated, from both state and trait perspectives, that the enhancing effect of height disadvantage on male risk-taking is moderated by mating motivation level, with the effect being further amplified among men with higher mating motivation. Previous research shows that both men and women perceive higher risk-taking men as taller and more physically formidable (Fessler et al., 2014), and that both male height and risk-taking are adaptive features that facilitate intrasexual competition and mate selection (e.g., Barclay et al., 2018; Baker & Maner, 2009; Buss, 2015; Fessler et al., 2014; Mishra et al., 2017; Shan et al., 2012). Combined with previous research, our findings suggest that men use risk-taking to compensate for height disadvantage when shorter than same-sex competitors. This compensatory behavior represents an adaptation for solving problems of intrasexual competition and intersexual selection, serving dual functions in competition and mate acquisition. These results support our hypotheses and provide a new theoretical perspective for understanding the relationship between male height and risk-taking.

Previous research from a life history theory perspective has examined the relationship between absolute height and risk-taking in non-competitive contexts (e.g., Ball et al., 2010; Fessler et al., 2014; Ruedl et al., 2010), finding no significant association. In contrast, this study examined the relationship between absolute height and risk-taking in competitive contexts (Studies 1 and 4). Consistent with previous research, our results still showed that absolute height did not significantly predict risk-taking; rather, relative height differences from competitors determined men's risk-taking levels in subsequent competitive activities. This extends previous research, further suggesting that risk-taking represents a "rational" choice made after careful consideration of one' s own status and situational benefits—that is, risk-taking is context-sensitive (Barclay et al., 2018; Mishra et al., 2017). This supports the relative state model of risk-taking and the evolutionary theory of the Napoleon Complex (Barclay et al., 2018; Just & Morris, 2003; Knapen et al., 2018; Mishra et al., 2017). Both theories posit that male risk-taking should be regulated based on relative differences from competitors rather than determined solely by absolute physical condition. Additionally, previous research shows that when men face height disadvantage, they compensate through resource acquisition, indirect aggression, and increased competitor sensitivity (e.g., Brewer & Riley, 2009; Just & Morris, 2003; Knapen et al., 2018; McCarrick et al., 2020). Combined with these findings, our results further suggest that when men face physical disadvantages, they adjust behavioral strategies to win competitions, providing additional evidence that the Napoleon Complex may have evolutionary foundations.

Extensive research demonstrates the influence of mating motivation on male risk-taking (Shan et al., 2010; Li & Zhang, 2010; Su & Su, 2017; Xing et al., 2015; Baker & Maner, 2009; Barclay et al., 2018; Buss, 2015; Herbert, 2018; Mishra et al., 2017; Shan et al., 2012). Building on this foundation, our study further reveals that relative height differences moderate the effect of mating motivation on male risk-taking. Specifically, Studies 3 and 4 showed that mating motivation significantly affected risk-taking only among men shorter than same-sex competitors. This suggests that men deficient in good genes traits are more likely to display risk-taking to obtain reproductive opportunities. These findings further support the relative state model of risk-taking: when individuals can only obtain benefits by actively taking risks due to their needs, they are more likely to engage in risk-taking (Barclay et al., 2018; Mishra et al., 2017). This further suggests that risk-taking is context-sensitive (Shan et al., 2010; Li & Zhang, 2010; Xing et al., 2015; Baker & Maner, 2009; Barclay et al., 2018; Buss, 2015; Herbert, 2018; Mishra et al., 2017; Prokosch et al., 2019; Shan et al., 2012). Notably, Studies 3 and 4 revealed different effects of situational mating motivation activation and trait mating motivation. In Study 3, we found that after mating motivation activation, taller-than-opponent men also increased their risk-taking (compared to controls). However, in Study 4, high trait mating motivation did not produce this effect. Three possible explanations exist for this discrepancy. First, when facing potential high-reproductive-value mates, height-related cues may direct attention to one' s own physical condition, thereby activating motivation to display physical condition to obtain reproductive opportunities. Second, trait-level and situationally activated fundamental social motives may exert different influences on behavior, as suggested by previous fundamental social motives research (Ackerman, Hill, & Murray, 2018). Third, Study 3 activated short-term mating motivation by presenting sexually accessible, high-reproductive-value targets (Su & Su, 2017; Buss, 2015), whereas Study 4' s mating motivation scale assessed combined short-term and long-term mating motivation (Neel et al., 2016). Differences between short-term and long-term mating motivations may produce different effects on risk-taking (Su & Su, 2017; Buss, 2015). Additionally, previous fundamental social motives research suggests that effects of situational activation may be moderated by trait-level motivation (Ackerman et al., 2018), indicating that situational mating motivation effects on male risk-taking may be moderated by trait mating motivation. Future research should explore these possibilities.

6.2 Gender Differences in Risk-Taking

In this study, we found gender differences in risk-taking using the BART paradigm. Results showed that height differences from same-sex competitors affected male but not female risk-taking. However, we did not find overall gender differences in risk-taking. The study only showed that when shorter than opponents, men exhibited greater risk-taking than women in the BART paradigm (Study 2). This differs somewhat from previous research on gender differences in risk-taking (Shan et al., 2010; Apicella et al., 2017; Barclay et al., 2018; Mao et al., 2018; Mishra et al., 2017). Several factors may explain this discrepancy. First, previous BART research has also found no gender differences in risk-taking using this paradigm (e.g., Cazzell et al., 2012; Shan et al., 2012). Second, in our study, the BART task was competitive—participants' scores determined competition outcomes rather than final monetary rewards, differing from previous BART research (e.g., Cazzell et al., 2012; Fukunaga et al., 2012; Mao et al., 2018; Prokosch et al., 2019; Rao et al., 2014). Differences in task motivation may have produced our specific results. Third, risk-taking has both domain-generality and domain-specificity (Barclay et al., 2018; Mishra et al., 2017), and gender differences show clear domain specificity (Li & Zhang, 2010; Prokosch et al., 2019). For example, men are more risk-taking than women in economic, recreational, and moral domains, but women are more risk-taking than men in social domains (Figner & Weber, 2011). Our BART task primarily reflected domain-general risk-taking (Baker & Maner, 2009; Cazzell et al., 2012; Fukunaga et al., 2012; Gamble & Walker, 2016; Lejuez et al., 2002; Mao et al., 2018; Prokosch et al., 2019; Rao et al., 2014; Shan et al., 2012). Using domain-specific self-report risk-taking questionnaires (e.g., Li & Zhang, 2010; Prokosch et al., 2019) might yield different results. Finally, our study used only one BART indicator—the average number of pumps per unexploded balloon. Although this indicator most validly represents real-world risk-taking (Lejuez et al., 2002; Gamble & Walker, 2016; Prokosch et al., 2019), using other BART indicators such as average pumps across all balloons, number of exploded balloons, or total score might produce different findings. Future research should examine these possibilities to confirm the reliability of our gender difference results.

6.3 Limitations and Future Directions

This study examined the evolutionary adaptiveness of the Napoleon Complex from an ultimate cause perspective (Li & Zhang, 2010; Su & Su, 2017; Wu et al., 2019). Therefore, our research cannot address proximate cause questions about how height disadvantage leads men to increase risk-taking. For example, have men and women evolved corresponding behavioral norms (or sociocultural patterns) due to evolutionary pressures that produce this behavior? What specific behavioral and environmental cues are necessary to activate this psychological mechanism? Is perception of these cues conscious or unconscious? What are the underlying neural mechanisms? According to the evolutionary theory of the Napoleon Complex (Just & Morris, 2003; Knapen et al., 2018), the complete set of psychological and behavioral responses activated by height differences from competitors can be unconscious—men may not need to consciously perceive physical disadvantages, but simply being in a disadvantaged position relative to same-sex competitors should activate this mechanism. Additionally, this theory predicts that the relationship with same-sex individuals (e.g., competitive vs. cooperative) will moderate height cue effects. In competitive relationships, men should compensate, while in cooperative relationships, this effect should be reduced. Our study examined only competitive contexts; how results would change if same-sex relationships varied remains to be investigated.

This study examined the evolution of the Napoleon Complex primarily through risk-taking behavior. However, when men face physical disadvantages, they have many other methods to display qualities desired in a good mate, such as demonstrating commitment, generosity, altruism, conspicuous consumption, or creativity (Xing et al., 2015; Knapen et al., 2018; Watkins, 2017). This suggests that physical condition gaps from same-sex competitors may influence many male social behaviors. When men are disadvantaged in good genes traits (e.g., height, strength, facial attractiveness, intelligence, humor), a range of emotional and behavioral responses may be activated to compensate. Additionally, men' s good provider and good father traits are also subject to sexual selection (Lu et al., 2015). If men are disadvantaged in these traits, do they employ other compensation strategies in sexual selection? Researchers must further explore these questions. Additionally, cross-cultural and developmental psychology research is needed to achieve a deep understanding of the biological functions of the Napoleon Complex.

For humans, almost all social behaviors involve some degree of risk (Mishra et al., 2017). Therefore, studying the emergence of human risk-taking tendencies is crucial for understanding the mechanisms underlying human social behavior (Barclay et al., 2018; Mishra et al., 2017). Using the BART paradigm, which reflects domain-general risk-taking tendencies, our study found that ecological cues related to same-sex competition and reproduction influenced general risk-taking tendencies in both real and virtual contexts. These results hold important theoretical and practical value, suggesting that ecological cues related to height and reproductive partners in real-world environments may subtly influence numerous social and economic behaviors closely related to risk-taking, such as cooperation, conflict resolution, risk/intertemporal decision-making, investment, and consumption. By controlling environmental information such as relevant individuals' heights and cues indicating high-reproductive-value mates, researchers may be able to achieve social engineering goals of influencing key decision-making by target individuals in critical domains. For example, in business negotiations or political competition, based on activity goals (making opponents more or less risk-taking) and opponent characteristics (e.g., height, marital status, reproductive status, sexual orientation), controlling characteristics of one' s own personnel (e.g., height, gender, attractiveness) and arranging assistants displaying sexual accessibility cues might influence outcomes. Notably, our results cannot confirm that these possibilities are products of natural selection. Rather, considering the association between risk-taking and general social behavior (Barclay et al., 2018; Mishra et al., 2017), these potential influences may represent evolutionary byproducts (Buss, 2015): adjusting risk-taking based on mating needs and competitor height is adaptive, but changes in social behaviors unrelated to same-sex competition and mating that result from risk-taking changes may not be adaptive. However, because natural selection operates on average fitness (Buss, 2015), these byproducts have not been eliminated and persist. These questions hold important practical and theoretical significance and should be a key direction for future research.

7 Conclusion

This research found that relative height disadvantage compared to same-sex competitors leads men to increase their risk-taking and exhibit more risk-taking behavior, with male mating motivation moderating this effect. Men with higher mating motivation further increase their risk-taking due to height disadvantage from competitors. These findings support the evolutionary theory of the Napoleon Complex, suggesting that men' s compensatory risk-taking when height-disadvantaged relative to competitors serves dual functions in intrasexual competition and mate acquisition.

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Footnotes

1. This effect size value was converted from the average effect size in social psychology, r = 0.21.

2. To avoid confusion with the variable name "relative height difference," participants' actual height is referred to as "absolute height" in this paper.

3. The average effect size r = 0.21 in social psychology research (Richard et al., 2003) represents a small-to-medium effect. However, this effect size cannot be directly converted to the f^2 value required for our study design. Given that previous research suggests studying effects smaller than medium effect sizes is not meaningful and is costly in social psychology, it is reasonable to assume a medium effect size for a priori sample size estimation (Cooper, 1982; Sawilowsky, 2009). Moreover, the average effect size in social psychology is similar to the medium effect size r = 0.3, so we adopted $f^2 = 0.153$.

4. Evolutionary psychology research generally considers human behavioral norms or social culture as results of evolutionary mechanisms functioning,

belonging to proximate causes (e.g., Li & Zhang, 2010; Su & Su, 2017; Ackerman et al., 2018; Wu et al., 2019).

Note: Figure translations are in progress. See original paper for figures.