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Interactive Effects of Risk Propensity and Secure Attachment on Prosocial Risk-Taking: Based on Polynomial Regression and Response Surface Analysis

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Abstract

Prosocial risk-taking behavior refers to voluntary actions that benefit others despite potential personal costs. Despite its importance, the interactive effects of personality traits such as risk propensity and secure attachment on prosocial risk-taking behavior remain underexplored. This study investigated these effects and the mediating roles of risk perception and outcome expectancy among 762 Chinese undergraduates. Participants completed validated scales assessing the variables. Response surface analysis revealed significant congruence effects, indicating higher prosocial risk-taking behavior when both traits are high. While the levels of these traits are incongruent, individuals with low risk propensity and high secure attachment exhibit more prosocial risk-taking behavior compared to those with high risk propensity and low secure attachment, which reflects secure attachment's compensatory role in low risk propensity scenarios. Outcome expectancy partially mediated the interaction, but risk perception did not. These findings clarify the interactive mechanisms of dual personality traits in prosocial risk-taking behavior and provide a theoretical basis for encouraging individuals to engage more in such behaviors.

1 Introduction

Prosocial risk-taking behavior (PRB) is defined as a positive risk-taking to help others despite potential personal costs or uncertainties (Armstrong-Carter & Telzer, 2023), such as intervening in emergencies or advocating for justice in high-stakes situations (Do et al., 2017). Prosocial risk-taking behavior combines altruism with bold decision-making, thereby fostering social harmony and personal growth(Skaar, 2021). In collectivist cultures like China, where interpersonal bonds and collective well-being are emphasized, prosocial risk-taking behavior plays a pivotal role in maintaining societal norms and responding to crises (Zhan et al., 2023).

However, the personality antecedents of prosocial risk-taking behavior—particularly how traits like risk propensity and secure attachment interact—remain underexplored. This lack limits strategies to cultivate such heroic behaviors in educational and organizational settings. The present study addresses this by examining the synergistic effects of risk propensity and secure attachment on prosocial risk-taking behavior. We also explore mediation by cognitive factors such as risk perception and outcome expectancy.

1.1 The Influence of Risk Propensity and Secure Attachment on Prosocial Risk-Taking Behavior

- The occurrence of prosocial risk-taking behavior depends on two distinct psychological foundations: the willingness to take risks and prosocial motivation. At the level of personality traits, the former manifests as risk propensity, while the latter manifests as secure attachment. Risk propensity, defined as an individual's tendency to approach or avoid risks, is a significant predictor of risk-taking behavior (Szrek et al., 2012). Theoretical models of risk-taking behavior indicate that risk-averse individuals are more inclined to avoid risky behaviors, whereas risk-seeking individuals are more likely to engage in them (Sitkin & Weingart, 1995). Thus, risk propensity provides the necessary behavioral activation condition for prosocial risk-taking, enabling individuals to initiate actual behavioral responses in risky situations.

Risk propensity is a cognitive factor influencing prosocial risk-taking behavior, while secure attachment provides support for such behavior from an emotional perspective. Secure attachment plays a crucial role in prosocial behavior (Gross et al., 2017). It typically develops when attachment figures respond promptly and positively to an individual's needs, facilitating emotion regulation and stress coping(Mikulincer, Shaver, 2003). Attachment theory states that attachment styles shape subsequent cognitive processes and behavioral patterns(Bowlby, 1982). Specifically, securely attached individuals, characterized by positive self- and other-representations and higher empathy, often exhibit more prosocial behaviors (Oldfield et al., 2016; Pan et al., 2019; Wang et al., 2017). As a subset of prosocial behavior, prosocial risk-taking behavior is also significantly promoted by secure attachment. While existing research confirms the separate influences of risk propensity and secure attachment on prosocial risk-taking behavior, their combined mechanism remains unclear.

Theoretical models of prosocial risk-taking behavior propose that risk preference (i.e., risk-taking tendency) and social preference (i.e., prosociality) jointly influence prosocial risk-taking behavior (Zhan et al., 2023). Specifically, insufficient risk propensity may prevent individuals from acting, even with prosocial motivation. Conversely, a lack of secure attachment may cause risk-taking to deviate from prosocial goals. This suggests risk propensity and secure attachment may work together in enabling prosocial risk-taking(Armstrong-Carte & Telzer, 2025). When both traits are high, individuals possess both the willingness to take risks and strong empathic capabilities (Sitkin & Weingart, 1995; Oldfield et al., 2016). These individuals are most likely to engage in prosocial risk-taking. When both traits are low, individuals tend to avoid risks and lack concern for others, consequently exhibiting the least prosocial risk-taking behavior.

An incongruency effect between risk propensity and secure attachment may also exist. When risk propensity is low and secure attachment is high, although individuals typically avoid risks, strong social connectedness and empathy may motivate them to engage in prosocial risk-taking behavior in specific situations. This aligns with the super-altruism perspective, which suggests highly empathic individuals may intuitively engage in prosocial risk-taking, overlooking inherent negative consequences(Zhan et al., 2023). Therefore, securely attached individuals may overlook risks and engage in more prosocial risk-taking due to higher empathy(Li et al., 2021). In contrast, the perspective of competitive altruism suggests that when risk propensity is high and secure attachment is low, although individuals are willing to take risks, their lower empathic capacity may lead them to prefer self-serving risk-taking behavior(Xie & Wang, 2003). While both risk propensity and secure attachment influence prosocial risk-taking behavior, secure attachment appears to play a more pivotal role.

Based on the above analysis, we propose the following hypotheses:

H1: When levels of risk propensity and secure attachment are congruent, individuals are more likely to engage in prosocial risk-taking behavior when both traits are high compared to when both are low.

H2: When levels of risk propensity and secure attachment are incongruent, individuals with low risk propensity and high secure attachment will engage in more prosocial risk-taking behavior relative to those with high risk propensity and low secure attachment.

1.2 The Mediating Roles of Risk Perception and Outcome Expectancy

To better understand how risk propensity and secure attachment jointly influence prosocial risk-taking, it is necessary to explore the underlying psychological mechanisms. Theoretical models of risk-taking behavior highlight the significant roles of risk perception and outcome expectancy(Wong, 2005). However, it remains unclear whether this theoretical model applies to prosocial risk-taking behavior. Therefore, exploring the roles of risk perception and outcome expectancy in prosocial risk-taking formation is necessary.

Risk perception denotes the subjective appraisal of both the magnitude and the severity of potential threats (Slovic, 1978). Some research suggests that an individual's risk propensity is closely related to their level of risk perception. Individuals with higher risk propensity tend to exhibit lower risk perception (Ding & Zhang, 2016; Wang et al., 2019). This makes them more likely to engage in risk-taking behavior (Kummeneje & Rundmo 2020; Teng et al., 2025). In short, high risk propensity is linked to lower risk perception and greater risk-taking. Furthermore, the dynamic processing model of the attachment system demonstrates that activating secure attachment reduces attention to threats and distress while enhancing feelings of security. This promotes greater engagement in prosocial behavior(Ma et al., 2021; Mikulincer & Shaver, 2001, 2003; Wang et al., 2023). Thus, activating secure attachment appears to lower risk perception, thereby increasing prosocial behavior.

Outcome expectancy refers to an individual's predictions about the potential consequences of performing a specific behavior, along with the perceived significance and impact of those consequences (Strathman et al., 1994). Risk propensity influences outcome expectancy. Individuals with high risk propensity pay greater attention to and value positive outcomes more than those with low risk propensity (Greenwald et al., 2021). Simultaneously, outcome expectancy influences behaviors such as risky decision-making (Stocks & Slater, 2016). Individuals are more inclined to take risks when they perceive that the benefits outweigh the potential losses (Moore & Gullone, 1996). Therefore, individuals with high risk propensity hold higher positive outcome expectancy and engage in more risk-taking behavior. Additionally, activating secure attachment can enhance individuals' positive interpersonal expectations, thereby promoting altruistic behavior (Ma et al., 2021). Other research also confirms that positive outcome expectancy strengthens the willingness to help (Zheng et al., 2018). In summary, higher secure attachment levels correlate with higher positive outcome expectancy and a greater likelihood of prosocial behavior. Concurrently, Wong (2005) found that outcome expectancy judgments are based on risk perception. Related research also indicates that individuals have greater confidence in their actions leading to positive outcomes when risk perception is low (Zhang et al., 2018).

Based on the above, we propose the following hypotheses:

H3: Risk perception mediates the effects of risk propensity and secure attachment on prosocial risk-taking behavior.

H4: Outcome expectancy mediates the effects of risk propensity and secure attachment on prosocial risk-taking behavior.

H5: Risk perception and outcome expectancy play serial mediating roles in the effect of the congruence between risk propensity and secure attachment on prosocial risk-taking behavior.

1.3 The present research

The present study aims to examine how risk propensity and secure attachment interact to predict prosocial risk-taking behavior. First, it tests whether congruence and incongruence patterns of the two traits differentially predict prosocial risk-taking. Then, it explores the mediating roles of risk perception and outcome expectancy in these relationships. Specifically, the study examines whether risk perception and outcome expectancy act as serial mediators between trait congruence and prosocial risk-taking. Figure 1 illustrates the conceptual model, depicting the serial mediation pathways.

2 Methods

2.1 Participants and Procedure

We required a sample of 300 participants to achieve a power of (1 - α = 0.80 adopting a Type-I error of α = 0.05 (moderate correlations ρ = 0.25, two-tailed; 1000 replications with 20,000 Monte-Carlo draws) to detect effects among two mediators (Schoemann et al., 2017).

A total of 830 undergraduate students were initially recruited from two universities in Zhejiang Province, China, through a cluster sampling method. The final sample consisted of 762 participants (60.1% female, 39.9% male) after excluding 68 responses that were incomplete or failed attention checks, 91.8% retention rate. The mean age of the participants was 20.74 years (*SD* = 2.10).

The study protocol was approved by the Institutional Review Board (IRB) of the corresponding author's university. All participants provided written informed consent before the study. Data were collected in classroom settings by trained psychology graduate students. Participants were informed that their participation was voluntary and anonymous. They completed the paper-and-pencil questionnaire packet, which took approximately 15 minutes. To control for order effects, the sequence of the scales was counterbalanced across different versions of the packet. After completion, participants received a small gift as a token of appreciation.

2.2 Measures

Prosocial Risk-Taking Behavior

- The Prosocial Risk-Taking Behavior Scale (PRB; Armstrong-Carter et al., 2021) was used to assess prosocial risk-taking behavior. It consists of 6 items rated on a 5-point scale from 1 (“very unlikely”) to 5 (“very likely”). Higher average scores indicated greater engagement in prosocial risk-taking behavior. In this study, Cronbach’s α coefficient for this scale was 0.85.

Risk Propensity

- The General Risk Propensity (GRP) scale (Huang et al., 2012) was used to assess risk propensity, which consists of 8 items. All items were rated on a 5-point scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Higher average scores suggested higher levels of risk propensity. In this study, Cronbach’s α coefficient for this scale was 0.90.

Secure Attachment

The Inventory of Parent and Peer Attachment (IPPA; Armsden et al., 1987) was used to assess secure attachment. The IPPA is a 25-items self-report questionnaire, with items being measured on a 5-point scale ranging from 1 (“very untrue of me”) to 5 (“very true of me”). After reverse-scoring the Alienation dimension, higher mean scores indicated greater levels of secure attachment. In this study, Cronbach’s α coefficient for this scale was 0.92.

Risk Perception

- Risk perception was assessed using a 4-item scale adapted from the measure (Simon et al., 2000), which was used to study how cognitive biases influence entrepreneurial decision-making. Items were rated on a 5-point scale from 1 (“completely disagree”) to 5 (“completely agree”). Higher average scores suggested higher levels of risk perception. In this study, Cronbach’s α coefficient for this scale was 0.82.

Outcome Expectancy

The Internet Preference Cognition Scale (IPC; Li et al., 2010) was used to assess outcome expectancy, and combined with prosocial risk-taking contexts to assess individuals' levels of outcome expectancy. This scale consists of 6 items. All items were rated on a 5-point scale and higher average scores reflected more positive outcome expectancy. In this study, Cronbach’sαcoefficient for this scale was 0.72.

2.3 Data Analysis

Descriptive statistics and correlation analyses were conducted using SPSS 26.0. To test our main hypotheses regarding the interactive effects (H1 and H2), we performed polynomial regression with response surface analysis (Edwards & Parry, 1993). Compared to traditional moderated regression analysis and difference score analysis, RSA visually presents the effects of two predictors' congruence, discrepancy, and direction of discrepancy on the outcome variable through three-dimensional surfaces. It overcomes the limitation of traditional difference score methods. RSA accurately captures the complex relationships among variable combinations and provides a more rigorous analytical framework(Shanock et al., 2010). Before the analysis, risk propensity (X) and secure attachment (Y) scores were standardized. The dependent variable, prosocial risk-taking behavior, was regressed on the standardized predictors (X, Y), their squared terms (X^2, Y^2), and their interaction term (X × Y). This study examined the surface values (*a*1-*a*4) to test for congruence and incongruence effects, The dependent variable, Prosocial Risk-Taking Behavior (Z), was regressed on the centered predictors using the following quadratic equation::

$$Z = b_0 + b_1X + b_2Y + b_3X^2 + b_4XY + b_5Y^2 + e$$

We then examined the response surface parameters (e.g., $a_1 = b_1 + b_2$; $a_4 = b_3 - b_4 + b_5$) to test for congruence and incongruence effects.

Next, following Edwards and Cable's (2009) recommendation, a block variable representing the combined effect of risk propensity and secure attachment was created to test the mediating effects. This block variable captures the variance explained by the five polynomial terms (Edwards & Cable, 2009).Subsequently, the PROCESS macro (Hayes, 2018; based on the principles outlined by Wen & Ye, 2014) was used to test the serial mediation effects using the bootstrap method with 5000 resamples. All continuous variables were standardized prior to these analyses.

3 Results

3.1 Common Method Bias Test

Given that all data were collected via self-report measures, we assessed the potential for common method bias. We implemented procedural remedies including reverse-scored items and anonymous responses. Post hoc statistical control was performed using Harman’s single-factor test (Tang & Wen, 2020). Eight factors revealed eigenvalues greater than 1, with the first factor accounting for only 28.88% of the variance—well below the 40% threshold indicative of problematic common method bias.

3.2 Descriptive Statistics and Correlations

As shown in Table 1, risk propensity (M = 3.04, SD = 0.38), secure attachment(M = 3.46, SD = 0.46), and prosocial risk-taking behavior (M = 3.31, SD = 0.61) demonstrated moderate positive intercorrelations (r = 0.09, p = 0.01; r = 0.24, p < 0.001). What's more, prosocial risk-taking behavior positively correlated with outcome expectancy (r = 0.16, p < 0.001). However, no significant correlations were found between risk propensity and outcome expectancy, as well as between risk perception and prosocial risk-taking behavior (ps. > 0.05).The remaining variables are significantly correlated with each other(ps. < 0.01).Gender and only-child status were significantly correlated with prosocial risk-taking behavior and were therefore included as covariates in subsequent analyses.

Table 1
Descriptive statistics and correlation analysis (N = 762)

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1.Gender	-	-										
2.Age	20.74	2.10	-0.13**									
3.Grade	2.16	1.05	-0.08*	0.45**								
4.Only-Child Status	1.82	0.38	0.19**	0.05	0.03							
5.Religion	1.94	0.24	0.18**	-0.03	-0.04	0.22**						
6.Class Cadre	1.70	0.46	-0.02	-0.05	-0.13**	-0.02	-0.04					
7.Risk Propensity	3.04	0.38	-0.01	-0.02	-0.01	-0.02	-0.09*	-0.14**				
8.Secure Attachment	3.46	0.46	0.08*	-0.09*	-0.07	-0.08*	0.03	-0.01	0.12**			
9.Risk Perception	3.30	0.56	0.08*	-0.08*	-0.02	0.01	0.04	0.02	-0.11**	0.14**		
10.Outcome Expectancy	3.03	0.44	-0.04	-0.02	-0.04	-0.02	0.03	0.01	0.05	0.13**	-0.43**	
11.Prosocial Risk-taking Behavior	3.31	0.61	-0.09*	-0.01	-0.03	0.08*	0.06	-0.04	0.09*	0.24***	-0.02	0.16***

Notes: Gender and grade were dummy variables. ***p < 0.001, ** p < 0.01, * p < 0.05. The same notation applies below.

3.3 The Interactive Effects of Risk Propensity and Secure Attachment on Prosocial Risk-Taking Behavior

To test our primary hypotheses regarding the interactive effects of risk propensity and secure attachment on prosocial risk-taking behavior (H1 and H2), a polynomial regression with response surface analysis was conducted. As shown in Table 2, we estimated three nested models with gender and only-child status as covariates. Model 1 included only the control variables, Model 2 added the linear effects of risk propensity and secure attachment, and Model 3 incorporated the quadratic and interaction terms.

The results revealed that Model 3 provided the best fit to the data. The polynomial terms explained significant incremental variance beyond the linear effects (ΔR^2 = 0.06, p < 0.001). The equation was $Z = -0.04 + 0.08X + 0.28Y - 0.05X^2 - 0.15Y^2 + 0.01XY$.

Response surface parameters (Table 2) were calculated to examine the congruence and incongruence effects (see Table 2). Along the congruence line (LOC; $X = Y$), the positive and significant slope (a_1 = 0.36,, p < 0.001, 95% CI [0.26, 0.45]) indicated that prosocial risk-taking behavior increased as risk propensity and secure attachment increased in tandem, supporting H1. The significant negative curvature along this line (a_2 = -0.18, p < 0.001, 95% CI [-0.26, -0.11]) suggested a curvilinear relationship, with the rate of increase in prosocial risk-taking behavior decelerating at higher levels of both traits.

Along the incongruence line (LOIC; $X = -Y$), the negative slope (a_3= -0.19, p < 0.001, 95% CI [-0.29, -0.09]) confirmed that individuals with low risk propensity but high secure attachment exhibited more prosocial risk-taking behavior than those with high risk propensity but low secure attachment, supporting H2. The significant negative curvature (a_4 = -0.21, p < 0.001, 95% CI [-0.30, -0.12]) indicated that this effect was also nonlinear.

Table 2
Polynomial regression results and response surface analysis (N = 762)

	Prosocial Risk-taking Behavior		
	Model 1	**Model 2**	**Model 3**
Constant(b_0)	-0.28	-0.35*	-0.04
Gender	-0.26**	-0.32***	-0.34***
Only-Child Status	0.26**	0.33***	0.28**
Risk Propensity(X)(b_1)		0.06	0.08*
Secure Attachment(Y)(b_2)		0.25***	0.28***
X^2(b_3)			-0.05**
X*Y(b_4)			0.01
Y^2(b_5)			-0.15***
R^2	0.02	0.09	0.15
ΔR^2		0.07***	0.06***
Response surface parameters			
a_1-slope alone LOC(X = Y)			0.36***
a_2-curvature alone LOC(X = Y)			-0.18***
b_1-slope alone LOIC(X = -Y)			-0.19***
b_2-curvature alone LOIC(X = -Y)			-0.21***

Figure 2 presents the three-dimensional response surface plot. The highest levels of prosocial risk-taking behavior occurred when both risk propensity and secure attachment were high. This was followed by the condition of low risk propensity paired with high secure attachment, then high risk propensity with low secure attachment, and finally, the lowest levels occurred when both traits were low.

Note

X = risk propensity (standardized); Y = secure attachment (standardized); Z = prosocial risk-taking behavior(standardized). **The plot visually demonstrates that prosocial risk-taking behavior is highest when both risk propensity and secure attachment are high (congruence effect) and that high secure attachment can compensate for low risk propensity (incongruence effect).**

3.4 Mediation Analysis of Risk Perception and Outcome Expectancy

To examine the mediating roles of risk perception and outcome expectancy (H3-H5), the analytical approach by Edwards and Cable (2009) was adopted. A block variable was created to capture the combined effect of risk propensity and secure attachment. First, the raw values of the five polynomials were multiplied by the regression coefficients and summed. Subsequently, Model 6 in the PROCESS macro with 5,000 bootstrap method tested the mediating effect (Hayes, 2018; Zhao et al., 2010). As shown in Table 3, the block variable significantly predicted risk perception (β = -0.17, p < 0.001) and outcome expectancy (β = -0.11, p < 0.001). Risk perception significantly predicted outcome expectancy (β = -0.44, p < 0.001), but risk perception did not significantly predict prosocial risk-taking behavior (β = 0.03, p = 0.44). However, outcome expectancy significantly predicted prosocial risk-taking behavior (β = 0.15, p < 0.001), indicating that only outcome expectancy played a partial mediating role between the block variable and prosocial risk-taking behavior. According to the results in Table 4, the mediating effect size of outcome expectancy was − 0.02, with a 95% confidence interval of [-0.04, -0.01]. These results indicated that outcome expectancy partially mediated the relationship between the interactive effect of risk propensity and secure attachment and prosocial risk-taking behavior, supporting H4 but not H3 or H5.

Table 3
Testing of the mediation model for risk perception and outcome expectancy

Predictor	Equation1(Risk Perception)		Equation2(Outcome Expectancy)		Equation3(Prosocial Risk-taking)	
	β	*t*	*β*	*t*	*β*	*t*
Constant	-0.15	-0.84	0.01	0.05	-0.36	-2.05*
Gender	0.18	2.06*	-0.04	-0.48	-0.30	-3.50***
Only-Child Status	0.01	0.05	0.01	0.14	0.32	3.47**
Block Variable	-0.11	-2.89**	-0.17	-5.19***	-0.28	-5.77***
Risk Perception			-0.44	-13.61***	0.03	0.84
Outcome Expectancy					0.16	3.79***
R^2		0.02		0.21		0.09
F		4.58**		50.29***		14.55***

Table 4
Analysis of chain mediation effect

Path	Effect Value	SE	95% CI
Total Effect	-0.23	0.04	[-0.30, -0.16]
Total Indirect effect	-0.02	0.01	[-0.04, -0.01]
Block Variable→Risk Perception→prosocial risk-taking behavior	-0.01	0.01	[-0.02, 0.01]
Block Variable→Outcome Expectancy→prosocial risk-taking behavior	-0.02	0.01	[-0.04, -0.01]
Block Variable→Risk Perception→Outcome Expectancy→prosocial risk-taking behavior	0.01	0.01	[-0.01, 0.01]

4 Discussion

As suggested by the theoretical model of prosocial risk-taking behavior, risk propensity and secure attachment jointly influence prosocial risk-taking behavior (Zhan et al., 2023). Furthermore, the study results partially verify the generalizability of the risk-taking behavior theoretical model to the theoretical model of prosocial risk-taking behavior. In the current study, polynomial regression and response surface analysis were used. These methods examined how the (in)congruence between risk propensity and secure attachment affected prosocial risk-taking behavior. The results demonstrated that when both risk propensity and secure attachment were congruently high, individuals were most likely to exhibit prosocial risk-taking behavior. While the levels of the two were incongruent, a higher level of secure attachment was more effective in promoting prosocial risk-taking behavior. In addition, the study found that outcome expectation played a partial mediating role. This role occurred in the process where risk propensity and secure attachment influenced prosocial risk-taking behavior. By emphasizing the impact of (in)congruence between risk propensity and secure attachment on prosocial risk-taking behavior, the current study expanded the theoretical model of prosocial risk-taking behavior.

4.1 Interactive Effects of Risk Propensity and Secure Attachment on Prosocial Risk-Taking Behavior

The results indicated that when risk propensity and secure attachment levels were congruent, high levels of both traits more effectively promoted the occurrence of prosocial risk-taking behavior,which supported H1. In accordance with previous studies, individuals with high risk propensity engage in more prosocial risk-taking behavior(Duell & Steinberg, 2019). Sensation seeking is one of the traits of risk preference. Individuals with greater sensation-seeking have a strong desire and craving for stimulation(Zuckerman, 1984). Therefore, individuals with high sensation-seeking (i.e., high risk propensity) face prosocial risk-taking situations. They tend to obtain external rewards through risk seeking (Duell et al., 2016). Thus, such individuals are more likely to engage in prosocial risk-taking behavior. A study pointed out that individuals in secure attachment relationships will show warm helping behaviors(Wang et al., 2023). Compared with individuals with insecure attachment, those with secure attachment show more empathy (Mikulincer et al., 2005). The Perceptual

Behavior Model points out that individuals with high trait empathy will pay attention to others' distress in crises, automatically activating identification and enhancing both risk propensity and prosocial tendency (Verplanken & Holland, 2002; Vieira et al., 2020). This result indicates that risk propensity and secure attachment, as two important predictors of prosocial risk-taking behavior, when their levels are congruent and higher, can better stimulate individuals to engage in prosocial risk-taking behavior.

In line with H2, the results showed that when the two traits diverged, high secure attachment compensated for low risk propensity more effectively than high risk propensity compensated for low secure attachment. Aligning with prior studies, highly empathetic adolescents help others despite social risks due to strong helping tendencies(Eisenberg et al., 2016). At the same time, studies have shown a positive correlation between adolescents' risky and prosocial behaviors, driven by social desire(i.e., the desire for peer interaction; Armstrong-Carter et al., 2023), and individuals with secure attachment tend to be more inclined to interpersonal communication.

In addition, a study further showed that empathy ability (rather than sensation seeking) plays a moderating role in the relationship between social risk tolerance and prosocial behavior(Armstrong-Carter et al., 2023). Moreover, empathy is positively correlated with secure attachment (Li et al., 2021), so secure attachment may play a more critical role in prosocial risk-taking behavior. This aligns with the super-altruism perspective: urgent situations, strong prosocial tendencies, and high empathy can override situational risks (Zhan et al., 2023).

Thus, the pronounced prosocial tendencies and empathic capacities linked to secure attachment effectively counteracted the inhibitory effect of low risk propensity on risky behavior. This means that even individuals who typically avoid risks were motivated to engage in prosocial risk-taking due to their strong concern for others and intuitive drive to assist. The above research results prove that risk propensity and secure attachment are important predictors of individuals' prosocial risk-taking behavior, and emphasize the key role of secure attachment here.

4.2 Mediating Roles of Risk Perception and outcome expectancy

Consistent with the H4, outcome expectancy partially mediated the joint influence of risk propensity and secure attachment, aligning with models positing that anticipated benefits guide risky decisions. Specifically, individuals with high risk propensity will have more positive outcome expectancy and engage in more risky behaviors (Huber & Huber, 2019). Moreover, individuals have a "self-interested" tendency when facing risky situations, that is, they will weigh potential losses and expected gains. Therefore, when individuals feel that the loss is not too great or even the gain is greater than the loss (i.e., they have a positive expectation of the outcome), they are more likely to engage in prosocial risk-taking behavior (Larrick et al., 2009). Attachment theory points out that individuals with secure attachment have positive internal and external working models, so they will have more positive cognition of others (Li et al., 2016), thus engaging in prosocial risk-taking behavior. Specifically, high secure attachment fosters positive relationship expectations(Shaver et al., 2019), which increase helping behavior(Ma et al., 2021). Therefore, we found that outcome expectancy plays a mediating role in the impact of risk propensity and secure attachment on prosocial risk-taking behavior.

Risk perception did not mediate the relationship. This finding didn’t support H3 and H5. Two explanations are plausible. First, measurement differences may matter. Previous studies primarily used Sitkin and Pablo's (1992) Risk Perception Scale in consumption and entrepreneurship contexts(Houghton et al., 2000; Riasudeen et al., 2022), with limited application to prosocial risk-taking behavior. Second, secure attachment’s effect on threat detection appears context-dependent: it reduces perception of interpersonal risks but not necessarily physical dangers. Studies found securely attached individuals perceive lower interpersonal risk (Mikulincer & Shaver, 2001, 2003), but may not perceive lower physical threat risk, leading to avoidance(Wang et al., 2019). Therefore, future research should select more appropriate risk propensity scales and examine differences in prosocial risk-taking behavior across different types of risk situations. To sum up, risk perception did not mediate the effects of risk propensity and secure attachment on prosocial risk-taking.

Altogether, this study explores the impact of risk propensity and secure attachment on prosocial risk-taking behavior and its mechanism, which has certain value and significance. Based on the personality trait theory of risky behavior and the theoretical model of risky behavior, this study explores the occurrence and mechanism of prosocial risk-taking behavior, expanding the research scope and content of prosocial risk-taking behavior. First, from a theoretical perspective, the research significance of this study lies in: (1) Response surface analysis provides a more comprehensive and refined theoretical perspective, revealing richer information patterns that linear models cannot capture; (2) It emphasizes that when the two traits are inconsistent, secure attachment takes on a more fundamental and determining role; (3) It identifies outcome expectation, rather than risk perception, as a key cognitive mechanism. These findings enrich the complex (dual) trait model in the field of prosocial risk-taking and broaden the relevance between attachment theory and prosocial risk-taking behavior.

Second, from a practical perspective, based on the study findings, both risk propensity and secure attachment may affect individuals' prosocial risk-taking behavior, among which secure attachment is particularly critical. Therefore, in the process of individual growth, a warmer and safer environment should be created to improve individuals' secure attachment level. This is not only conducive to their physical and mental development, but also conducive to cultivating individuals' positive character, thereby increasing their sense of morality and responsibility, and further contributing to creating a harmonious and positive social atmosphere. Outcome expectancy plays a mediating role in the impact of risk propensity and secure attachment on prosocial risk-taking behavior. Therefore, we can correctly guide individuals' positive outcome expectancy, make them willing to trust others when facing prosocial risk-taking situations, so as to encourage individuals to lend a helping hand when others are in danger, and create a more harmonious and good social atmosphere.

4.3 Limitation and Future Direction

Despite the above implications, the present study has the following limitations. First, the cross-sectional, self-report design precludes causal inference. Moreover, self-report measures are vulnerable to response biases that distort the true nature of associations. Therefore, future research can use experimental priming of secure attachment to make results more objective and accurate. It can also try longitudinal tracking to clarify temporal order. Secondly, sampling exclusively from collectivist-culture undergraduates restricts ecological validity. Prosocial risk-taking manifests differently across developmental stages (e.g., adolescents vs. older adults; Lockwood et al., 2021) and cultural contexts (e.g., collectivist societies prioritizing social obligations; Septarini et al., 2025). Replication in diverse populations—varying in age and cultural orientation—is critical to determine the model's universality. Third, only two personality traits were examined. Future studies should integrate additional dispositional factors. These factors, including empathy, impulsivity, sensation-seeking, and risk types (Duell & Steinberg, 2020; Eisnberg & Spinrad, 2014; van Rijn et al., 2025), aim to construct a more comprehensive predictive model. Finally, the present study may have failed to detect the mediating role of risk perception due to the inappropriate selection of scales. Thus, context-specific measures of risk perception should be developed to determine whether the null mediation observed here stems from methodological constraints or genuine theoretical boundaries.

5 Conclusion

Prosocial risk-taking behavior is significantly influenced by risk propensity and secure attachment. Yet the impact of their congruence or incongruence, as well as the underlying mechanism, remains under explored. This study adds to a more comprehensive understanding of the associations between risk propensity, secure attachment, and prosocial risk-taking behavior, shedding light on their internal mechanism. The findings reveal that when risk propensity and secure attachment are congruent, individuals with high levels of both engage in more prosocial risk-taking behavior. When they are incongruent, those with low risk propensity and high secure attachment exhibit more such behavior. Outcome expectancy plays a partial mediating role in the process through which risk propensity and secure attachment affect prosocial risk-taking behavior. Overall, these findings underscore the combined roles of risk propensity and secure attachment in influencing prosocial risk-taking behavior, with outcome expectancy as a key mediator.

Declarations

Author Contribution

J.J.X. and E.N.F. wrote the main manuscript text; Y.J.Z. and P.X.F. analyzed the data; J.L.X. and W.J.L. collected the data; Z.R. reviewed, revised and polished the manuscript.; L.Z. provided overall supervision of this study. All authors reviewed the manuscript.

Data Availability

The datasets supporting the current study are available in the supplementary files accompanying this manuscript. Additional materials, including the full survey instruments and procedural documentation, have been deposited in the Open Science Framework repository at https://osf.io/rtjh3/files/atjk8/. All data are anonymized and shared in accordance with the journal's data sharing policies.

Clinical trial number: not applicable

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Figures

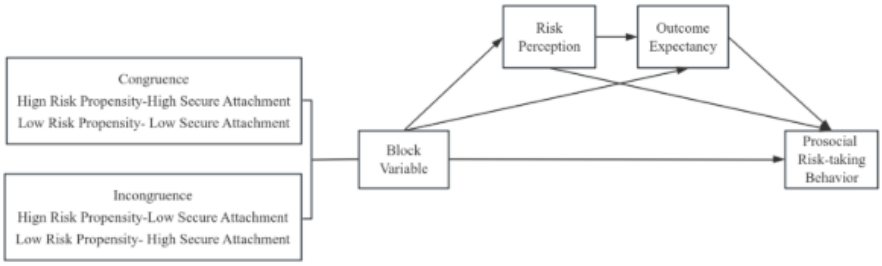


Figure 1

Conceptual model.

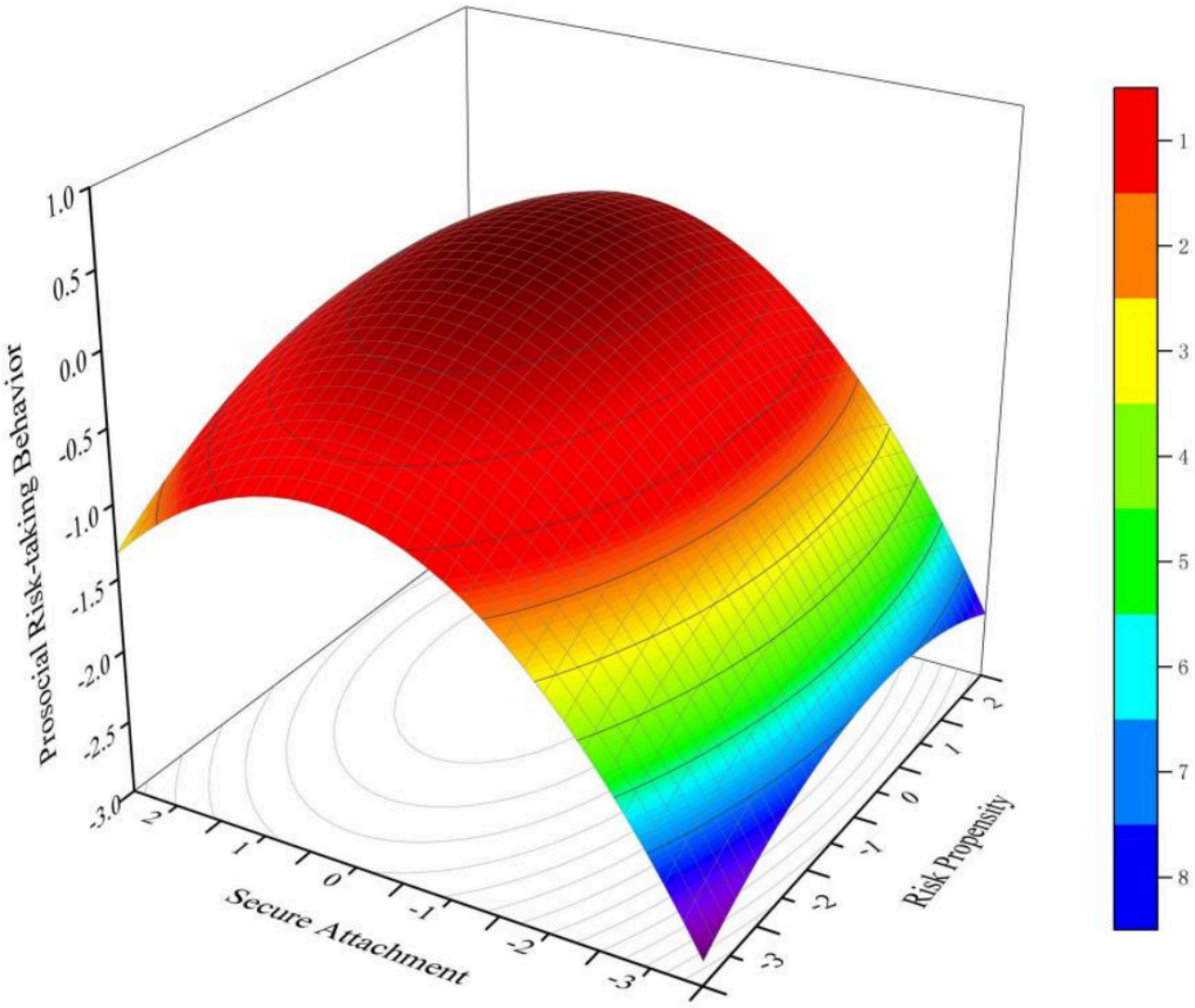


Figure 2

Response surface analysis of risk propensity and secure attachment matching with prosocial risk-taking behavior.

Note. *X = risk propensity (standardized); Y = secure attachment (standardized); Z = prosocial risk-taking behavior(standardized).* ***The plot visually demonstrates that prosocial risk-taking behavior is highest when both risk propensity and secure attachment are high (congruence effect) and that high secure attachment can compensate for low risk propensity (incongruence effect).***

Supplementary Files

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- QuestionnaireMaterials.docx