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Mediator Effects of Cognitive and Affective Empathy on the Relationship Between Schizotypal Symptoms and Social Anxiety/Avoidance Levels

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ABSTRACT

Objective: This study aims to examine the relationship between the levels of social anxiety and social avoidance as an indicator of social functioning with positive and negative schizotypal symptoms in a non-clinical sample. In addition, the mediating effects of cognitive and affective empathy between these variables will also be examined.

Methods: A sample of 133 men and 214 women participated in the study. Schizotypal symptoms were assessed with Schizotypal Personality Scale, social anxiety and social avoidance levels were assessed with Liebowitz Social Anxiety Scale, cognitive empathy was assessed with Reading Mind in The Eyes Test, and affective empathy was assessed with the Pictorial Empathy Test. Pearson correlation analysis was used for testing the significant correlations between the variables and the mediator effects were examined with PROCESS developed by Hayes.

Results: Correlation analysis revealed that all variables were significantly correlated. While cognitive empathy has partial mediator effect between negative schizotypal symptoms and social anxiety and avoidance levels (95% CI = [0.01, 0.11]), affective empathy has full mediator effect on this relationship (95% CI = [0.18, 0.41]). Despite the presence of a predictive effect of positive schizotypal symptoms on social anxiety and avoidance levels, affective and cognitive empathy have no mediator effects between these variables.

Conclusion: The findings suggest that the relationship between negative schizotypy and social anxiety and avoidance as indicators of social functioning is attributable to deficits in social cognitive functions. However, the lack of these mediator effects for positive schizotypy clearly demonstrates that individuals with different schizotypy traits show different profiles of social cognitive abilities and point out the importance of differentiating subtypes of schizotypy both in clinical and experimental settings.

Keywords: Schizotypal symptoms, affective empathy, cognitive empathy, social cognitive functions

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INTRODUCTION

Empathy is a higher-order cognitive ability of humans and it is thought to be comprised of 2 dimensions, namely, affective and cognitive empathy.[1-3] While cognitive empathy is an ability related to understanding and interpreting other people's minds, thoughts, and intentions, affective empathy is an ability related to sharing other people's emotions and feelings.[3] This 2-dimensional structure

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of empathy is supported by the findings of neuroimaging studies. During the empathy tasks, the medial prefrontal cortex, temporoparietal sulcus, and temporal pole were the active areas of the brain together with the amygdala, anterior and posterior cingulate cortex, and para-cingulate cortex which are the structures responsible for emotion processing.[4]

Dysfunctions in social cognitive functions were observed in patients with damages to brain areas which are thought to be related to cognitive and affective types of empathy.

There are also study findings which demonstrate the social cognitive dysfunctions of individuals diagnosed with psychiatric disorders such as high functioning autism[1] or psychotic disorders.[5-7] Among these groups, a large majority of the research had focused on individuals diagnosed with schizophrenia.[8] In a study examining the 2 dimensions of empathy in schizophrenia patients, the patient group's performance was worse than the control group's only for cognitive empathy. These behavioral findings have also supported the 2-dimensional structure of empathy.[9,10] Although many studies are examining the social cognitive functions of individuals diagnosed with schizophrenia, the relationship between the impairments in empathy and underlying psychopathology was rarely examined. A few existing literature findings reveal mixed results.[9-12] While some of the studies involving self-report measurements of empathy found no relationship with the symptom levels,[9] some found significant relationships between the negative schizotypal symptom levels and empathy in patients.[11,12]

In studies with clinical samples, different patient characteristics such as duration of the illness and applied treatments might have different effects on the cognitive abilities. Therefore, discrepancies between different studies' findings were explained by these diverse clinical features of the patient samples.[9,10] Studying un-diagnosed individuals with pre-clinical symptoms, eliminate the effects of these confounding clinical variables. For this reason, individuals with schizotypal symptoms are among the most studied ones. Schizotypal personality disorder is characterized by mild symptoms similar to those observed in schizophrenia patients. Schizotypal symptoms are categorized as positive and negative and those 2 clusters of symptoms might be observed concurrently or in some cases, one of them might be observed more severely than the other.[13] Within the current literature, only a few studies had examined the 2 sub-types of empathic abilities in different schizotypy traits. In one study, it had been shown that positive schizotypy was associated with poor cognitive empathy, whereas negative schizotypy was found to be associated with both cognitive and affective empathy.[14] Thakkar and Park[15] also found that reduced cognitive and affective empathic abilities were associated with elevated levels of negative schizotypy.

The relationship between schizotypal symptoms and social dysfunctions might be mediated by social cognitive functioning. According to the results of a review study which included 15 studies that examined this hypothesis, social cognitive functions have a mediator role between negative schizotypal symptoms and social functions.[16] Studies examining the empathic abilities either by measurements of self-report questionnaires or by behavioral tasks found that lower levels of empathic abilities are related to heightened levels of negative schizotypal symptoms.[14,16]

Social functioning of schizophrenia patients relies on their social cognitive functions.[17-19] As expected, schizotypal symptoms are related to dysfunctions in social functioning, and dysfunctions in social functioning are closely related to social anxiety.[20,21] On the other hand, social dysfunction related to social anxiety is also associated with impairments in empathy.[21] High levels of empathy positively affect interpersonal relations and hence improve social functioning.[22] This was supported by the findings revealing a positive correlation between empathy levels and social functioning.[23] In addition, given that the claim that positive and negative schizotypal symptoms have different underlying neurobiological mechanisms, social behaviors, as behavioral outcomes of these 2 types of symptom groups might be related to different types of social cognitive functions. In a study, the relationship of schizotypy with 2 dimensions of empathy and with social functioning was examined separately and a partial mediating role of cognitive empathy in this relationship was found.[24] In another study, although a relationship was found between schizotypy and social functioning, empathy was found to have no mediator effect on this relationship.[25] On the other hand, social functioning is highly correlated with social anxiety and social anxiety is the most frequently reported comorbid anxiety disorder in patients with schizophrenia.[26-28] It is also reported that the changes in social anxiety levels directly affect the functional outcomes of patients with schizophrenia.[29]

However, the relationship between social anxiety and schizotypy is not clear. Although studies revealed contradictory findings regarding the relationships between different schizotypal traits and social anxiety[30-33], in some studies, social anxiety was also found as being a separate factor of schizotypy.[34,35]

It is important to examine whether empathic abilities might play a role as a latent factor in the social functioning deficits observed in individuals with schizotypal symptoms. It is generally assumed that schizotypy is a personality construct that can be presented as a determinant of a predisposition to develop schizophrenia, and therefore, individuals with high schizotypal traits might be at heightened risk for the later development of schizophrenia.[36] Examining the deficits in social cognitive functions of individuals with schizotypal symptoms would provide a better understanding of schizophrenia such as whether impairments in empathy would precede the onset of the disorder and findings on this question might provide diagnostic information that can be useful in clinical evaluations. In addition, empathy tasks might be included in both behavioral and cognitive rehabilitation programs in order to improve patients' social functioning.

In the present study, it was hypothesized that both the levels of positive and negative schizotypal symptoms would show positive correlations with the levels of social anxiety and avoidance as indicators of social functioning in healthy individuals. In addition, the mediating effects of cognitive and affective empathic abilities in the relationship between the schizotypal symptoms and social anxiety and avoidance levels will also be examined separately for positive and negative symptoms of schizotypy. For this purpose, schizotypal symptoms were measured with a self-report questionnaire. Items in the social functioning questionnaires are generally composed of statements demonstrating the social behaviors of schizophrenia patients and it was assumed that using these questionnaires on a non-clinical sample would reduce the validity of measurement. For this reason, the social anxiety and avoidance scale was used instead. Cognitive and affective empathy was examined separately with behavioral tasks. It was hypothesized that there would be positive correlations between the positive and negative schizotypy scores and social anxiety and avoidance levels. It was also hypothesized

that the significant relationships between these variables would be mediated by cognitive and affective empathy. Based on the literature, mediator effects of both the affective and cognitive empathy seem possible both on negative and positive schizotypy. Thus, no a priori hypothesis was specified concerning the type of empathy or schizotypy.

METHODS

Measures

Schizotypal Personality Questionnaire: Schizotypal Personality Questionnaire (SPQ) was developed by Raine[37] and the reliability and validity study of the Turkish form was conducted by Şener et al.[38] The questionnaire includes 74 yes/no typed answering items. Schizotypal Personality Questionnaire includes 3 correlated higher-order factors, namely, interpersonal, cognitive–perceptual, and disorganized, which in turn are indicated by 7 sub-factors. The interpersonal higher-order factor includes no close friends (CF), constricted affect (CA), and social anxiety (SA). The cognitive–perceptual higher-order factor includes ideas of reference (IR), suspiciousness (SU), magical thinking (MT), and unusual perceptions (UP). The disorganized higher-order factor includes: eccentric behavior (EB) and odd speech (OS). This 3-factor solution can also be reduced to 2 factors as positive schizotypy (PS) and negative schizotypy (NS). According to this 2-factor solution, cognitive–perceptual and disorganized factors constitute the PS; interpersonal factor corresponds to NS. Answering "yes" to an item is scored as 1 point and "no" to an item is scored as "0." Higher scores on these factors indicate higher levels of schizotypal behavior. In the present study, PS and NS scores are used for evaluation. For this study, Cronbach alpha coefficients for PS and NS were 0.88 and 0.88, respectively.

Liebowitz Social Anxiety Scale: The Liebowitz Social Anxiety Scale (LSAS) assesses the individuals' level of anxiety and their avoidance behaviors in situations involving social interaction. The scale includes 24 items with 4-point Likert-type questions, which are divided into 2 subscales. Adaptation[39] and validity and reliability studies[40] of Turkish versions were conducted. For the present study, the Cronbach alpha coefficient for social anxiety scores is 0.82, and the Cronbach alpha coefficient for social avoidance scores is 0.88. Although scores for social anxiety and social avoidance sub-scales can be obtained seperately; in present study, only the total scores of LSAS were used in analyses.

Reading the Mind in the Eyes Test: The Reading the Mind in the Eyes Test (RMET)[41] is mostly used for assessing the theory of mind (ToM), the social cognition mechanism which forms the root of empathy. Given the similarities between the theoretical explanations of cognitive empathy and ToM, these 2 terms are used interchangeably in literature.[42] For this reason, RMET was used as a psychometric tool for measuring both ToM and cognitive empathy.[43,44] In the present study, the test is used to assess cognitive empathy. The Reading the Mind in the Eyes Test includes 32 items with an additional practice item. Each test item is a black and white photograph that depicts an eye expression related to a specific emotional and cognitive state of the person on the photograph, and under each of the items, there are 4 words. One of these words is the target word which states the thoughts and feelings of the person in the photograph. The participant is required to choose the target word regarding that item to get a point. To ensure that participants can understand the terms, they initially read through a glossary of definitions, and they were permitted to return this glossary at any point during the test in case they do not know the exact definition of any of the terms. Before the test, participants were asked to respond as quickly as possible, but response times are not limited. For each correct choice, the participant gets 1 point, so the maximum score that can be obtained from this test is 32. Higher scores on this test indicate higher cognitive empathy skills. Validation and reliability study of the Turkish form was conducted by Yıldırım et al.[45]

Pictorial Empathy Test: Pictorial Empathy Test (PET) is a short and easy-to-use test developed by Lindeman, Koirikivi, and Lipsanen[46] for assessing affective empathy skills. The participants are presented with 7 sequential photographs of individuals in distress. Two of the photographs were of women, 2 were men, 2 were boys, 1 photograph depicted a girl, and 1 depicted a baby whose sex was not identifiable in the photograph. Illustrations of the 7 photographs can be found in the Appendix. The original photographs can be loaded from the links provided in the Appendix. The participants are asked "How emotionally moving do you find the photograph?" (1 = not at all, 2 = a little bit; 3 = it arouses some feelings, 4 = quite a lot, 5 = very much). To obtain a total PET score, a mean score of the responses was calculated as in the original study. The photographs had been downloaded from Wikimedia Commons with the highest resolution and reflected on a computer screen. Participants select their responses and marked them on a rating scale on a sheet of paper in front of them. The Cronbach alpha coefficient is 0.78 for the present study.

Since there is no reliability and validity study of a Turkish version of this test, all participants were given The Empathy Quotient (EQ) which was developed by Baron–Cohen and Wheelwright[47] and the relationship between the scores of the emotional empathy sub-scale items and RET total scores was analyzed by Pearson correlation analysis. Turkish adaptation study of the EQ was carried out by Baysan-Arabacı.[48] A moderate, significant correlation was found between the 0 test scores ($r = 0.621$, $P = .003$).

Procedure

Participants comprised university students who were from different departments of the same university. Students were informed through the collaboration of departments' chairs regarding the research and inclusion criteria, and participants with no psychiatric and neurological disease and with no psychological or neurological pharmacological treatment in their past or during the time of the study were reached. Students who were willing to participate in the study contacted the researchers. The participants were divided into groups of 5 and sessions were scheduled according to the research hours. All sessions were conducted in researcher's office at the university. Participants were given EQ, LSAS, SPQ, and REMT. The session took approximately 1 hour for each group. Totally 396 participants with written informed consent were included in the study. After checking for normality assumptions, 22 participants' data were excluded for having extreme values in LSAS. According to the results of the remaining 374 participants' data analysis, the skewness and kurtosis coefficients were between −1.5 and +1.5. Therefore, parametric statistical tests were used for testing the hypotheses.[49,50]

There were 133 men and 241 women in the study sample. There was no significant difference between the ages of women (21.95 ± 4.08) and men (22.31 ± 5.29). Among 374 student participants, 196 of them were from the psychology department, 54 of them were from the computer engineering department, 60 of them were from the

Table 1. Different Test Scores of Men and Women

	Women (N=241)	Men (N=133)	*t*	*p*
Reading The Mind in The Eyes Test	24.02 ± 2.99	24.83 ± 2.97	−1.78	.076
Pictorial Empathy Test	23.64 ± 7.04	24.65 ± 7.08	−0.93	.351
Liebowitz Social Anxiety and Social Avoidance Total	88.38 ± 21.37	85.09 ± 19.38	1.06	.291
Negative Schizotypal Symptoms	17.43 ± 16.57	9.02 ± 7.87	0.66	.505
Positive Schizotypal Symptoms	12.40 ± 7.04	11.66 ± 6.55	0.71	.473

business administration department, and 64 of them were from the architecture department.

Statistical Analysis

International Business Machines Statistical Package for the Social Science (SPSS) Statistics for Windows, version 24 (IBM Corp., Armonk, NY, USA) was used for data analyses. The group differences were examined by independent *t*-sample test, relationships between the variables were examined with Pearson correlation analysis, and mediation analyses were conducted with the model 4 template of SPSS macro extension PROCESS.[51] In this method, total mediation effect models were fitted through a series of regression analyses. First, the predicting effects of positive schizotypy scores on cognitive and affective empathy scores were analyzed separately. Then, the predicting effects of empathy scores on social anxiety and avoidance levels were analyzed separately for cognitive and affective empathy. Finally, predictor effect of positive schizotypy on social anxiety and avoidance levels was analyzed. The same series of analyses were also conducted on same variables except for the change in which positive schizotypy was replaced with negative schizotypy as independent variable.

RESULTS

Different Gender Scores

To determine if gender would be included in the model as a control variable, all test scores were compared across gender groups and no significant differences were found between men and women in neither of the test scores (Table 1).

Table 2. Correlations Across Variables

	Mean±SD	1	2	3	4	5
1	24.18 ± 6.97	1				
2	12.05 ± 6.81	−0.943*	1			
3	17.02 ± 8.48	−0.557*	0.628*	1		
4	24.40 ± 3.0	0.324*	−0.295*	−0.265*	1	
5	86.81 ± 20.45	−0.531*	0.554*	0.275*	−0.215*	1

*Correlation is significant at .01 level

1, Pictorial Empathy Test; 2, positive schizotypal symptoms; 3, negative schizotypal symptoms; 4, Reading the Mind in the Eyes Test; 5, Liebowitz Social Anxiety and Avoidance Scale Total Score.

Correlations Between Test Scores

Pearson correlation analysis was usedr to test for correlations between test variables. The results revealed significant correlations between PET and SPQ Negative Symptoms ($r=-0.55$, $P=.00$); RMET and SPQ Negative Symptoms ($r=-0.26$, $P=.00$); SPQ Negative Scores and Liebowitz social Anxiety and Avoidance Scores ($r=0.27$, $P=.00$); PET and SPQ Positive Scores ($r=-0.94$, $P=.00$), RMET scores and PET scores ($r=0.32$, $P=.00$), PET and Liebowitz Social Anxiety and Avoidance Scores ($r=-0.53$, $P=.00$), SPQ Negative Scores and SPQ Positive Scores ($r=0.62$, $P=.00$), SPQ Positive Scores and REMT ($r=-0.29$, $P=.00$), SPQ Positive Scores and Liebowitz Social Anxiety and Avoidance Scores ($r=0.55$, $P=.00$); and finally REMT and Liebowitz Social Anxiety and Avoidance Scores ($r=-0.21$, $P=.00$) (Table 2).

Mediating Effects of Cognitive and Affective Empathy on the Relationship Between Positive and Negative Schizotypal Symptoms and Social Anxiety and Avoidance Levels

Mediating effects of the empathy skills on the relationship between schizotypal symptoms and social anxiety levels were analyzed separately for both cognitive and affective empathy and separately for both positive and negative schizotypy (Table 3).

According to the results of mediation analyses, the effect of positive schizotypy on the social anxiety and avoidance levels is not mediated via cognitive or affective empathy. However, the effect of negative schizotypy on social anxiety and avoidance levels is mediated via both the cognitive and affective empathy.

As demonstrated in Table 3, the total effect ($B=0.27$, $SE=0.07$, $P<.001$) of negative schizotypal symptoms on social anxiety and avoidance levels is reduced with the inclusion of cognitive empathy to the model ($B=-0.22$, $SE=0.07$) (direct effect). The total effect of negative schizotypal symptoms ($B=0.27$, $SE=0.07$, $P<.001$) on social anxiety and avoidance levels is reduced to a non-significant level with the inclusion of affective empathy to the model ($B=-0.006$, $SE=0.08$) (direct effect). While cognitive empathy has a partial mediator effect on the relationship between negative schizotypal symptoms and social anxiety and avoidance levels (95% CI=[0.01, 0.11]), affective empathy has a full mediator effect on the same relationship (%95% CI=[0.18, 0.41]). According to the bootstrapped confidence intervals, if 0 does not occur between the LL and the UL, then it can be concluded that the indirect effect is significant. Sobel test[52] also supported the significance of mediating effects (for cognitive empathy $z=2.23$, $P=.025$; for affective empathy $z=4.15$, $P<.001$). Figure 1 and Figure 2 show the paths regarding the mediator models.

The partial mediating effect of cognitive empathy on the relationship between negative schizotypy and social anxiety and avoidance

Table 3. Analysis Regarding the Mediator Effects of Affective and Cognitive Empathy Scores Between Positive and Negative Schizotypal Symptoms and Social Anxiety and Avoidance Levels

Predictor	Total Effect (Path c)	Direct Effect (Path c')	Indirect Effect (Path ab)	CI	Sobel Test
Positive schizotypal symptoms	0.51*	0.47*	CE=0.04	−0.0013 to 0.0840]	1.88^{ns}
Negative schizotypal symptoms	0.27*	0.22**	CE=0.05	[0.0083 to 0.1130]	2.23***
Positive schizotypal symptoms	0.51*	0.27^{ns}	AE=0.22	[−0.2317 to 0.6079]	1.14^{ns}
Negative schizotypal symptoms	0.27*	−0.006^{ns}	AE=0.28	[0.1806 to 0.4079]	5.74*

*$P<.001$, **$P<.01$, ***$P<.05$. The values presented in table are bias-corrected 95% CI. Outcome variable, social anxiety and avoidance; CE, cognitive empathy; AE, affective empathy.

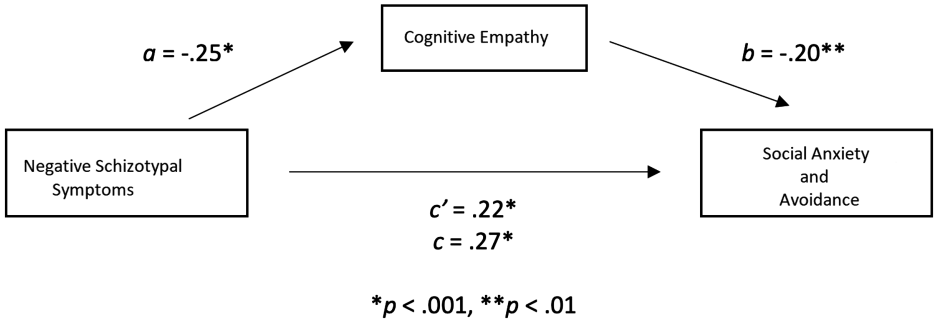

Figure 1. Mediating effect of cognitive empathy between negative schizotypal symptoms and social anxiety and avoidance.

is presented in Figure 1. The total effect of negative schizotypy is significant (path c, $B = 0.27$, SE = 0.07). Also, the regression coefficients between negative schizotypy and cognitive empathy (path a, $B = -0.25$, SE = 0.07) and between the cognitive empathy and social anxiety and avoidance levels (path b, $B = -0.20$, SE = 0.07) are significant. Inclusion of the indirect effect (path ab, $B = 0.5$, SE = 0.26), which is calculated by multiplying the coefficients of these two paths, significantly reduced the regression coefficient of total effects (path c). Since the statistically significant direct effect (path c' = 0.22, SE = 0.07), which was calculated by subtracting the indirect effect from total effect, on the result variable is still significant, the indirect path has a mediating effect.

As shown in Figure 2, affective empathy has a full mediating effect on the relationship between the negative schizotypy and social anxiety and avoidance levels. Total effect of negative schizotypy is significant (path c, $B = 0.27$, SE = 0.07). Also, the regression coefficients between negative schizotypy and affective empathy (path a, $B = -0.56$, SE = 0.06) and between affective empathy and social anxiety and avoidance levels are significant (path b, $B = -0.51$, SE = 0.07). The indirect effect, which is calculated by multiplying the coefficients of these 2 paths (path ab, $B = 0.28$, SH = 0.058), has caused a significant reduction in the total effect's regression coefficient. Since the subtraction of indirect effect from the total effect removed the significance of direct effect (path c' = −0.006, SE = 0.08) on the outcome variable completely, the indirect path including the affective empathy has been found to be a full mediator role.

DISCUSSION

This study aims to examine the relationships between schizotypal symptoms and social anxiety and avoidance levels and to reveal if cognitive and affective empathy mediate these relationships. Given that individuals with high schizotypal traits are at heightened risk for later development of schizophrenia, the findings of these studies may provide further insight into ontogeny of social cognitive impairments in schizophrenia.

Since the sample of the study is composed of university students of similar ages and that no significant differences were observed between the scores in terms of gender groups, the analyses were conducted with the main variables of the study.

According to the results, all variables were correlated with each other, revealing that both positive and negative schizotypal symptoms and both affective and cognitive empathy had significant relationships with social anxiety and avoidance. While the positive and negative schizotypal symptom levels were positively correlated with social anxiety and avoidance levels; they were negatively correlated with affective and cognitive empathy levels. These findings are in line with previous studies' findings. Wang et al[53] had also found significant relationships between negative schizotypal symptoms and empathy scores. But unlike the current study's findings, a significant positive relationship between positive schizotypal symptoms and empathy had also been found in the same study. On the other hand, Henry et al[14] examined the relationship between empathy and schizotypy, and they found that negative schizotypy was negatively related to both affective and cognitive empathy. In the current study, no relationship differences were found in terms of different dimensions of empathy. This can be explained by the different tools used to measure empathy skills. For the most part, studies on empathy involve using self-report questionnaires which only assess trait empathy which is being defined as a general disposition to empathize with other people.[54] On the other hand, state empathy is measured through eliciting an affective response by the observer and thus, the measurement is based on behavioral tasks. Since affective and cognitive empathy was both assessed by behavioral tasks in the present study, one possible explanation for empathy associations

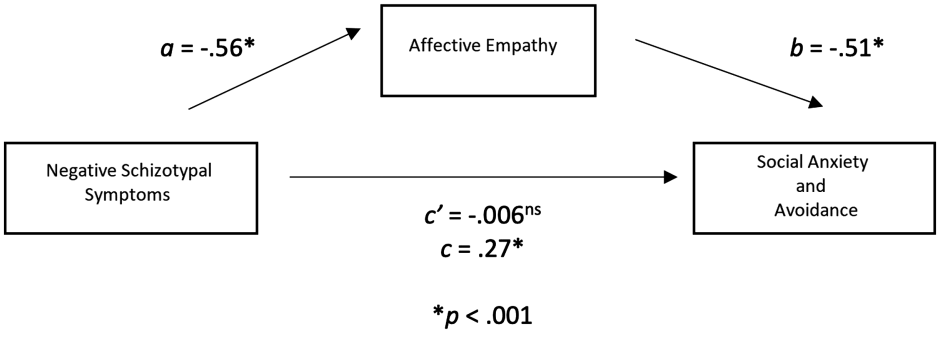

Figure 2. Mediating effect of affective empathy between negative schizotypal symptoms and social anxiety and avoidance.

that are incompatible with the literature might be the different measurements of these different types of tools.

In addition, both positive and negative schizotypal symptoms were found to be positively correlated to social anxiety and avoidance levels. This finding is in line with the previous studies. In a study with 365 young adults, while social anxiety was found to be related to both negative and positive schizotypy, this relationship was much higher in the case of positive schizotypy.[55] When the correlations are examined, it can be seen that this is also a finding for the present study. This will be discussed together with the other related findings in the following sections.

Another finding of this study is that both affective and cognitive empathy act as mediators only in the relationship between social anxiety and avoidance of negative schizotypy. Only a few studies have examined the mediator effects of social cognitive abilities between these variables and they mainly focused on schizophrenia patients. In a review study regarding the mediator effects of social cognitive functions between other neuro-cognitive functions and social functioning, the mediator effects of social cognitive functions had been revealed consistently.[16] Studies with non-clinical samples had also yielded consistent findings with the current study in a manner that not the positive schizotypal symptoms but the negative schizotypal symptoms have mediator effects between social cognitive functions and social functioning.[29,45] In another study examining the mediator effect of empathy, differences between affective and cognitive empathy were observed. While a partial mediator effect of cognitive empathy had been found between schizotypal symptoms and social functioning; such effect was not found for affective empathy.[12] In another study with a non-clinical sample, adding affective empathy to the relationship between schizotypy and social functioning reduced the predictive effect of negative schizotypy and therefore a partial mediator effect was found for affective empathy.[45] In the same study, no such effect was observed for cognitive empathy. These findings of the present study might also be argued based on the demonstrated brain areas related to different types of schizotypy. Arvid Carlsson[56,57] suggested that the increased activity of the mesolimbic pathway which involves the connections of limbic system with the prefrontal cortex provides a basis for the development of positive symptoms. In line with this assumption, a reduction in the hippocampal volume of schizophrenia patients is consistently been shown and this reduction had also been associated with positive symptoms. On the other hand, smaller amygdala was claimed as being associated with both positive and negative symptoms.[58] From a cognitive "systems" approach, negative symptoms are suggested to be related to reduced activity in the mesocortical pathway which originates from the ventral tegmental area and projects to prefrontal cortex. Different dysfunctions of the social cognitive functions as seen in positive and negative schizotypy might be influenced by the altered interactions between these different pathways of the human social brain. However, for a clear underlying anatomical distinction between these symptoms, further detailed studies are required. Although, in the present study, positive schizotypy is not associated with social anxiety and avoidance over empathy, it still has a predictor effect on it. This finding might be an indicator of how social anxiety and avoidance observed in schizotypy emerge through distinct cognitive mechanisms. Such that, social anxiety which is caused by a reduction in social motivation as a negative symptom, is not the same as social anxiety resulting from paranoia. Although the associations between social anxiety and schizotypy symptoms are not clearly understood, for this study, it can be suggested that in the presence of negative symptoms, social anxiety and avoidance levels are related to empathic abilities.

Another finding of the study is that mediator effects of affective and cognitive empathy on the social anxiety and avoidance are different. Affective empathy is highly related to sharing other people's feelings and is often measured by the participant's feeling of discomfort when witnessing other people's negative experiences.[59] Therefore, it is expressed as a response to other people's negative emotional states.[60-62] Cognitive empathy, on the other hand, is related to making inferences regarding other people's minds, beliefs, goals, and intentions. While lower cognitive empathy levels are found to have a relationship with bullying[63] and narcissistic personality disorder; lower affective empathy levels are found to have a relationship with schizophrenia and borderline personality disorder.[64] Therefore, the underlying neuro-cognitive mechanisms and the behavioral impairments as outcomes are expected to be different for these 2 types of empathy. Individuals with impaired affective empathy show deficits in their responding to emotional situations and interpreting social cues which then reflect in their social functioning in a negative way.

In a review study examining either the cognitive or affective empathy influences social anxiety, the controversial findings which were discussed regarding the methodological differences between the studies were pointed out. While a positive correlation was found between affective empathy and social anxiety, no relationship was found between cognitive empathy and social anxiety.[65] On the other hand, some moderator analyses revealed the predictor effect of cognitive empathy on social anxiety. While social anxiety which is achieved through learning experiences causes an elevating awareness on individuals' own emotions, social avoidance which is emerged through negative schizotypy and supported by neuroanatomical findings reduces the ability to understand other individuals' feelings and therefore eventually may result in social anxiety and avoidance. One other possible explanation for this finding might be that the brain areas responsible for affective empathy overlap with the areas which were shown to be associated with negative schizotypy.

In a study involving individuals who have high anhedonia scores as one of the negative symptoms, a decreased activity in the related brain regions was observed during the task of processing face emotions.[66] As mentioned above, although the brain regions which were found to be related to affective and cognitive empathy are not entirely distinct from each other, the activity levels were found to be different during the tasks of these 2 different kinds of empathy. As an example, affective empathy is more related to amygdala activity, whereas cognitive empathy is more related to activities of the temporal pole, temporo-parietal junction, and ventromedial prefrontal cortex.[67]

There are limitations of this study. First, social cognitive functions are not limited to empathy. The current study findings regarding empathy should not be generalized to explain the relationship between schizotypal symptoms and social cognitive functions. Also, the presence of a schizophrenia diagnosis in the first relatives of the participants was not inspected in this study. The behaviors of these participants might be in a different fashion and the current findings should be supported by findings from participants who have dispositions to psychosis.[68]

As a result, study findings reveal both affective and cognitive empathy are related to positive and negative schizotypal symptoms and social anxiety and avoidance. Since affective empathy has a predictive role on the social behaviors of individuals with schizotypal symptoms, involving the affective and cognitive empathy tasks in therapeutic implementations for treating impairments of social functioning might be useful in clinical settings.[69,70] Besides, assessment of social cognitive functions, specifically the empathic abilities, might provide useful information for the diagnosis, or the planning and tracking of treatment processes of patients with schizotypal symptoms.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Haliç University (Date: October 27, 2021, No: 171).

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APPENDIX 1. IMAGES USED IN PICTORIAL EMPATHY TEST

Image 1: https://commons.wikimedia.org/wiki/File:Julien_Bryan_-_Life_-_50893.jpg

Image 2: https://commons.wikimedia.org/wiki/File:2012_East_Azerbaijan_earthquakes._by_Mardetanha_1527.JPG

Image 3: https://commons.wikimedia.org/wiki/File:Rahima_Banu.jpg

Image 4: https://commons.wikimedia.org/wiki/File:Tratamiento_epidermolisis_bullosa.jpg

Image 5: https://commons.wikimedia.org/wiki/File:V_rekonstrukcja_Bitwy_o_Mławę,_miasto_0992.jpg

Image 6: https://commons.wikimedia.org/wiki/File:Bala_Baluk_massacre_by_US_troops.jpg

Image 7: https://commons.wikimedia.org/wiki/File:Wounded_Minsk_blast_2.jpg