Psychology Research and Behavior Management

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ORIGINAL RESEARCH

The Moderation Effect of Approach Motivation Between Schizotypy and Creative Ideational Behavior

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Introduction: The schizotypy-creativity link has been studied from different perspectives over the past few decades, yet the results of this relationship are inconsistent in the literature. Previous studies have suggested that two basic motivational systems—Behavioral Inhibition System (BIS, avoidance motivation) and Behavioral Activation System (BAS, approach motivation)—underlie the relationship between schizotypy and creativity. Few empirical studies, however, have examined how the relationship interacts with other variables. This study fills these gaps and explores the role of the approach and avoidance motivation assessed by trait behavioral activation and inhibition in the link between schizotypy as a dimensional personality trait and creative ideational behavior as a measure of creativity.

Method: Undergraduate students (N = 388) completed questionnaires including the Schizotypal Personality Questionnaire (SPQ) measuring 3 dimensions of schizotypy, Runco Ideational Behavior Scale (RIBS) measuring creative ideational behavior, and BIS/BAS Scales measuring trait behavioral motivation. Bivariate Pearson correlation was computed, and hierarchical linear regression was performed to explore the effects of schizotypy, BIS/BAS, and their interaction on creative ideational behavior. The conditional effect of schizotypy based on different levels of the moderator was further tested.

Results: The total score, positive dimension and disorganized dimension of SPQ were all positively correlated with RIBS, BAS, and BIS. Negative dimension of SPQ was not significantly correlated with the RIBS score but was positively correlated with BIS. Additionally, after controlling gender and age, BAS significantly moderated the relationship between the positive and disorganized dimensions of schizotypy and creative ideational behavior measured by RIBS. However, BIS was not a significant moderator.

Discussion: The findings of this study regarding the relationships between different dimensions of schizotypy, two motivational systems, and creative ideational behavior were mostly consistent with previous findings. The significant moderated effect of BAS on the relationship between two dimensions of schizotypy and creative ideational behavior made significant contributions to the understanding of the relationship between schizotypy and creativity.

Keywords: schizotypy, creativity, creative ideational behavior, motivation

Introduction

The link between schizotypy and creativity has received increased attention from researchers in the fields of schizophrenia spectrum[1–3] and creativity.[4,5] However, research findings on this link are inconsistent. Some studies showed that creativity is positively associated with schizotypy, functioning as a protective factor,[6–8] while others found that it is not schizotypy, but other factors, such as openness to experience and intelligence, that are associated with creativity.[9] A meta-analysis showed that positive and impulsive schizotypy had a positive relationship with creativity (r = 0.14), while negative and disorganized schizotypy was negatively related to creativity (r = −0.09).[10]

This inconsistency in the literature about the relationship between schizotypy and creativity may be due to two main reasons. One is that the creative tasks employed in the studies assessed different aspects of creativity.[11,12] The other reason is that various dimensions of schizotypy[10] were examined in different studies. As a set of personality traits that exist on a continuum[13,14] in the general population,[3] schizotypy generally includes three dimensions that correspond to different symptoms of schizophrenia:

Received: 19 September 2023
Accepted: 21 April 2024
Published: 9 May 2024

positive, negative, and disorganized.[15] Positive schizotypy, which is the cognitive-perceptual factor of schizotypy, refers to perceptual anomalies that are similar to subsyndromal hallucinations and uncommon ideas that are similar to the delusions of schizophrenia. Negative schizotypy, which is the interpersonal factor of schizotypy, is shown by a reduction in emotional, physical, and social functions, such as the experience of pleasure or interest in social contacts. Disorganized schizotypy focuses on the tendency to have disorganized thoughts and bizarre behaviors.

Positive schizotypy has received more attention in the literature than the other two dimensions of schizotypy, especially its relationship with divergent thinking tasks.[10,16,17] For instance, Abu-Akel et al[18] found that positive schizotypy measured by magical ideation and unusual experiences was associated with better divergent thinking assessed by fluency and originality of Alternative Uses Tasks (AUTs). Hedley[19] showed that the positive schizotypy was positively correlated with the fluency of AUTs but negatively associated with convergent thinking measured by the Remote Associates Test.

In addition to creativity measured by divergent thinking tasks, creative competencies, creative cognition, daily creative experiences and behaviors were also reported to be positively related to positive schizotypy. McDonald et al[3] found a positive relationship between positive schizotypy shown by magical thinking and unusual perceptual experiences and creative experiences related to positive affect or pleasure. Jacquet et al[20] revealed that compared to the negative schizotypy cluster, the positive schizotypy cluster had better creative competencies, such as capturing (eg, preserving new ideas), challenging (eg, taking on difficult tasks), broadening (eg, seeking training), and surrounding (eg, seeking out unusual stimuli), and creative cognition (eg, idea manipulation, imagery, idea generation, and incubation). Webb et al[21] reported that positive schizotypy measured by unusual perceptual experiences was a positive predictor of insight experiences, which can happen in the process of generating a creative idea. Holt[22] used the experience sampling method to explore the experiential correlates of schizotypy in a sample of artists and indicated that positive schizotypy reported by unusual experiences predicts creativity-related experiences, such as flow state (i e, an enjoyable experience of intense absorption), internal dialogue, and vivid imagery. The researcher also found that positive schizotypy was a significant predictor of art-making and inspiration in artists' daily lives. Similarly, O'Reilly et al[23] found that individuals with high positive schizotypy pursued more creative activities in their daily lives and argued that schizotypal traits might facilitate individuals' motivation or willingness to engage in creative activities.

The relationship between negative schizotypy and creativity mostly focuses on divergent thinking tasks and presents a rather complex picture. The literature generally shows a negative relationship between negative schizotypy and creativity.[10] For instance, Batey and Furnham indicated that negative schizotypy (introvertive anhedonia) was negatively associated with divergent thinking fluency in AUT and consequences test.[24] Schuldberg found a negative relationship between negative schizotypy (physical anhedonia) with four creativity tests, including the Adjective Check List (ACL).[25] There are studies, however, that showed a positive relationship or no significant relationship between the two variables. Cox and Leon's study supported a positive relationship between negative schizotypy (social anhedonia) and divergent thinking measured by AUT.[7] Other studies, however, did not find a significant association between these variables.[9,26,27] Minor et al, for instance, demonstrated that divergent thinking was not significantly different between negative schizotypy and non-schizotypy or positive schizotypy groups.[27] In the same vein, Claridge and McDonald reported a nonsignificant relationship between negative schizotypy (introvertive anhedonia) and AUT.[9]

Conflicting results about the disorganized schizotypy and creativity have also been documented in the literature. Batey and Furnham[26] found that disorganized schizotypy was negatively associated with creativity measured by creative personality, whereas Hedley[19] concluded that disorganized schizotypy was positively correlated with the fluency of divergent thinking ideas generated from AUTs but was negatively associated with convergent thinking measured by the Remote Associates Test.

Despite the use of divergent thinking tasks and other creativity assessments in studies on the relationship between schizotypy and creativity, researchers were concerned about equating divergent thinking with creativity and losing sight of other aspects of creativity, such as creative ideational behavior, which has seldom been examined in previous studies.[10] Creative ideational behavior refers to the behavior shown in the process of one's "use of, appreciation of, and skill with ideas".[28] It has been found to be a significant predictor of many outcomes. For example, Paek et al conducted a study with over 200 elementary school students and found that ideational behavior explained variance in creative performance in six domains

after controlling grade and gender.[29] Although previous studies have shown that creative ideational behavior was significantly predicted by divergent thinking test scores,[30] divergent thinking tasks cannot measure creative ideational behavior because the former tasks provide information about the ideas produced by the individuals, or creative products, while the latter construct focuses on individual behaviors in daily life when individuals are engaged in creative ideational processes.

Besides the associations between schizotypy and creativity, researchers have also explored the mechanism of the association between the two variables. They suggested two main possible paths: one is related to cognitive processes[31] and the other to the motivational system.[6,22] The path of cognitive processes was supported by Wang et al,[31] which showed that overinclusive thinking and cognitive inhibition partially mediated the relationship. Many studies have shown significant relationships between schizotypy, creativity, and two motivational systems that determine the boundary between what individuals can do and what they actually do: Behavioral Inhibition System (BIS), or avoidance motivation (ie, the tendency to inhibit movement toward goals) and Behavioral Activation System (BAS), or approach motivation (ie, the tendency to engage in goal-directed efforts).[32,33] BIS/BAS was suggested to be associated with specific types of psychopathology and personality.[34,35] For instance, positive schizotypy was found to be positively correlated with novelty seeking[36] and openness to experience[37] and to be positively related to BAS.[38] On the other hand, negative schizotypy was found to be negatively related to BAS[38] but positively related to amotivation (eg, reward responsiveness).[39,40] Roskes et al[41] found that in real-life problem-solving tasks, individuals showed more flexibility or generated ideas in more categories when their approach motivation was activated, while they showed more persistence or switched less between categories when their avoidance motivation was activated. Dreu et al[42] demonstrated that trait behavioral activation assessed by the BIS/BAS scale positively predicted the performance in creativity tests, such as the Gestalt completion test, remote associates test, and problem-solving tasks, when global processing mode was primed.

To further examine the role of the motivational systems in the relationship between personality traits and creativity, Baas et al[43] proposed a dual-pathway creativity model (DPCM), which indicates that approach-related traits (eg, openness to experience, extraversion, positive affectivity) may facilitate creativity through cognitive flexibility, while avoidance-related traits (eg, negative affectivity and neuroticism) may facilitate creativity through cognitive persistence. That is, DPCM suggests that creative outcomes are a function of cognitive flexibility and cognitive persistence and that any trait or state may influence creativity through their effects on flexibility and/or persistence.[44,45] Recently, Baas et al[35] found that approach-related psychopathologies, such as positive schizotypy and hypomania, were positively related to divergent thinking, creative achievements, and self-rated creative behaviors, yet avoidance-related psychopathologies, such as anxiety, depressive mood, and negative schizotypy, had no association with creativity, and that both approach-related psychopathologies and creativity had high correlations ($r > 0.60$) with novelty approach measured by principal component of personal expansion and novelty seeking. It is worth noting that a few of the eight self-rated creative behaviors measured by the Janssen Creativity Scale were similar to creative ideational behaviors, such as coming up with original solutions for problems.

Despite the proposed relationships between schizotypy, BIS/BAS, and creativity, to our knowledge, no empirical study to date has examined how BIS/BAS moderates the connection between different dimensions of schizotypy and creative ideational behavior, which is a commonly overlooked aspect of creativity. This study aimed to address these gaps in the existing literature and provide more clarity about the relationships between specific dimensions of schizotypy and creative ideational behavior and provide insights into the broader examination of the moderation effects of the two motivation systems on the relationship between schizotypy and creativity and the underlying mechanism of this relationship. The findings of this study will have significant implications for treating individuals with schizophrenia at the early stages of illness[46] and enhancing creativity[31] as a behavioral activation activity to increase willpower.[47]

We aimed to answer the following two research questions:

1. Are there significant relationships between different dimensions of schizotypy, BIS/BAS, and creative ideational behavior?
2. Does BIS/BAS significantly moderate the relationship between schizotypy and creative ideational behavior?

Based on the literature, we proposed the following hypotheses:

Hypothesis 1: Positive Schizotypy is Positively Correlated with Creative Ideational Behavior.

Hypothesis 2: Negative Schizotypy is Negatively Correlated with Creative Ideational Behavior.

Hypothesis 3: Disorganized Schizotypy is Positively Correlated with Creative Ideational Behavior.

Hypothesis 4: Different Dimensions of Schizotypy are Significantly Correlated with BIS/BAS.

Hypothesis 5: BIS/BAS are Significantly Correlated with Creative Ideational Behavior.

Hypothesis 6: BIS/BAS significantly moderates the relationship between schizotypy and creative ideational behavior.

Method

Subjects

Undergraduate students were recruited as subjects of this study from two colleges in Shanghai, China. Individuals who self-reported a personal history of schizophrenia and other serious mental disorders, neurological disorders, head trauma in the past, and drug abuse and dependence were excluded from the study. A total of 392 students participated in the study and completed the questionnaires. The final valid questionnaires were 388 after excluding 4 students who did not complete all scales. In the final sample of the subjects, there were more female students (n = 333) than male students (n = 55). The mean age of the subjects was 20 (*SD* = 1.2). About 21% of the subjects were freshmen (n = 82), 23% were sophomores (n = 88), half were juniors (n = 195), and 6% were seniors (n = 23). Subjects' majors included nursing (n = 279), public health administration (n = 23), pharmacy (n = 16), cosmetology (n = 13), and political science (n = 57) (see Supplementary Material 1).

Measures

Schizotypal Personality Questionnaire (SPQ)[49] was used to measure schizotypy. It is one of the most widely used self-report schizotypy scales,[50] which is based on the diagnostic criteria for schizotypy in the Diagnostic and Statistical Manual of Mental Illness (DSM-III-R).[49,51] It has 74 items that include three factors and nine traits: positive schizotypy/cognitive-perceptual factors (implicating perceptions, strange thoughts, abnormal experiences, and paranoid; 33 items), negative schizotypy/interpersonal factors (paranoid, social anxiety, lack of close friends, contractionary emotions; 33 items), and disorganized factors (bizarre speech and bizarre behavior; 16 items).[52–55] Each item is based on a yes/no response format, and an item responded with a "yes" receives a score of 1, with the highest score of SPQ total being 74. A higher score indicates a more pronounced schizotypal trait. An example item was "I often hear a voice which speaks out what I think". Previous studies reported that the reliability of SPQ ranged from 0.82 to 0.91, and convergent and criterion-related validity were both 0.81[47]. Cronbach's α of SPQ in this study was 0.91.

Runco Ideational Behavior Scale (RIBS)[28] was used to assess creative ideational behavior. As the most widely used tool for evaluating creative ideational behaviors, the scale is based on the belief that ideas can be treated as the products of creative thinking and the behaviors reflect what an individual usually does in the process of generating ideas.[12,28,56] It includes 23 items that are based on a 5-point Likert scale (1-"Never", 5-"Very often"). A total score was calculated by summing 23 items, and a higher score indicates more frequency of creative ideational behavior. An example item was "I have some ideas about new inventions or how to improve things". RIBS was reported with excellent internal consistency (Cronbach's alpha = 0.92) and good validity evidence.[28] Cronbach's α of RIBS in this study was 0.91.

The Behavioral Inhibition/Activation System (BIS/BAS) Scales[32] was employed to measure motivation. BIS/BAS was developed based on Gray's BIS/BAS theory and focuses on two motivational systems: the BIS, which refers to avoidance motivation, and the BAS, which refers to approach motivation. The scale has been widely used in psychology and education.[42,57] It has 24 self-report items, including four filler items to balance the number of statements and prevent response biases, which is a common practice in psychological measurement.[58,59] The four filler items are as follows: 1) A person's family is the most important thing in life; 2) How I dress is important to me; 3) It's hard for me to find the

time to do things such as get a haircut; 4) I often wonder why people act the way they do.[60] The 20 items include 7 items of BIS and 13 items of BAS (5 items for Reward Response, 4 items for Drive and Pleasure Search separately). The responses were based on a 4-point Likert scale (1-"Very True for Me", 4-"Very False for Me"). An example item of the BIS scale was "I worry about making mistakes". An example item of the BAS scale was "I'm always willing to try something new if I think it will be fun". A total score of the BIS was calculated by summing 7 BIS items, and a total score of the BAS was calculated by summing 13 BAS items. A higher score indicates a higher level of behavior inhibition (avoidance motivation) or behavior activation (approach motivation). Previous studies reported that the scale had good reliability (0.73-0.88) and validity in clinical, non-clinical, and Chinese samples.[61,62] Cronbach's α of BIS and BAS in this study were 0.67 and 0.82, respectively.

Research Process

This study was approved by the Institutional Research Board at the East China Normal University (No. HR2014/12,008) and complied with the Declaration of Helsinki. With the class instructors' consent, the researcher went to college classrooms during the class break, introduced the study, and administered the paper questionnaires to students who were interested in the study. The subjects signed a written consent form before completing the questionnaires, which were all translated into Chinese versions. The whole process took about 20 minutes, and each subject received a small gift that was worth about $1 as compensation for their time. The questionnaire was collected, and the data was entered into an Excel spreadsheet.

Statistical Analyses

Analyses were conducted using IBM SPSS 28 and RStudio 2023.12.1. The missing values only account for 5% of the sample and were missing completely at random. Listwise deletion was used in hierarchical linear regression (HLM) analysis in IBM SPSS and the full information maximum likelihood (FIML) approach was used in the moderation analysis in RStudio.[63] Bivariate Pearson correlation coefficients were first computed for the relationships between different dimensions of schizotypy, BIS/BAS, and creative ideational behavior measured by RIBS. Hierarchical linear regression was performed to explore the effects of the positive/disorganized dimension, BIS/BAS, and their interactions on creative ideational behavior. After a significant interaction was found, we further examined the moderation effects of BIS/BAS by using sem (Structural Equation Models) 3.1.15 package in RStudio[64] and tested the conditional effect of the positive/disorganized dimension with both the pick-a-point estimation technique and Johnson-Neyman technique based on different levels of the moderator by using bruceR 0.8.5 package in RStudio[65] (see Supplementary Material 2). Following previous studies,[66,67] three points of the moderator were picked. Low BIS/BAS was represented by one standard deviation below the mean, medium BIS/BAS by the mean, and high BIS/BAS by one standard deviation above the mean.

Results

The Correlations Between Schizotypy, Creative Ideational Behavior, and BIS/BAS

Descriptive statistics of different dimensions of schizotypy, BIS/BAS, and creative ideational behavior are shown in Table 1. All three schizotypy components were significantly and positively related to the SPQ total score, with the correlation coefficients being all above 0.80. The positive schizotypy, or cognitive-perceptual dimension, was positively related to the negative schizotypy, or interpersonal dimension ($r = 0.597$, $p < 0.001$). The total score of SPQ ($r = 0.285$, $p < 0.001$), the cognitive-perceptual dimension ($r = 0.364$, $p < 0.001$), and the disorganized factor ($r = 0.325$, $p < 0.001$) were all positively correlated with RIBS. The interpersonal factor was not significantly related to RIBS. The total score of SPQ was positively correlated with BIS and BAS. Similarly, the cognitive-perceptual factor was positively correlated with BIS and BAS. The disorganized factor was also positively correlated with BIS and BAS. Interpersonal was only positively correlated with BIS (see Supplementary Material 3).

Table 1 Descriptive Statistics and Correlation Between Schizotypy, Creative Ideational Behavior and Motivation

	M	SD	1	2	3	4	5	6	7
1 SPQ total	23.48	12.06	–						
2 Cognitive-perceptual (Positive)	11.17	6.13	0.865**	–					
3 Interpersonal (Negative)	9.49	6.08	0.866**	0.597**	–				
4 Disorganized	4.76	3.47	0.815**	0.578**	0.605**	–			
5 BIS	20.22	3.02	0.396**	0.333**	0.398**	0.264**	–		
6 BAS	40.53	5.13	0.179**	0.220**	0.053	0.204**	0.246**	–	
7 RIBS	66.22	12.09	0.285**	0.364**	0.076	0.325**	0.050	0.486**	–

Note: **$p < 0.01$.
Abbreviations: SPQ, Schizotypal Personality Questionnaire; BIS, Behavioral Inhibition System; BAS, Behavioral Activation System; RIBS, Runco Ideational Behavior Scale.

The Moderating Effect of BAS

A three-step hierarchical linear regression analysis was performed to explore the effects of cognitive-perceptual and disorganized dimensions of schizotypy, BAS, and their interaction effect on RIBS, or the dependent variable, after controlling the effects of participants' demographic backgrounds, including gender and age. Negative schizotypy, or interpersonal dimension, was not included in the analysis because it was not significantly correlated with the dependent variable. Gender (Men = 1, Women =2) and age ($M = 20.3$, $SD = 1.2$) were entered in Step 1. Two major predictors, the cognitive-perceptual /disorganized dimension of schizotypy and BAS, were entered in Step 2. The interaction between the cognitive-perceptual and disorganized dimensions of schizotypy and BAS was entered in Step 3. Results from Tables 2 and 3 showed that gender, but not age, significantly predicted RIBS in Step 1. In Step 2, both the cognitive-perceptual and disorganized dimensions of schizotypy and BAS predicted RIBS, and extra variance explaining the dependent variable was significant with the addition of these variables in the model (cognitive-perceptual as a predictor, $\Delta R^2 = 0.31$, $p < 0.001$; disorganized as a predictor, $\Delta R^2 = 0.29$, $p < 0.001$). In Step 3, the inclusion of the

Table 2 The Interaction Effect of Cognitive-Perceptual Factor and BAS on RIBS

Predictors	β	t	ΔR^2
Step 1			
Gender	−0.15	−2.85**	
Age	−0.06	−1.15	
	Model R^2 = 0.02, F (2,363) = 4.32*		0.02*
Step 2			
Gender	−0.18	−4.07***	
Age	−0.02	−0.47	
Cognitive-perceptual	0.26	5.98***	
BAS	0.44	9.96***	
	Model R^2 = 0.33, F (4,361) = 45.26***		0.31***
Step 3			
Gender	−0.17	−3.97***	
Age	−0.03	−0.67	
Cognitive-perceptual	−0.56	−1.73	
BAS	0.25	2.90**	
Cognitive-perceptual × BAS	0.89	2.57*	
	Model R^2 = 0.35, F (5,360) = 38.09***		0.04*

Notes: Gender was coded as 2 = women, 1 = men; All variables were standardized; *$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.
Abbreviations: Cognitive-perceptual, Cognitive-perceptual factor in Schizotypal Personality Questionnaire; BAS, Behavioral Activation System; RIBS, Runco Ideational Behavior Scale.

Table 3 The Interaction Effect of Disorganized Factor and BAS on RIBS

Predictors	*β*	t	ΔR^2
Step 1			
Gender	−0.15	−2.83**	
Age	−0.06	−1.19	
	Model R^2 = 0.02, F (2,364) = 4.29*		0.02*
Step 2			
Gender	−0.17	−3.81***	
Age	−0.04	−0.94	
Disorganized	0.23	5.09***	
BAS	0.45	10.02***	
	Model R^2 = 0.31, F (4,362) = 41.48***		0.29***
Step 3			
Gender	−0.17	−3.87***	
Age	−0.04	−0.99	
Disorganized	−0.91	−2.80**	
BAS	0.26	3.64***	
Disorganized × BAS	1.20	3.54***	
	Model R^2 = 0.33, F (5,361) = 36.74***		0.02***

Notes: Gender was coded as 2 = women, 1 = men; All variables were standardized; *p < 0.05 **p < 0.01 ***p < 0.001.

Abbreviations: Disorganized, Disorganized factor in Schizotypal Personality Questionnaire; BAS, Behavioral Activation System; RIBS, Runco Ideational Behavior Scale.

interaction between the cognitive-perceptual and disorganized dimensions of schizotypy and BAS significantly explained extra, though a small, variance (cognitive-perceptual as a predictor, ΔR^2 = 0.04, p = 0.01; disorganized as a predictor, ΔR^2 = 0.02, p < 0.001). Taken together, the results showed a significant interaction effect of cognitive-perceptual and disorganized dimensions and BAS on RIBS.

The *sem* package was further used to test the moderation effect of BAS in the relationship between the cognitive-perceptual and disorganized dimensions and RIBS, with FIML being used to handle the missing values. Bootstrap was used 1000 times. Results showed that the effects of the cognitive-perceptual dimension of schizotypy (β = 0.496, p < 0.001), BAS (β = 1.003, p < 0.001), and their interaction (β = 0.042, p = 0.020) were all significant. The effects of disorganized dimension (β = 0.801, p < 0.001), BAS (β = 1.018, p < 0.001) and the interaction between disorganized dimension and BAS (β = 0.094, p = 0.003) were all significant. Both models converged after 1 iteration, indicating a good model fit.

Further, we used both the pick-a-point estimation technique and the Johnson-Neyman (J-N) technique[67] to test the conditional effects of cognitive-perceptual and disorganized dimensions based on various levels of BAS. As a continuous moderator, three points of BAS were picked. Results showed that cognitive-perceptual dimension was positively associated with RIBS score for high BAS group (β = 0.721, t = 6.607, p < 0.001, 95% CI [0.507, 0.936]), medium BAS group (β = 0.513, t = 5.981, p < 0.001, 95% CI [0.344, 0.682]), and low BAS group (β = 0.305, t = 2.594, p = 0.010, 95% CI [0.074, 0.536]). Disorganized dimension was positively associated with RIBS score for high BAS group (β = 1.265, t = 6.671, p < 0.001, 95% CI [0.892, 1.638]) and medium BAS group (β = 0.810, t = 5.425, p < 0.001, 95% CI [0.516, 1.103]) but not low BAS group (β = 0.354, t = 1.724, p = 0.086, 95% CI [−0.050, 0.758]).

The general level of RIBS was also plotted against the cognitive-perceptual dimension (see Figure 1) and the disorganized dimension (see Figure 2) for low, medium, and high BAS groups separately. To further show how the main effect varies across the full range of the values of the moderator, the J-N technique was also used. The results showed that when BAS was outside the interval [−3.05, 34.76], the slope of the cognitive-perceptual dimension was

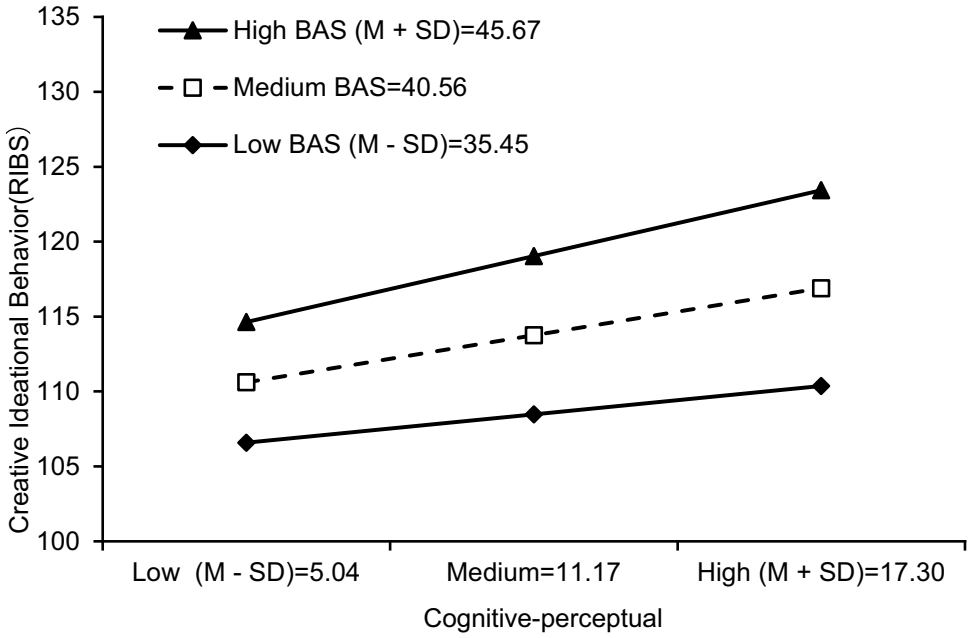

Figure 1 The pick-a-point simple slopes of the regression of creative ideational behavior on cognitive-perceptual factor of schizotypy at high, medium, and low levels of BAS.

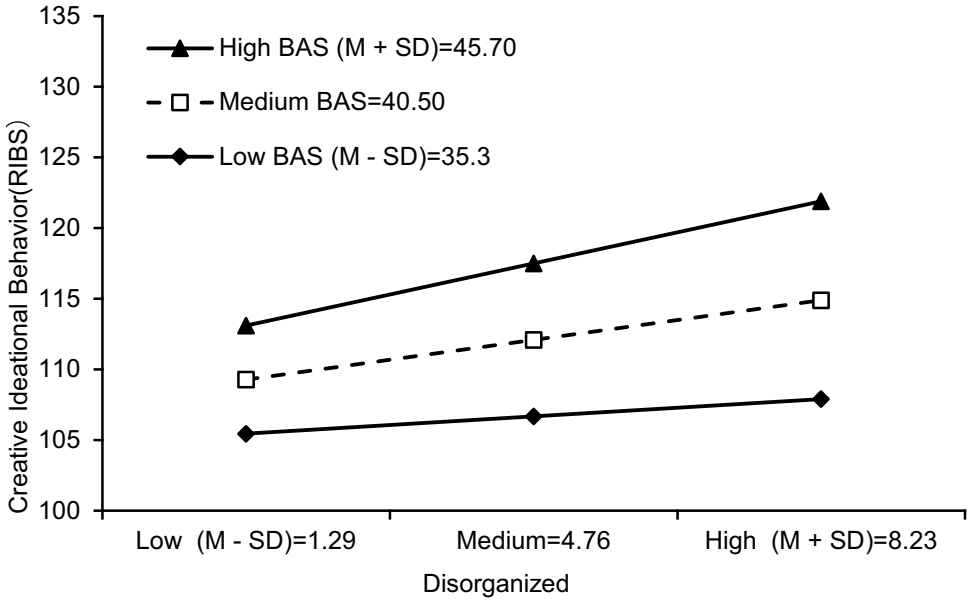

Figure 2 The pick-a-point simple slopes of the regression of creative ideational behavior on disorganized factor of schizotypy at high, medium, and low levels of BAS.

significant ($p < 0.05$); when BAS was outside the interval [19.69, 36.12], the slope of the disorganized dimension was also significant ($p < 0.05$, see Figure 3). These results indicated that as BAS increased, the significantly positive relationship between the cognitive-perceptual and disorganized dimensions of schizotypy and RIBS became stronger. Overall, BAS positively moderated the relationship between the cognitive-perceptual dimension of schizotypy and creative ideational behavior and the relationship between the disorganized dimension of schizotypy and creative ideational behavior.

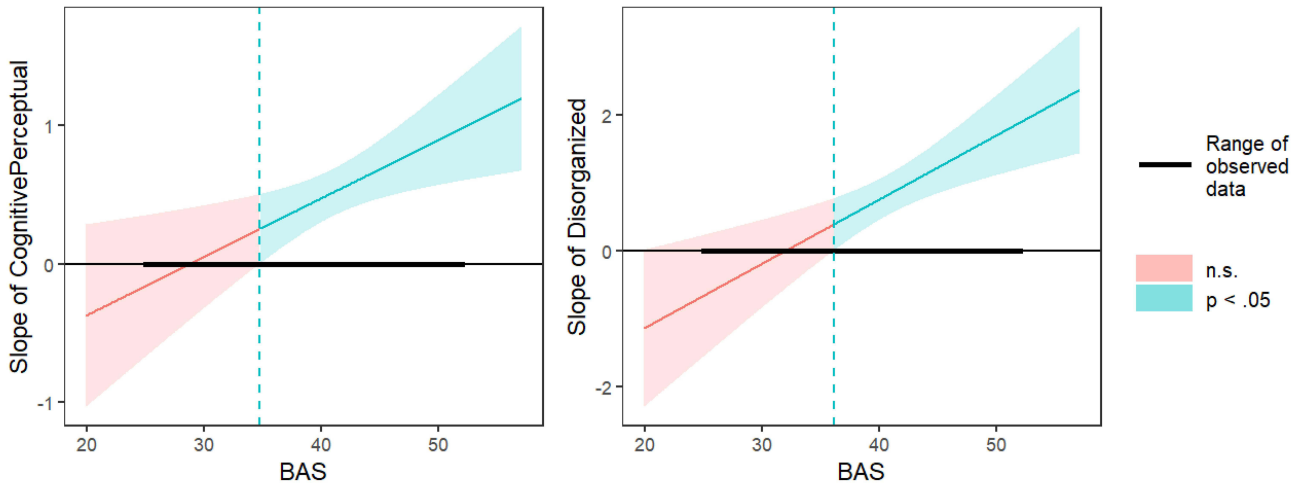

Figure 3 Johnson-Neyman plot for the conditional relation between cognitive-perceptual (Left)/disorganized (Right) factor of schizotypy and creative ideational behavior (RIBS) as a function of BAS.

The Moderating Effect of BIS

The same three-step hierarchical linear regression analysis used earlier was also employed to explore the effects of the cognitive-perceptual and disorganized dimensions of schizotypy, BIS, and their interaction effects on RIBS, after controlling the effects of participants' gender and age. Results in Tables 4 and 5 showed that gender significantly predicted RIBS in Step 1. In Step 2, cognitive-perceptual and disorganized dimensions significantly predicted RIBS (cognitive-perceptual as a predictor, $\beta = 0.39$, $p < 0.001$; disorganized as a predictor, $\beta = 0.32$, $p < 0.001$), while BIS did not (cognitive-perceptual as

Table 4 The Interaction Effect of Cognitive-Perceptual Factor and BIS on RIBS

Predictors	*β*	t	ΔR^2
Step 1			
Gender	−0.13	−2.54*	
Age	−0.07	−1.37	
	Model R^2 = 0.02, F (2,373) = 3.67*		0.02*
Step 2			
Gender	−0.13	−2.71**	
Age	−0.03	−0.63	
Cognitive-perceptual	0.39	7.54***	
BIS	0.06	−1.23	
	Model R^2 = 0.15, F (4,371) = 16.82***		0.13***
Step 3			
Gender	−0.13	−2.71***	
Age	−0.03	−0.63	
Cognitive-perceptual	−0.42	1.28	
BIS	0.05	−0.53	
Cognitive-perceptual × BIS	0.04	−0.10	
	Model R^2 = 0.15, F (5,370) = 13.43***		<0.01

Notes: Gender was coded as 2 = women, 1 = men; All variables were standardized; *p < 0.05 **p < 0.01 ***p < 0.001.

Abbreviations: Cognitive-perceptual, Cognitive-perceptual factor in Schizotypal Personality Questionnaire; BIS, Behavioral Inhibition System; RIBS, Runco Ideational Behavior Scale.

Table 5 The Interaction Effect of Disorganized Factor and BIS on RIBS

Predictors	β	t	ΔR^2
Step 1			
Gender	−0.14	−2.63**	
Age	−0.07	−1.37	
	Model R^2 = 0.02, F (2,374) = 3.89*		0.02*
Step 2			
Gender	−0.11	−2.24*	
Age	−0.06	0.25	
Disorganized	0.32	6.30***	
BIS	−0.03	−0.53	
	Model R^2 = 0.12, F (4372) = 12.48***		0.09***
Step 3			
Gender	−0.11	−2.27***	
Age	−0.06	−1.16	
Disorganized	0.02	0.0	
BIS	−0.09	−1.16	
Disorganized × BIS	0.33	1.07	
	Model R^2 = 0.12, F (5,371) = 10.22***		<0.01

Notes: Gender was coded as 2 = women, 1 = men; All variables were standardized; *p < 0.05 **p < 0.01 ***p < 0.001.

Abbreviations: Disorganized, Disorganized factor in Schizotypal Personality Questionnaire; BIS, Behavioral Inhibition System; RIBS, Runco Ideational Behavior Scale.

a predictor, $\beta = -0.06$, $p = 0.218$; disorganized as a predictor, $\beta = -0.03$, $p = 0.596$). The model significantly explained the extra variance in the dependent variable (cognitive-perceptual as a predictor, $\Delta R^2 = 0.13$, $p < 0.001$; disorganized as a predictor, $\Delta R^2 = 0.09$, $p < 0.001$). In Step 3, the inclusion of the interaction between the cognitive-perceptual and disorganized dimensions of schizotypy and BIS did not significantly explain the extra variance (cognitive-perceptual as a predictor, $\Delta R^2 < 0.01$, $p = 0.920$; disorganized as a predictor, $\Delta R^2 < 0.01$, $p = 0.284$). Taken together, the results showed that no significant moderation effect of the BIS on the relationship between cognitive-perceptual and disorganized dimensions of schizotypy and RIBS.

Discussion

This study found a positive relationship between the cognitive-perceptual dimension of schizotypy or positive schizotypy, and creative ideational behavior, which supports Hypothesis 1. This finding is consistent with that of previous studies. Rust et al,[68] for example, found that a higher score that an individual has on the schizotypy scale was significantly related to higher originality and fluency scores of creative ideas. Schuldberg et al[69] also demonstrated that individuals with higher scores of unusual perception and magical thinking that characterize positive schizotypy were more likely to score higher on the Barron-Welsh Art Tendency Scale and the Creative Personality Scale.

This study did not find a significant correlation between negative schizotypy and creative ideational behavior, which does not support Hypothesis 2. The result was consistent with previous research, which also did not find significant negative relationships between negative schizotypy (Introvertive Anhedonia) and creativity.[9,26] This study, however, found a significant positive correlation between disorganized schizotypy and creative ideational behavior, which supports Hypothesis 3. The same finding was reported in previous research. For example, Hedley[19] reported a positive correlation between disorganized schizotypy and both average creativity and fluency scores of ideas generated from AUTs among first-year undergraduate students. Creative ideas or behaviors are often regarded as deviant and unreasonable.[70] Our

result may suggest that bizarre behavior displayed in people with schizotypy shares common characteristics with individuals with creative ideational behavior.

This study also showed that schizotypy was significantly correlated with both BAS and BIS, which supports Hypothesis 4. Similarly, Pastor et al[71] found that schizotypal personality disorder was positively associated with BAS and BIS. Karoly et al[72] also reported a higher level of BIS in the high schizotypy group than in the low schizotypy group. This result can also be understood from the theoretical framework of BIS/BAS. BIS and BAS are considered two separate systems because they have different neural system bases, and an individual's sensitivity to them can exist independently. Therefore, a combination of high or low BAS/BIS can occur in particular groups of people.[32] This study further found that BAS was positively correlated with creative ideational behavior, which supports Hypothesis 5. The same finding was also reported in previous studies. Hao et al[73] found greater creative tendencies of malevolent creativity in high BAS individuals and lower creative tendencies in low BAS individuals. The literature also suggests that approach motivation may enhance creativity through processing style, attention flexibility, and memory search. Friedman and Förster[74] reported enhanced insight problem solving and more creative idea generation in people with approach motivation. They explained that approach motivation may enhance creativity through a more adventurous processing style and more memory searches for novel reactions. A subsequent study by the same researchers[75] also showed that approach motivation increased the flexibility of attention and the ability to shift attention focus based on task requirements.

Most importantly, this study found a significant moderation role of BAS in the relationship between positive schizotypy and creative ideational behavior, which partially supports Hypothesis 6. These results provide empirical evidence to support the combined effect of positive schizotypy and the motivational system, which indicates the important role of the motivational system in mental illnesses or disorder tendencies and creativity.[57] It further substantiates Baas's proposition that mental illness or disorder tendencies with high approach-related traits (eg mania, positive schizotypy) would benefit creativity through the effect of the behavioral approach system.[57] The facilitative function of the motivational approach system on creativity also has a biological basis because the dopamine system was reported as a positive predictor of divergent and convergent thinking.[38] Previous studies and our study altogether suggest that the motivational approach system of high schizotypy people is more sensitive to external circumstances, which may help them experience a more creative state and show more creative ideational behaviors in their daily lives.

Unexpectedly but interestingly, this study also found that disorganized schizotypy was positively correlated with BIS and BAS and that BAS significantly moderated the relationship between disorganized schizotypy and creative ideational behavior. Though the literature consistently found that positive schizotypy and negative schizotypy were positively or negatively related to BAS, respectively,[38] research on the relation between disorganized schizotypy and BAS was scant. The mechanism underlying the significant interaction effect of disorganized schizotypy and BAS on creative ideational behavior may be that disorganized schizotypy is associated with a stronger approach sensitivity toward novelty. Moreover, this study further showed that disorganized schizotypy was positively associated with RIBS for high and medium BAS groups, but not the low BAS group. These may indicate that people with disorganized schizotypy need BAS to promote creative ideational behavior; otherwise, disorganized thoughts may be just bizarre speech or behavior.

There are a few limitations in this study. First, the sample only included undergraduate students and an overwhelming number of females in China, which limited the generalizability of the findings. Future studies can be conducted with samples in different cultures or clinical samples. Second, subjects' personal history of mental disorders was self-reported in this study. Future studies can use other measures to assess personal history. Third, this study was just a cross-sectional study. The verified moderation effect of BAS does not suggest any causality relationship. Experimental studies should be conducted in the future to support the cause-and-effect relationships among the variables. Further, considering the mediation roles of overinclusive thinking and cognitive inhibition in the relationship between schizotypy and creativity in previous studies,[31] more studies are needed in the future to examine the combined effects of motivation and cognition or the moderated mediation model of all the variables.

Conclusion

This study examined the relationship between schizotypy, motivational system, and creative ideational behavior. The results supported the hypotheses that positive schizotypy was positively correlated with creative ideational behavior and

approach motivation (BAS), that approach motivation was positively correlated with creative ideational behavior, and that approach motivation significantly moderated the relationship between positive dimension of schizotypy and creative ideational behavior. This study also found that the disorganized dimension of schizotypy was positively correlated with creative ideational behavior and approach motivation (BAS), and that approach motivation significantly moderated the relationship between disorganized schizotypy and creative ideational behavior. It, however, did not find a significant relationship between negative schizotypy and creative ideational behavior, or the significant moderation effect of avoidance motivation (BIS) on the relationship between different dimensions of schizotypy and creative ideational behavior. The results of this study will help researchers, counselors, and healthcare professionals understand the importance of approach motivation in schizotypy and creative research.

Funding

This study was funded by the Shanghai Municipal Educational Science Research Program (C2-2020014) to Lixia Wang. This study was also supported by the funding from Shanghai Humanities and Social Sciences Key Research Base of Psychology (13200-412224-18093).

Disclosure

The authors report no conflicts of interest in this work.

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