



Abu-Akel, A., Baxendale, L., Mohr, C., & Sullivan, S. (2018). The association between schizotypal traits and social functioning in adolescents from the general population. *Journal of Psychiatric Research*, 270, 895-900.
<https://doi.org/10.1016/j.psychres.2018.11.007>

Peer reviewed version

License (if available):
CC BY-NC-ND

Link to published version (if available):
[10.1016/j.psychres.2018.11.007](https://doi.org/10.1016/j.psychres.2018.11.007)

[Link to publication record in Explore Bristol Research](#)
PDF-document

This is the author accepted manuscript (AAM). The final published version (version of record) is available online via Elsevier at DOI: 10.1016/j.psychres.2018.11.007 . Please refer to any applicable terms of use of the publisher.

University of Bristol - Explore Bristol Research

General rights

This document is made available in accordance with publisher policies. Please cite only the published version using the reference above. Full terms of use are available:
<http://www.bristol.ac.uk/red/research-policy/pure/user-guides/ebr-terms/>

Title: The association between schizotypal traits and social functioning in adolescents from the general population

Authors: Ahmad Abu-Akel^{1*}, Laura Baxendale², Christine Mohr¹, Sarah Sullivan³

¹ Institute of Psychology, University of Lausanne, Lausanne, Switzerland

² Avon and Wiltshire Mental Health Partnership NHS Trust, Chippenham, U.K.

³ Bristol Medical School, Population Health Sciences, University of Bristol, Bristol, U.K.

Word count: 4214

* Correspondence: Ahmad Abu-Akel. Institut de Psychologie, Université de Lausanne, Quartier UNIL-Mouline, Géopolis, Lausanne 1015, Switzerland. Email: ahmad.abuakel@unil.ch

Abstract

Difficulties in social functioning have been linked to schizotypy, which may reflect vulnerability to psychotic disorders. We investigated these links in early adolescence, a developmental stage when many mental illnesses first emerge. Using the Strength and Difficulties Questionnaire and The Community Assessment of Psychic Experiences, we examined the association of peer-relationship problems and prosocial behavior with positive and negative schizotypy in a sample of 149 school children (70 girls, 79 boys) between 12 and 15 years old. The results showed that while increased positive schizotypy was significantly associated with increased peer-relationship problems, increased negative schizotypy was significantly associated with decreased prosocial behavior. These effects were observed after the potential effects of age, sex, general cognitive abilities, the ability to infer affective mental states, anxiety, and depression had been taken into account. These results suggest that different dimensions of schizotypy are associated with different aspects of social dysfunction in adolescents. Interventions aimed at improving social functioning in adolescence would benefit from considering these unique associations.

Keywords: Adolescence, Prosocial Behavior, Peer relationships, Social Functioning, Schizotypy

Introduction

Schizotypy is a heritable, multidimensional, and normally distributed construct within the general population, representing a subclinical manifestation of the same underlying biological and cognitive factors seen in schizophrenia and psychotic disorders (Kwapil and Barrantes-Vidal, 2015). While the exact factorial structure of schizotypy continues to be debated, by consensus, it includes a positive (e.g., unusual experiences and magical ideation) and a negative (reduced emotional and social functioning) dimension (Chan et al., 2016; Mason, 2015).

Research within non-clinical populations reports that individuals with higher levels of schizotypy tend to exhibit greater difficulties in social functioning (Aguirre et al., 2008; Asher et al., 2013; Fonseca-Pedrero and Debbané, 2017; Jahshan and Sergi, 2007; Nunez et al., 2015; Sullivan et al., 2013). However, the link between specific dimensions of schizotypy and different aspects of social functioning remains unclear, particularly in adolescent populations. In this study, we examined, in adolescents from the general population, the relationship between positive and negative schizotypal dimensions and social functioning in terms of peer-relationship problems and prosocial behavior. This study is important because it sheds light on the hitherto unclear relationship between different aspects of schizotypy and social functioning, and evaluates these relationships during a critical period in the development of social behavior and mental illness onset (Fonseca-Pedrero and Debbané, 2017; Patel et al., 2007), while accounting for a number of important confounding factors.

The limited research within adolescent populations reported negative, but modest associations between schizotypy and social functioning. For example, Fonseca-Pedrero et al. (2010) reported

that higher expressions in all dimensions of schizotypy were associated with diminished social functioning, and Aguirre et al. (2008) reported that high overall schizotypal traits were impaired in peer and family relationships as well as academic functioning (see also (McCleery et al., 2012)). In addition, adolescents who scored high on both the negative and positive dimensions received the highest teacher ratings of behavioral problems (Barrantes-Vidal et al., 2003). Consistent with this, peer problems in children at 7 and 11 years of age were independently associated with positive psychotic experiences at age 12 (Sullivan et al., 2013).

Studies have also reported additional factors that are associated with social functioning and schizotypy in adolescents and young adults. Theory of mind (ToM), a set of abilities that enables one to make inferences about the mental states of others, has been shown to be sensitive to individual differences in the expression of schizotypal traits and social functioning (Abu-Akel et al., 2015; Barragan et al., 2011b; Caputi and Schoenborn, 2018; Gibson et al., 2010; Gooding and Pflum, 2011; McCleery et al., 2012). For example, in a community sample of adolescents, Barragan et al. (2011b) found a positive association between ToM difficulties and positive schizotypy, but not negative schizotypy. In contrast, in a sample of undergraduates, while there was no significant association between schizotypy and ToM, or ToM and social functioning, there was evidence for moderate associations between negative, positive and overall schizotypy and social functioning difficulties (McCleery et al., 2012). Moreover, a study that examined both social functioning and ToM found that, relative to controls, adolescents at genetic risk for psychosis presented social skills, but not ToM, impairments (Gibson et al., 2010). However, contrary to previous studies, Caputi and Schoenborn (2018) found, in a sample

of middle childhood and early adolescent children, robust evidence for a relationship between ToM abilities and better social coping strategies, as well as lower depressive and anxiety symptoms. In addition, it has been reported that anxiety and depressive symptoms are associated with higher levels of positive schizotypy (Lewandowski et al., 2006; Raynal et al., 2016; Rey et al., 2009), as well as with both negative and positive schizotypy (Barragan et al., 2011a, b). Higher levels of anxiety and depressive symptoms were also linked to poorer social functioning (Caputi and Schoenborn, 2018; La Greca and Harrison, 2005; Verboom et al., 2014), and that positive schizotypy, distress, and depression contributed to poorer functioning of adolescents and young adults (Armando et al., 2010). Reports also show that social functioning can be moderated by age, sex, and general cognitive ability (Hsiao et al., 2013; McCleery et al., 2012; Schwenck et al., 2014).

In summary, previous research suggests that while social functioning is linked to schizotypy, the association of schizotypy dimensions (i.e., negative vs positive) with specific aspects of social function (i.e., peer-relationship and prosocial behavior) is unclear. It is noteworthy that we are investigating these dimensions separately because if used as a total score we would not be able to discern differential effects, particularly when both positive (e.g., paranoid ideations) and negative (e.g., social withdrawal) traits can conceivably lead to social dysfunction via social isolation. Indeed, it has been suggested that failing to differentiate these dimensions could lead to conflicting results and which is likely due to the relative composition of these trait dimensions in a given sample (Kwapil and Barrantes-Vidal, 2015). It is also evident that an interpretation of these links may be confounded by other factors, which include ToM abilities,

depression, anxiety, age, sex as well as general cognitive abilities. In an attempt to provide a fuller understanding of the link between social functioning and schizotypy in adolescents from the general population, the current study accounts for these various aspects using a method of online testing which can be administered in group-settings.

We hypothesize that adolescents with high schizotypal traits will present greater impairment in social functioning, after accounting for potential confounders. Based on the proposed distinction linking, on the one hand, passive social withdrawal with negative symptoms and, on the other, active social avoidance with positive symptoms (Hansen et al., 2009), we predicted that negative and positive schizotypy would affect different aspects of social functioning.

Specifically, based on evidence for a link between negative symptoms and lack of initiative to make contact (Siegrist et al., 2015), and the apparent lack of their association with peer-relationship problems (McCleery et al., 2012), we predicted that negative schizotypy would be more likely to be associated with diminished prosocial behavior than peer-relationship problems. Conversely, we predicted that positive schizotypy would be more likely to be associated with peer-relationship problem, based on evidence showing that positive schizotypy uniquely contributed to inter-personal problems in adolescents with psychiatric problems (Verbeke et al., 2017).

Method

Participants

Data were collected from 149 adolescents (M/F=79/70; Age range= 12-15; mean age (SD)= 13.3

(1.0), recruited from a secondary school in the South West of England. Specifically, recruitment was conducted by letters sent to their parents or guardians, explaining the nature of the study and asking them provide consent. There were no exclusion criteria. All had written parental consent to take part in the study, and all had an IQ score > 70, estimated by the Cognitive Abilities Test, Third Edition (Wright, 2005). The University of Bristol ethics committee approved the study.

Materials

The Community Assessment of Psychic Experiences

The Community Assessment of Psychic Experiences (CAPE) is a self-report measure of lifetime schizotypy (Stefanis et al., 2002). For the purposes of this study, we used the positive and negative schizotypy subscales. The positive schizotypy subscale consists of 20 items: For example, “Do you ever feel as if things in magazines or on TV were written especially for you?”; The negative schizotypy subscale consists of 14 items: For example, “Do you ever feel that you experience few or no emotions at important events?” Frequency of each experience is measured on a four-point scale ranging from never (1) to nearly always (4). A total score for each subscale is calculated by summing the scores on the frequency question. For the positive subscale possible scores were 20-80, and for the negative subscale possible scores were 14-56. We chose the CAPE due to its demonstrated sensitivity to psychic experiences in individuals as young as 13 years of age (Mossaheb et al., 2012), and meta-analytic research showing that CAPE scores for the negative and positive dimensions were reliable for adolescents and young adults (Mark and Toulopoulou, 2016). Cronbach’s alpha in this study’s sample is 0.91 for the

CAPE, and 0.86 and 0.77 for the positive and negative dimensions, respectively.

Strengths and Difficulties Questionnaire

The Strengths and Difficulties questionnaire (SDQ) is a behavioural screening questionnaire for children aged 4-16 years (Goodman et al., 1998). It consists of items describing positive and negative attributes with five subscales each made up of five items. For the purpose for the present study two of these subscales were used to assess social functioning (Sebire et al., 2011): Peer-relationship problems, for example “Other people my age generally like me”, and prosocial behaviour for example “I usually share with others”. Statements are presented and participants rate their agreement with each statement as not true, somewhat true or certainly true. Each of the scales has a minimum score of 0 and a maximum score of 10. Where the wording of the question suggested it, the answer was reversed coded. The SDQ has established reliability and retest stability after 4-6 months (Goodman, 2001). Validity is also demonstrated with SDQ scores above the 90th centile predicting a substantially raised probability of independently diagnosed psychiatric disorders (Goodman, 2001). In this study’s sample, Cronbach’s alpha of the peer-relationship problems and prosocial behavior subscales are 0.61 and 0.56 respectively, which represent an acceptable level of consistency for short scales (< 10 items) (Schmitt, 1996). Moreover, the mean inter-correlation values of both subscales is 0.20 and 0.24, which are within the optimal range recommended by Briggs and Cheek (Briggs and Cheek, 1986).

The Spence Children’s Anxiety Scale (SCAS)

The Spence Children's Anxiety Scale consists of 44 items, 38 of which are used to assess anxiety symptoms along six domains (Spence et al., 2003). 6 items relate to positive filler items to reduce negative response bias and are not included in scoring. Participants are presented with statements and asked to rate each according to the frequency with which they experience each symptom on a four point scale consisting of never (0), sometimes (1), often (2) and always (3). A total score is obtained by adding all subscale items together and individual domain scores can be obtained by adding subscale item scores together resulting in a possible score between 0 and 114. Reliability and validity of the SCAS has been established (Spence et al., 2003). Cronbach's alpha of the SCAS in this study's sample is 0.88.

Emotional Triangles

The Emotional Triangles test was used to measure an aspect of ToM, namely the ability to infer affective mental states (Blakemore et al., 2003; Boraston et al., 2007). This test utilizes abstract animations, similar to other such tests that have been used to test mental state attribution abilities (Heider and Simmel, 1944). It was presented on desktop computers with a screen size of 1280x1024 or 1024x768. The test consists of a total of 28 silent animations featuring a black outline triangle and circle moving on a white background. In 8 animations the triangle moves in a living manner demonstrating one of four possible emotions, happy, sad, scared or angry. Each of these emotions was shown three times. In four other animations the triangle moves in an inanimate manner. After each animation, the participant was asked an emotion question either referring to the emotion seen (actual emotion) or to an alternative emotion such as "was the triangle happy?". Participants answered using a rating scale ranging from 0 ("not at all") to 5

("extremely"). A score is calculated for each participant by subtracting the alternative emotion rating from actual emotion rating, resulting in a score ranging from -5 to +5. A higher score indicates greater accuracy. The Emotional Triangles test has established validity and reliability (Boraston et al., 2007). Cronbach's alpha of the test in this study's sample is 0.94.

The present study utilizes a non-verbal mental state inference animation task, as such tasks have been shown to be sensitive to variation in the expression of schizotypal traits (Langdon and Coltheart, 1999), and eliminate the potential confound of literacy problems on performance (Barragan et al., 2011b). The use of a non-verbal task is further underscored by evidence showing that adolescents from the general population who scored high on both the negative and positive dimensions demonstrated poor verbal fluency (Barrantes-Vidal et al., 2003).

Short Mood and Feelings Questionnaire (SMFQ)

The short version of the MFQ (SMFQ) was used to assess the depressive symptomology of participants (Angold et al., 1995), which was previously administered in a large sample, from the same community, and of approximately the same age (Sullivan et al., 2013). It consists of 13 phrases, which address how the participant has been feeling or acting. Each statement is presented and participants rate it as a "true", "sometimes true", or "not at all true" description of how they have been feeling or acting in the past two weeks. A "true" response is scored as 2, a "sometimes true" response is scored as 1 and a "not at all true" response is scored as 0. The overall score is obtained by totaling the individual ratings, and a total of eight or more is

indicative of possible clinical depression (Angold et al., 1995). The SMFQ has been established as valid (Angold et al., 1995) and reliable (Messer et al., 1995). Cronbach's alpha of the SMFQ in this study's sample is 0.89.

Cognitive Abilities Test Third edition (CAT-3)

The CAT scores were obtained from the school where testing took place. This is common practice in UK secondary schools and aids with assigning pupils to the appropriate level of teaching. The CAT is a test of three forms of reasoning abilities; verbal (for example sentence completion and analogies), non-verbal, and numerical/quantitative (for example, data interpretation). The CAT-3 correlates with the Wechsler Intelligence Scale for Children (WISC-III) and appears stable over time (Wright, 2005). In the present study the CAT-3 scores were used as an indication of general cognitive ability and a general estimate of IQ.

Procedure

Testing took place in a school computer laboratory in groups of 15 and 25. Each participant was assigned a participant identification number to ensure confidentiality and anonymity. Two researchers were present in the room throughout the study in line with ethics guidelines to answer any queries about the study and to encourage participants to complete their own tasks.

A brief information page was presented on the front screen of the online website on which the tasks were presented. This encouraged honesty and informed participants that completion of tasks would offer the opportunity to win a prize of a music gift voucher. Information about the

web page set-up was also given to ensure that participants had their web browser window maximized and how to move through the tasks. Participants were asked to enter the participant identification number, their age in years and months and their sex before the tasks began. For each participant, tasks were presented in a predetermined order as follows: CAPE, SDQ, SCAS, Emotional Triangles (preceded by a practice session of four animations), and SMFQ. For all questionnaires, an answer was required before participants could move onto the next task ensuring full completion. On completion of all of the tasks, a debrief screen was shown thanking the pupils for taking part and providing contact information for the researchers. The researchers in the room also asked each pupil on completion of the study whether they had any queries or issues they would like to discuss.

Statistical analysis

For the main analyses, we used linear regressions to examine the association between positive and negative schizotypal traits and social functioning (peer-relationships problems and prosocial behavior), while accounting for the following potential confounding variables: age, sex and general cognitive abilities, depression and anxiety, and theory of mind. In all analyses, only scores for peer-relationship problems were log transformed due to the non-normal distribution of the scores. To facilitate comparing estimates, we reported standardized beta coefficients and their 95% confidence intervals.

Results

Sample description

In Table 1, we report total scores on the various measures, as well as by sex. Girls presented with higher levels of anxiety and depressive symptoms, but were also more prosocial than the boys. No other differences were discerned.

Table 1 About Here

Regression results with social functioning as the dependent variable

Unadjusted associations between social functioning, schizotypal traits and confounders

Table 2 shows the results of the simple linear regression models of the unadjusted associations of peer-relationship problems and prosocial behavior with negative and positive schizotypal traits and potential confounding variables. Results indicate that depressive symptoms, anxiety, positive and negative schizotypal traits are associated with increase in peer-relationship problems, explaining 23, 14, 23 and 14% of the total variance, respectively. More specifically, with every 1 SD increase in these factors, peer-relationship problems increased by 0.37 to 0.48 SD. On the other hand, age, sex and scores on the Emotional Triangles Test were associated with increased prosocial behavior, explaining 3, 6 and 4% of the total variance, respectively. More specifically, with every 1 SD increase in age, prosocial behavior increased by 0.17 SD, and by 0.19 SD for every 1 SD increase in ToM scores. Moreover, girls, relative to boys, were associated with better prosocial behavior by 0.23 SD.

Table 2 About Here

Adjusted associations between social functioning and schizotypal traits

Table 3 shows the effects of schizotypal traits on social functioning after taking into account the effect of confounding variables, with the peer-relationship and prosocial models explaining 31 and 18% of the total variance, respectively. More specifically, the results show that with every 1 SD increase in positive schizotypal traits, peer-relationship problems increased by 0.33 SD. Conversely, with every 1 SD increase in negative schizotypal traits, prosocial behavior decreased by 0.26 SD. The unique variance (ΔR) explained by the schizotypal traits after adjusting for the confounding variables were 5% and 3%, which is approximately 16 and 17% of the total variance explained by the peer-relationship and the prosocial models, respectively. We note that the association of positive schizotypy with peer-relationship problems attenuated slightly after adjustment, but the association with negative schizotypy, attenuated considerably. Conversely, the adjustment for confounders seems to strengthen the association of positive and negative schizotypy with prosocial behavior, and particularly the association with negative schizotypy.

Table 3 About Here

Discussion

Adolescence is a period during which peer relationships are paramount and increasingly more complex (Foulkes and Blakemore, 2018). The key question of this study was whether positive and negative schizotypy would explain significant variance in peer-relationship problems and prosocial behavior of adolescents after the variance explained by age, sex, general cognitive abilities, affective mental state inferencing, anxiety, and depression had been taken into account. The adjusted effects showed that while positive schizotypy was associated with

increased peer-relationship problems, negative schizotypy was associated with decreased prosocial behavior of young adolescents. These findings suggest that there is evidence that negative and positive schizotypy are associated with different aspects of social functioning in adolescents.

These findings are consistent with existing reports on the association between schizotypy (including those assessed with CAPE) and the SDQ in large adolescent populations (Fonseca-Pedrero et al., 2011; Wigman et al., 2011), reporting adverse associations of both negative and positive schizotypy with peer-problems and prosocial behavior. It is worth mentioning that Wigman et al. (2011) have only assessed the association of the positive dimension and overall CAPE scores with the SDQ. More importantly, however, the associations reported in both of these studies were correlational, and did not adjust for potential confounders. Moreover, the study's findings are consistent with other reports from both adolescent (Fonseca-Pedrero et al., 2010) and young adult (Aguirre et al., 2008) populations. Aguirre et al (2008) found that undergraduates with high schizotypal traits were impaired in peer and family relationships as well as academic functioning, although we found no association between general cognitive abilities and social functioning. Moreover, Fonesca-Pedrero et al. (2010) found that higher expressions in all domains of schizotypy were associated with diminished social functioning in adolescents. However, while the study by Aguirre et al. (2008) did not differentiate between aspects of schizotypy, the study by Fonesca-Pedrero et al. (2010) did not discern between different aspects of social functioning. Our results, therefore, add important new evidence to the field and underscore the importance of investigating the association of different

dimensions/aspects of both schizotypy and social functioning, while accounting for confounding variables.

Beyond the proposed respective links between negative and positive with passive social withdrawal and active social avoidance (Hansen et al., 2009), we further consider why positive schizotypy should be associated with increased peer problems but negative schizotypy with reduced prosocial behavior. To shed light on this question, it is important to reflect on the hypothetical mechanisms behind each association. The positive schizotypy domain includes questions on paranoia and unusual beliefs, for example “Do you ever feel as if you are being persecuted in some way?” and “Do you ever feel as if you are destined to be someone very important?”. Paranoia may make the adolescent more likely to avoid social contact, and unusual beliefs such as ideas of reference may make others more likely to avoid them.

The association between negative schizotypy and prosocial behavior is a little more difficult to explain. The domain of prosocial behavior appears to reflect awareness and understanding of social rules and norms and the willingness of the participant to adhere to these, rather than being a measure of social functioning per se. This is demonstrated by questions such as “I have shared readily with other children” and “I often volunteer to help others”. As negative schizotypy assesses feelings of social isolation and blunted emotion, it is less clear how these negative features would be associated with a reduced willingness to adhere to social norms. However, given established links between these traits with increased social distance from others and the desire to be alone (Kwapil et al., 2012), we suggest that lack of adherence to

social norms may be due to motivational factors, such as lack of initiative and disinterest in new experiences, rather than outright understanding of these norms. This finding should be replicated in other datasets before speculating further as to its meaning.

Our results show that schizotypy has measurable consequences on peer relationship problems and prosocial behavior during a critical period of development. Accordingly, schizotypy should be targeted directly when considering interventions that are aimed at enhancing social competence in individuals with high schizotypal traits. Importantly, such interventions need to be sensitive to the specific dimensions of schizotypy (positive or negative) as well as to the specific aspects of social functioning (peer-relationships or prosocial behavior). This approach holds promise in light of evidence showing that educationally-oriented skills training programs can be successful in enhancing social competence of high school students with high schizotypal traits (Lieberman and Robertson, 2005). However, since our cross-sectional design does not permit investigation of causal associations between schizotypy and functioning, further longitudinal research is required to establish such links. In this regard, it is important to consider bi-directional associations, given evidence showing that poor childhood social functioning precedes adolescent psychotic experiences (Sullivan et al., 2013).

Our results need to be considered in light of a number of limitations. First, while the observed effects of schizotypal traits on social functioning are modest, they remained after accounting for a number of confounding variables. Moreover, it is possible that the association between schizotypy and social functioning is stronger at the extreme end of schizotypy distribution,

which might explain the modest effects we observed. Second, as mentioned above, causality between schizotypy and social functioning cannot be inferred given the cross-sectional design of our study. It is noteworthy that while it is conceivable that schizotypal traits can lead to poor social functioning, poor social functioning can trigger the expression of schizotypal traits (Sullivan et al., 2013), perhaps through social isolation and the lack of reality checking available through social contact. Third, the use of the emotional triangles as a measure of the individual's ability to infer affective mental states may not reflect the *use* of ToM skills during social interaction, and thus ecologically valid instruments would improve this aspect of the study. Fourth, the sample is relatively small and should be replicated in a larger, longitudinal sample to avoid potential Type 2 errors. Moreover, the small sample size may have resulted in the lack of statistical power in detecting some effects. However, we have no reason to believe that this sample is not generalizable to other populations of adolescent school children. Fifth, and finally, the assessment of adolescents' social functioning can be improved with the additional inclusion of parent- and teacher-based assessments and other measures specifically designed for adolescent populations.

To conclude, this study revealed that both positive and negative schizotypal traits, respectively, have measurable consequences on peer relationship and prosocial behavior in adolescents once the potential effects of age, sex, general cognitive abilities, affective mental state inferencing, anxiety, and depression had been taken into account. These findings might have implications for social functioning interventions aimed at individuals at a higher risk of developing psychotic disorders. This is particularly important in adolescent populations because

the need for effective social functioning is enhanced at this age, as is the risk for mental illness. We recommend that a fuller understanding of the link between schizotypy and social functioning would benefit from a simultaneous examination of different dimensions/aspects of both schizotypy and social functioning, and longitudinal work that bidirectionally examines the association between schizotypy and social functioning.

Acknowledgements

We would like to acknowledge the leadership team and teaching staff of Backwell School, North Somerset, UK, for their cooperation and help. We would also like to acknowledge the pupils and parents who gave their consent and participated in this study.

Compliance with ethical standards

Conflict of interest: The authors declare that they have no competing interests.

Ethical standard statement: The authors assert that all procedures contributing to this work comply with the ethical standard of the relevant national and institutional committees on human experimentation and with the Helsinki declaration of 1975, as revised in 2008.

References

Abu-Akel, A., Wood, S.J., Hansen, P.C., Apperly, I.A., 2015. Perspective-taking abilities in the balance between autism tendencies and psychosis proneness. *Proceedings of The Royal Society: Biological sciences* 282(1808), 20150563.

Aguirre, F., Sergi, M.J., Levy, C.A., 2008. Emotional intelligence and social functioning in persons with schizotypy. *Schizophrenia research* 104(1-3), 255-264.

Angold, A., Costello, E.J., Messer, S.C., 1995. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *International journal of methods in psychiatric research* 5, 237-249.

Armando, M., Nelson, B., Yung, A.R., Ross, M., Birchwood, M., Girardi, P., Fiori Nastro, P., 2010. Psychotic-like experiences and correlation with distress and depressive symptoms in a community sample of adolescents and young adults. *Schizophrenia research* 119(1-3), 258-265.

Asher, L., Zammit, S., Sullivan, S., Dorrington, S., Heron, J., Lewis, G., 2013. The relationship between psychotic symptoms and social functioning in a non-clinical population of 12year olds. *Schizophrenia research* 150(2-3), 404-409.

Barragan, M., Laurens, K.R., Navarro, J.B., Obiols, J.E., 2011a. Psychotic-like experiences and depressive symptoms in a community sample of adolescents. *European psychiatry : the journal of the Association of European Psychiatrists* 26(6), 396-401.

Barragan, M., Laurens, K.R., Navarro, J.B., Obiols, J.E., 2011b. 'Theory of Mind', psychotic-like experiences and psychometric schizotypy in adolescents from the general population. *Psychiatry research* 186(2-3), 225-231.

Barrantes-Vidal, N., Fananas, L., Rosa, A., Caparros, B., Dolors Riba, M., Obiols, J.E., 2003. Neurocognitive, behavioural and neurodevelopmental correlates of schizotypy clusters in adolescents from the general population. *Schizophrenia research* 61(2-3), 293-302.

Blakemore, S.J., Boyer, P., Pachot-Clouard, M., Meltzoff, A., Segebarth, C., Decety, J., 2003. The detection of contingency and animacy from simple animations in the human brain. *Cerebral cortex* 13(8), 837-844.

Boraston, Z., Blakemore, S.J., Chilvers, R., Skuse, D., 2007. Impaired sadness recognition is linked to social interaction deficit in autism. *Neuropsychologia* 45(7), 1501-1510.

Briggs, S.R., Cheek, J.M., 1986. The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality* 54, 106-148.

Caputi, M., Schoenborn, H., 2018. Theory of mind and internalizing symptoms during middle childhood and early adolescence: the mediating role of coping strategies. *Cogent Psychology*, 1487270.

Chan, R.C., Gooding, D.C., Shi, H.S., Geng, F.L., Xie, D.J., Yang, Z.Y., Liu, W.H., Wang, Y., Yan, C., Shi, C., Lui, S.S., Cheung, E.F., 2016. Evidence of structural invariance across three groups of Meehlian schizotypes. *NPJ Schizophr* 2, 16016.

Fonseca-Pedrero, E., Debbané, M., 2017. Schizotypal traits and psychotic-like experiences during adolescence: An update. *Psicothema* 29(1), 5-17.

Fonseca-Pedrero, E., Lemos-Giraldez, S., Paino, M., Muniz, J., 2011. Schizotypy, emotional-behavioural problems and personality disorder traits in a non-clinical adolescent population. *Psychiatry research* 190(2-3), 316-321.

Fonseca-Pedrero, E., Lemos-Giraldez, S., Paino-Pineiro, M., Villazon-Garcia, U., Muniz, J., 2010. Schizotypal traits, obsessive-compulsive symptoms, and social functioning in adolescents. *Comprehensive psychiatry* 51(1), 71-77.

Foulkes, L., Blakemore, S.J., 2018. Studying individual differences in human adolescent brain development. *Nature neuroscience* 21, 315-323.

Gibson, C.M., Penn, D.L., Prinstein, M.J., Perkins, D.O., Belger, A., 2010. Social skill and social cognition in adolescents at genetic risk for psychosis. *Schizophrenia research* 122(1-3), 179-184.

Gooding, D.C., Pflum, M.J., 2011. Theory of Mind and psychometric schizotypy. *Psychiatry research* 188(2), 217-223.

Goodman, R., 2001. Psychometric properties of the strengths and difficulties questionnaire. *Journal of the American Academy of Child and Adolescent Psychiatry* 40(11), 1337-1345.

Goodman, R., Meltzer, H., Bailey, V., 1998. The Strengths and Difficulties Questionnaire: a pilot study on the validity of the self-report version. *Eur Child Adolesc Psychiatry* 7(3), 125-130.

Hansen, C.F., Torgalsboen, A.K., Melle, I., Bell, M.D., 2009. Passive/apathetic social withdrawal and active social avoidance in schizophrenia: difference in underlying psychological processes. *The Journal of nervous and mental disease* 197(4), 274-277.

Heider, F., Simmel, M., 1944. An experimental study of apparent behavior. *American Journal of Psychology* 57, 243-259.

Hsiao, M.N., Tseng, W.L., Huang, H.Y., Gau, S.S., 2013. Effects of autistic traits on social and school adjustment in children and adolescents: the moderating roles of age and gender. *Res Dev Disabil* 34(1), 254-265.

Jahshan, C.S., Sergi, M.J., 2007. Theory of mind, neurocognition, and functional status in schizotypy. *Schizophrenia research* 89(1-3), 278-286.

Kwapil, T.R., Barrantes-Vidal, N., 2015. Schizotypy: looking back and moving forward. *Schizophrenia bulletin* 41 Suppl 2, S366-373.

Kwapil, T.R., Brown, L.H., Silvia, P.J., Myin-Germeys, I., Barrantes-Vidal, N., 2012. The expression of positive and negative schizotypy in daily life: an experience sampling study. *Psychological medicine* 42(12), 2555-2566.

La Greca, A.M., Harrison, H.M., 2005. Adolescent peer relations, friendships, and romantic relationships: do they predict social anxiety and depression? *J Clin Child Adolesc Psychol* 34(1), 49-61.

Langdon, R., Coltheart, M., 1999. Mentalising, schizotypy, and schizophrenia. *Cognition* 71(1), 43-71.

Lewandowski, K.E., Barrantes-Vidal, N., Nelson-Gray, R.O., Clancy, C., Kepley, H.O., Kwapil, T.R., 2006. Anxiety and depression symptoms in psychometrically identified schizotypy. *Schizophrenia research* 83(2-3), 225-235.

Lieberman, R.P., Robertson, M.J., 2005. A pilot, controlled skills training study of schizotypal high school students. *Verhaltenstherapie* 15(3), 176-180.

Mark, W., Touloupoulou, T., 2016. Psychometric Properties of "Community Assessment of Psychic Experiences": Review and Meta-analyses. *Schizophrenia bulletin* 42(1), 34-44.

Mason, O.J., 2015. The assessment of schizotypy and its clinical relevance. *Schizophrenia bulletin* 41 Suppl 2, S374-385.

McCleery, A., Divilbiss, M., St-Hilaire, A., Aakre, J.M., Seghers, J.P., Bell, E.K., Docherty, N.M., 2012. Predicting social functioning in schizotypy: an investigation of the relative contributions of theory of mind and mood. *The Journal of nervous and mental disease* 200(2), 147-152.

Messer, S.C., Angold, A., Costello, E.J., Loeber, R., Van Kammen, W., Stouthamer-Loeber, M., 1995. Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents: Factor composition and structure across development. *International journal of methods in psychiatric research* 5, 251-262.

Mossaheb, N., Becker, J., Schaefer, M.R., Klier, C.M., Schloegelhofer, M., Papageorgiou, K., Amminger, G.P., 2012. The Community Assessment of Psychic Experience (CAPE) questionnaire as a screening-instrument in the detection of individuals at ultra-high risk for psychosis. *Schizophrenia research* 141(2-3), 210-214.

Nunez, D., Arias, V., Vogel, E., Gomez, L., 2015. Internal structure of the Community Assessment of Psychic Experiences-Positive (CAPE-P15) scale: Evidence for a general factor. *Schizophrenia research* 165(2-3), 236-242.

Patel, V., Flisher, A.J., Hetrick, S., McGorry, P., 2007. Mental health of young people: a global public-health challenge. *Lancet* 369(9569), 1302-1313.

Raynal, P., Goutaudier, N., Nidetch, V., Chabrol, H., 2016. Typology of schizotypy in non-clinical young adults: Psychopathological and personality disorder traits correlates. *Psychiatry research* 246, 182-187.

Rey, G., Jouvent, R., Dubal, S., 2009. Schizotypy, depression, and anxiety in physical and social anhedonia. *J Clin Psychol* 65(7), 695-708.

Schmitt, N., 1996. Uses and abuses of coefficient alpha. *Psychological assessment* 8(4), 350-353.

Schwenck, C., Göhle, B., Hauf, J., Warnke, A., Freitag, C.M., Schneider, W., 2014. Cognitive and emotional empathy in typically developing children: The influence of age, gender, and intelligence. *European Journal of Developmental Psychology* 11(1), 63-76.

Sebire, S.J., Jago, R., Fox, K.R., Page, A.S., Brockman, R., Thompson, J.L., 2011. Associations between children's social functioning and physical activity participation are not mediated by social acceptance: a cross-sectional study. *Int J Behav Nutr Phys Act* 8, 106.

Siegrist, K., Millier, A., Amri, I., Aballea, S., Toumi, M., 2015. Association between social contact frequency and negative symptoms, psychosocial functioning and quality of life in patients with schizophrenia. *Psychiatry research* 230(3), 860-866.

Spence, S.H., Barrett, P.M., Turner, C.M., 2003. Psychometric properties of the Spence Children's Anxiety Scale with young adolescents. *J Anxiety Disord* 17(6), 605-625.

Stefanis, N.C., Hanssen, M., Smirnis, N.K., Avramopoulos, D.A., Evdokimidis, I.K., Stefanis, C.N., Verdoux, H., Van Os, J., 2002. Evidence that three dimensions of psychosis have a distribution in the general population. *Psychological medicine* 32(2), 347-358.

Sullivan, S., Lewis, G., Wiles, N., Thompson, A., Evans, J., 2013. Psychotic experiences and social functioning: a longitudinal study. *Soc Psychiatry Psychiatr Epidemiol* 48(7), 1053-1065.

Verbeke, L., De Clercq, B., Van der Heijden, P., Hutsebaut, J., van Aken, M.A., 2017. The relevance of schizotypal traits for understanding interpersonal functioning in adolescents with psychiatric problems. *Personality disorders* 8(1), 54-63.

Verboom, C.E., Sijtsma, J.J., Verhulst, F.C., Penninx, B.W., Ormel, J., 2014. Longitudinal associations between depressive problems, academic performance, and social functioning in adolescent boys and girls. *Dev Psychol* 50(1), 247-257.

Wigman, J.T., Vollebergh, W.A., Raaijmakers, Q.A., Iedema, J., van Dorsselaer, S., Ormel, J., Verhulst, F.C., van Os, J., 2011. The structure of the extended psychosis phenotype in early adolescence--a cross-sample replication. *Schizophrenia bulletin* 37(4), 850-860.

Wright, I., 2005. Estimation of premorbid general cognitive abilities in children. *Educational and Child Psychology* 22(2), 100-107.

Table 1. Demographics and characteristics of overall sample and by sex

Variables*	Overall (N=149)	Boys (N =79)	Girls (N= 70)	<i>p</i> - value	Effect Size Cohen's <i>d</i>
Age	13.31 (1.04)	13.33 (1.01)	13.30 (1.08)	0.84	0.03
CAT-3	108.77 (12.66)	110.01 (13.39)	107.36 (11.72)	0.21	0.21
CAPE Positive	30.15 (6.67)	29.49 (6.50)	30.89 (6.83)	0.21	0.21
CAPE Negative	22.26 (4.78)	21.72 (4.41)	22.87 (5.13)	0.14	0.24
MFQ	6.69 (5.47)	5.43 (5.19)	8.05 (5.48)	0.005	0.49
SCAS	23.85 (13.15)	19.10 (10.58)	29.22 (13.52)	0.000	0.83
ETT	1.62 (1.01)	1.55 (1.02)	1.70 (1.00)	0.38	0.15
SDQ Prosocial	6.71 (1.86)	6.30 (1.98)	7.17 (1.61)	0.004	0.48
SDQ Peer problems	1.68 (1.67)	1.54 (1.53)	1.84 (1.82)	0.28	0.18

* Data are presented as means (SD). *p*-values are of independent-samples t-tests between boys and girls. CAPE = Community Assessment of Psychic Experiences; CAT-3 = Cognitive Abilities Test Third Edition; MFQ = Mood and Feelings Questionnaire; SCAS = Spence Children's Anxiety Scale; SDQ = Strength and Difficulties Questionnaire; ETT= Emotional Triangles Test.

Table 2. Simple linear regressions of unadjusted standardized risk factor effects on peer-relationship problems and prosocial behavior

Variables	Peer-relationship problems			Prosocial Behavior		
	β	CI 95%	R ²	β	CI 95%	R ²
<i>Confounding variables</i>						
Age	0.073	-0.089, 0.236	0.01	0.168*	0.007, 0.328	0.03
Sex = Girls	0.086	-0.077, 0.248	0.01	0.233**	0.075, 0.392	0.06
CAT-3	-0.141	-0.304, 0.022	0.02	-0.082	-0.247, 0.082	0.01
MFQ	0.477***	0.323, 0.622	0.23	0.024	-0.149, 0.197	0.00
SCAS	0.372***	0.217, 0.518	0.14	0.106	-.057, 0.267	0.01
ETT	-0.032	-0.197, 0.134	0.00	0.189*	0.025, 0.354	0.04
<i>Main risk factors</i>						
CAPE Positive	0.475***	0.332, 0.618	0.23	0.026	-0.138, 0.188	0.00
CAPE Negative	0.368***	0.216, 0.519	0.14	-0.105	-0.268, 0.057	0.01

CAPE= Community Assessment of Psychic Experiences; CAT-3= Cognitive Abilities Test Third Edition; MFQ= Mood and Feelings Questionnaire; SCAS= Spence Children’s Anxiety Scale. ETT= Emotional Triangles Test. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Multiple linear regressions of the standardized effects of schizotypal traits on peer-relationship problems and prosocial behavior, adjusted for confounding variables[‡]

Predictors	Model 1 (R ² = 0.31)			Model 2 (R ² = 0.18)		
	Peer-relationship problems			Prosocial Behavior		
	β	CI 95%	ΔR ²	β	CI 95%	ΔR ²
CAPE Positive	0.332**	0.108, 0.526	0.05	0.106	-0.130, 0.338	0.03
CAPE Negative	-0.027	-0.243, 0.190		-0.256*	-0.498, -0.012	

CAPE= Community Assessment of Psychic Experiences; * $p < 0.05$; ** $p < 0.01$

[‡] Model 1 and Model 2 are adjusted for the confounding variables of age, sex, cognitive abilities (CAT-3), depressive symptoms (MFQ), anxiety symptoms (SCAS), and affective mental state inferencing measured with the Emotional Triangles Test.