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Psychometric properties of two measures for the assessment of schizotypy in adolescents

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ABSTRACT

The purpose of this study was to examine the psychometric properties of the Thinking and Perceptual Style Questionnaire (TPSQ) and the Multidimensional Schizotypal Traits Questionnaire-Reduced (MSTQ-R) in non-clinical adolescents. The final sample consisted of 991 participants with a mean age of 14.7 years (S.D. = 1.8). The internal consistency of the TPSQ subscales ranged from 0.77 to 0.89, and that of the MSTQ-R subscales ranged from 0.62 to 0.81. Construct validity analysis from the TPSQ subscales showed a three-dimensional solution based on the factors social disorganisation, aberrant processing and anhedonia. For its part, factor analysis of the MSTQ-R also showed a three-dimensional solution based on the factors: positive symptoms, negative symptoms and impulsive-nonconformity. The TPSQ and MSTQ-R appear to have good psychometric properties and to be useful instruments for the measurement of schizotypy in adolescence. Moreover, the factor structure of these measures resembles that seen in young adult samples and provides further empirical evidence of the multidimensional structure of the instruments that we use to measure the complex schizotypy construct. Future research should explore in more depth the psychometric properties of these self-report instruments and improve our understanding of schizotypy in adolescents.

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1. Introduction

Efforts to permit the early identification of individuals at high risk of schizophrenia spectrum disorders have increased in recent decades. One approach used in this field involves research on schizotypy (or psychosis proneness), and is referred to as the psychometric high-risk paradigm (Lenzenweger, 1994). The use of self-report questionnaires has found widespread acceptance as a viable, valid and non-invasive technique for the detection of individuals vulnerable to schizophrenia (Gooding et al., 2005). The relevance of research on schizotypy rests basically on three points (Fonseca-Pedrero et al., 2007): first, it helps to improve understanding of the underlying mechanisms of schizophrenia; second, it involves the study of individuals who are free of psychotic illness, without the side effects of medication, hospitalisation and iatrogenic factors; and third, it offers the possibility of detecting, by means of self-reports or interviews, individuals at high risk of psychosis. Those with high scores on schizotypy self-report scales are at heightened risk of subsequent schizophrenia spectrum disorders (Gooding et al., 2005; Kwapil, 1998).

Meehl (1962) coined the term schizotypy to denote an organisation of the personality that represents vulnerability to the development of psychosis. Meehl's model incorporates the assumption that, although the majority of schizotypal individuals will never develop a psychosis, they will exhibit cognitive, behavioural, social, psychophysiological and neurobiochemical alterations that reflect their risk status (Fonseca-Pedrero et al., 2009; Henry et al., 2008; Horan et al., 2007; Raine, 2006; Siever and Davis, 2004; Young and Mason, 2007). These empirical findings seem to support the hypothesis that neurodevelopmental vulnerability to schizophrenia is expressed across a dynamic continuum of adjustment called schizotypy (Kwapil et al., 2008), which can fluctuate between two extreme poles, health and illness (psychosis) (Claridge, 1997), based on the interaction of biopsychological factors.

In the literature, there are a wide variety of questionnaires for the assessment of schizotypy or psychosis proneness (Fonseca-Pedrero et al., 2008b). Among the most widely used in adults are the Wisconsin scales (Chapman et al., 1995), the Schizotypal Personality Questionnaire (Raine, 1991) and the Oxford-Liverpool Inventory of Feelings and Experiences (Mason et al., 1995). Comprehensive measures for the assessment of schizotypy in the adolescent population have also been developed. The first self-report measure specifically designed for measuring schizotypy in this group was the Junior Schizotypy Scales (JSS), also called the Multidimensional Schizotypal Traits Questionnaire (MSTQ) (Rawlings and McFarlane, 1994). Recently, Cyhlarova and Claridge (2005) developed a version of the Schizotypal Personality Scale (STA) for children. However, the number of self-report instruments available is rather small, and their

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psychometric properties have been scarcely analysed. Moreover, a range of scales originally developed for measuring schizotypy in normal adult population are used in studies of adolescent samples (Fossati et al., 2007; Wolfradt and Straube, 1998). For example, Linscott et al. (2006) used the Thinking and Perceptual Style Questionnaire (TPSQ) (Linscott and Knight, 2004) for measuring schizotypy in this age group, finding it to have adequate psychometric properties.

Empirical evidence accumulated through exploratory and confirmatory factor analytic studies indicates that schizotypy is a multidimensional construct comprising two to six dimensions (Chmielewski and Watson, 2008; Fossati et al., 2003; Kwapil et al., 2008; Stefanis et al., 2004; Wuthrich and Bates, 2006), and similar to that found in schizophrenia patients (Liddle, 1987). A positive dimension (unusual experiences) and a negative dimension (anhedonia) are consistently evident throughout the literature (Kwapil et al., 2008). The third dimension (disorganisation), or even a fourth dimension (impulsive-nonconformity), probably related to antisocial behaviour, are also sometimes found (Fonseca-Pedrero et al., 2007). For instance, Linscott and Knight (2004) and Paino et al. (2008) using the TPSQ in young adults, found four factors: aberrant beliefs, social fear and paranoia, anhedonia and aberrant information processing. In the adolescent populations, the factor structure of schizotypy has scarcely been analysed, and appears to be slightly different from that found in adults. Factor analytic studies in adolescents indicate a certain tendency toward the Paranoid Ideation or impulsive-non-conformity dimension (Cyhlarova and Claridge, 2005; DiDuca and Joseph, 1999; Martínez-Suárez et al., 1999; Rawlings and MacFarlane, 1994; Venables and Bailes, 1994). Martínez-Suárez et al. (1999), using the MSTQ in Spanish adolescents, found three factors: positive symptoms (PSs), negative symptoms (NSs) and impulsive-nonconformity (INC). In comparisons of participants according to age, adolescents and young adults tend to score higher on the schizotypy scales and/or dimensions than those who are older (Chen et al., 1997; Fossati et al., 2003; Venables and Bailes, 1994).

There is no doubt that adolescence is an interesting time of life for studying schizophrenia risk markers (Keshavan et al., 2005), not only because of its proximity to the onset of the disorder, but also in view of the neurodevelopmental, hormonal, cognitive and social changes it involves (Feinberg, 1982; Harrop and Trower, 2003; Walker and Bollini, 2002). Currently, knowledge about schizotypy in adolescence and the potential for advances in this area are limited by insufficient psychometric research into the use of existing measures with this age group. The main objective of the present research was to explore the psychometric properties of the TPSQ (Linscott and Knight, 2004) and the MSTQ-R (Martínez-Suárez et al., 1999) in a sample of non-clinical adolescents, through the analysis of reliability and both construct and convergent-discriminant validity.

2. Methods

2.1. Subjects

The sample consisted of 1084 adolescents residing in Asturias, a region located in northern Spain. Participants were recruited from schools, selected to cover rural and urban areas as well as different socioeconomic backgrounds. Participants' co-operation was voluntary, and no incentive was offered. Incomplete questionnaires and those with completion errors were discarded, leaving a total of 991 Spanish secondary school students in the study, of whom 517 (52.2%) were boys. Ages ranged from 11 to 20 ($M = 14.7$, S.D. = 1.8).

2.2. Measures

2.2.1. Thinking and Perceptual Style Questionnaire (Linscott and Knight, 2004)

The Thinking and Perception Style Questionnaire (TPSQ) is a recently-developed instrument designed for measuring schizotypy in adult and adolescent populations (Fonseca-Pedrero et al., 2008a; Linscott et al., 2006), and which has been subjected to different taxometric and validity studies, showing high convergent validity with the SPQ, STA and Schizoidia Scale (Linscott, 2007). The TPSQ has a total of 99 items, all

with 5-point Likert-type response format. It is divided into six sections with a total of nine subscales. The first section, Anhedonia, is made up of the subscales physical anhedonia (PA) and social anhedonia (SA), with 33 items. The second section includes the hallucination (HS) subscale, with nine items. The third section, called social paranoia and negative evaluation, is made up of the subscales social paranoia (SP) and negative evaluation (NE), with four items each. The fourth section includes the thought disorder (TD) subscale, with a total of 19 items. The Ideation section is made up of the magical ideation (MI) and self-referential ideation (SI) subscales, with 12 and five items, respectively. Finally, the Perceptual Illusion (PI) subscale has a total of 13 items. This instrument has recently been adapted and validated for Spanish populations. The internal consistency of the TPSQ scales is in the range 0.73 to 0.87, and has a four-dimensional factor structure (Paino et al., 2008).

2.2.2. Multidimensional Schizotypal Traits Questionnaire-Reduced (Martínez-Suárez et al., 1999)

The Multidimensional Schizotypal Traits Questionnaire-Reduced (MSTQ-R) is the reduced and adapted to Spanish version of the JSS questionnaire (Rawlings and MacFarlane, 1994). It is a self-report including 51 yes–no items distributed in three subscales that explore PSs, NSs and INC. The PSs subscale contains 32 items assessing unusual perceptual experiences; the NSs subscale contains nine items measuring interpersonal relationship difficulties and lack of close confidants; and the INC subscale consists of 10 items tapping rebelliousness, impulsiveness and eccentricity. The psychometric properties of the Spanish version of the MSTQ-R have been studied previously. The internal consistency indices range from 0.63 to 0.82, the three-dimensional factor solution emerging as the most appropriate (Fonseca-Pedrero et al., 2008c).

2.3. Procedure

This study was conducted in the context of a broad psychosis prevention programme (http://:www.p3-info.es). Participants completed the questionnaires in their classrooms or school laboratories, in groups of 25 to 30 students, under the supervision of the researchers. The research was presented to students and teachers as a study on the diverse characteristics of personality. Participants were clearly informed that their involvement was voluntary and that all responses would remain strictly confidential.

2.4. Statistical analyses

First of all, we analysed the basic descriptive statistics for each subscale of the questionnaires, as well as correlations among the subscales. Secondly, we carried out a factor validity study of the TPSQ and the MSTQ-R. In the case of the TPSQ, we made a factor analysis of the subscales and items. At the level of the subscales, we carried out a Principal Components Analysis with subsequent Varimax rotation. At the item level, we carried out a second-order factor analysis on the correlation matrix of the first-order factors. Only the factors with eigenvalues above 1 (Kaiser's criterion) were included in the second-order factor analysis. The aim of the second-factor analysis is to reduce the dimensionality of the data and improve their interpretation. Subsequently, we made a confirmatory factor analysis (CFA) with the MSTQ-R items. The method of estimation was Diagonally Weighted Least Squares (DWLS). Since the item scores were non-normally distributed, as they are dichotomous variables, the CFA was conducted on the polychoric correlation matrix and asymptotic covariance matrix (Jöreskog and Sörbom, 1993). The following goodness-of-fit indexes were used: the Satorra–Bentler scaled statistic ($S–B\chi^2$), the chi-squared/degrees of freedom ratio (χ^2/df), the comparative fit index (CFI), the general fit index (GFI), the root mean square error of approximation (RMSEA) (and its confidence interval), the standardised root mean square residual (SRMR), and the Akaike Information Criterion (AIC). Thirdly, we estimated the reliability of the subscales using Cronbach's alpha coefficient. Finally, for the study of the convergent validity of the

Table 1
Descriptive statistics and alpha coefficients for the Thinking and Perceptual Style Questionnaire and Multidimensional Schizotypal Traits Questionnaire-Reduced subscales.

Subscales	Number of items	Mean	S.D.	Skewness	Kurtosis	Range	α
Physical Anhedonia	20	38.1	9.9	0.27	0.01	10–73	0.78
Social Anhedonia	13	17.7	8.6	0.59	0.41	0–52	0.85
Hallucination	9	10.6	6.8	0.75	0.25	0–36	0.84
Social Paranoia	4	5.1	3.7	0.70	−0.06	0–16	0.79
Negative Evaluation	4	5.5	3.7	0.59	−0.07	0–16	0.82
Thought Disorder	19	21.7	11.6	0.64	0.39	0–69	0.89
Magical Ideation	12	12.2	8.5	0.75	0.45	0–47	0.85
Self-reference Ideation	5	5.1	4.2	0.69	0.18	0–20	0.83
Perceptual Illusion	13	5.3	6.2	1.85	4.20	0–41	0.89
Positive Symptoms	32	10.1	5.3	0.60	0.11	0–29	0.81
Negative Symptoms	9	2.32	1.8	0.95	0.68	0–9	0.62
Impulsive-Nonconformity	10	3.05	2.1	0.51	−0.39	0–10	0.62

Table 2
Correlation matrix for the Thinking and Perceptual Style Questionnaire subscales.

Subscales	PA	SA	HS	SP	NE	TD	MI	SI	PI
Physical Anhedonia (PA)									
Social Anhedonia (SA)	0.58*								
Hallucination (HS)	−0.26*	−0.19*							
Social Paranoia (SP)	−0.17*	−0.13*	0.39*						
Negative Evaluation (NE)	−0.17*	−0.15*	0.36*	0.70*					
Thought Disorder (TD)	−0.17*	−0.09*	0.58*	0.48*	0.46*				
Magical Ideation (MI)	−0.20*	−0.10*	0.39*	0.24*	0.22*	0.34*			
Self-reference Ideation (SI)	−0.16*	−0.11*	0.33*	0.24*	0.18*	0.32*	0.61*		
Perceptual Illusion (PI)	−0.19*	−0.09*	0.51*	0.35*	0.30*	0.50*	0.43*	0.41*	

* $P < 0.01$.

MSTQ-R and the TPSQ, we carried out an analysis of the Pearson correlations between the subscales and a principal components analysis with subsequent Varimax rotation. For the data analysis, we used the statistical package SPSS 15.0 and LISREL 8.7 (Jöreskog and Sörbom, 1993).

3. Results

3.1. Descriptive statistics

Table 1 shows the mean, standard deviation, skewness, kurtosis, number of items, range of scores and Cronbach's alpha coefficient for each of the TPSQ and MSTQ-R subscales. The pairwise correlations among the TPSQ subscales are shown in Table 2. All the correlations are statistically significant. The physical anhedonia and Social anhedonia subscales correlated positively with one another and negatively with the remaining TPSQ subscales. Correlations among these remaining subscales ranged from 0.18 to 0.70. Correlations between the subscales of the MSTQ-R were: 0.25 ($P < 0.01$; PSs–NSs), 0.12 ($P < 0.01$; PSs–INC) and 0.01 ($P > 0.05$; NSs–INC).

3.2. Factor analysis

3.2.1. Factor analysis of the TPSQ

As in Linscott and Knight (2004), factor analyses of the subscales were carried out using the principal components method with Varimax rotation (Table 3). The Kaiser–Meyer–Olkin (KMO) was 0.77, and the Bartlett sphericity index was 3083.4 ($P < 0.001$). Only three of the factors had eigenvalues above 1 (Kaiser's criterion). The

analyses indicated that the three-factor solution explained 69.51% of the total variance. The first factor corresponds to the negative evaluation, social paranoia, thought disorder and hallucination subscales. This factor involves social paranoid and distorted information processing, and we labelled it social disorganisation. The second factor corresponds to the magical ideation, self-reference ideation, perceptual illusion and hallucination subscales. This factor was labelled aberrant processing. The hallucination subscale saturates equally in the first two components. The third factor appears to be independent of the previous ones, since most items belong to the physical and social anhedonia subscales. This third factor was labelled anhedonia.

Next, we carried out an exploratory factor analysis of the 99 items using the principal components method with Oblimin rotation. The KMO was 0.91 and the Bartlett sphericity index was 37379.9 ($P < 0.001$). This yielded 21 factors with eigenvalues greater than 1 that explained 56.98% of the total variance. Subsequently, a second-order factor analysis was carried out on the correlation matrix for the 21 components. The KMO measure of sampling adequacy was 0.75 and the Bartlett sphericity index was 1853.1 ($P < 0.001$). This analysis yielded seven components with eigenvalues above 1, together explaining 49.96% of the total variance (Table 4). Only four factors were clearly interpretable. The remaining factors are considered residual and difficult to interpret. The first second-order factor explained 13.4% of the variance, and was called social Disorganisation. The second factor explained 7.2% of the variance, and was called anhedonia. The third factor was labelled aberrant beliefs, and explained 6.6% of the total variance, whilst the fourth factor was named perceptual Illusion, and accounted for 6.0% of the total variance. The resulting second-order factors correspond to some extent with those obtained in the factor analysis of the subscales.

3.2.2. Factor analysis of the MSTQ-R

We carried out different confirmatory factor analyses to test two theoretical models. The first model postulated the existence of a single schizotypy dimension that would explain all the psychopathology present in the adolescents, whilst the second model postulated a three-dimensional structure based on the factors: PSs and INC. Goodness-of-fit indexes for the one-dimensional model were: S–Bχ^2 = 3668.9; df = 1224, P = 0.000, χ^2/df = 3.0; RMSEA = 0.045 (90% C.I: 0.043–0.047); GFI = 0.88; CFI = 0.95; AIC = 3872.9; SRMR = 0.10.

Table 3
Factor analysis of the Thinking and Perceptual Style Questionnaire subscales.

Subscales	Factors			
	I	II	III	h^2
Negative Evaluation	0.86			0.76
Social Paranoia	0.86			0.76
Thought Disorder	0.66	0.44		0.63
Magical Ideation		0.83		0.70
Self-reference Ideation		0.82		0.69
Perceptual Illusion	0.38	0.65		0.71
Hallucination	0.52	0.52		0.60
Social Anhedonia			0.89	0.80
Physical Anhedonia			0.86	0.78
Eigenvalues	3.58	1.41	1.25	
Accumulated explained variance	39.84	55.61	69.51	

h^2: commonalities.
Note: Loadings below 0.35 have been excluded.

Table 4
Second-order factor analysis of the Thinking and Perceptual Style Questionnaire.

First-order factors	Second-order factors			
	I	II	III	IV
Hallucination	−0.44			0.33
Social Anhedonia		0.70		
Magical Ideation			−0.66	
Social Paranoia and Negative Evaluation	0.59			
Perceptual Illusion I				−0.76
Physical Anhedonia I				
Physical Anhedonia II				
Thought Disorder I	−0.68			
Thought Disorder II				
Self-reference Ideation			0.68	
Physical Anedonia III		−0.41		
Thought Disorder III	−0.51			
Thought Disorder IV	0.68			
Perceptual Illusion II				0.68
Social Anhedonia II		0.60		
Magical Ideation II			0.75	
Social Anhedonia III		0.66		
Eigenvalues	2.82	1.85	1.39	1.28
Accumulated explained variance	13.44	22.25	28.86	34.94

Loadings below 0.35 have been excluded.
The factorial weights of the interpretable second-order components are presented.

Table 5
Correlation matrix for the Thinking and Perceptual Style Questionnaire subscales and Multidimensional Schizotypal Traits Questionnaire-Reduced subscales.

TPSQ	MSTQ-R		
	Positive Symptoms	Negative Symptoms	Impulsive-Nonconformity
Physical Anhedonia	−0.24**	0.07*	0.14**
Social Anhedonia	−0.14**	0.24**	0.13**
Hallucination	0.56**	0.13**	0.13**
Social Paranoia	0.38**	0.31**	0.01
Negative Evaluation	0.35**	0.28**	−0.04
Thought Disorder	0.51**	0.26**	0.27**
Magical Ideation	0.51**	0.10**	0.12**
Self-reference Ideation	0.41**	0.07*	0.06
Perceptual Illusion	0.57**	0.14**	0.12**

 * $P < 0.05$.
 ** $P < 0.01$.

For the three-dimensional model, goodness-of-fit indexes were: S–B$\chi^2 = 2363.8$; $df = 1221$, $P = 0.000$, $\chi^2/df = 1.93$; RMSEA = 0.031 (90% C.I: 0.029–0.033); GFI = 0.95; CFI = 0.98; AIC = 2573.8; SRMR = 0.08. As it can be seen, the model presenting the better fit to the data was the three-dimensional one. The χ^2/df ratio was lower than 2. CFI and GFI values were higher than 0.95, and RMSEA and SRMR values were lower than 0.08. All standardised coefficients were statistically significant and above 0.22. Correlation between the latent variables ranged from −0.04 to 0.34.

3.3. Reliability of the TPSQ and MSTQ-R subscales

Table 1 shows the alpha coefficients for TPSQ and MSTQ-R. Internal consistency of the TPSQ subscales ranges from 0.78 for the physical anhedonia subscale to 0.89 for the thought disorder and perceptual Illusion scales. Internal consistency of the MSTQ-R subscales range from 0.62 to 0.81.

3.4. Convergent validity

Correlations among the subscales of the TPSQ and MSTQ-R are shown in Table 5. The MSTQ-R Positive Symptoms subscale is consistently and strongly related to the TPSQ Hallucination, Thought Disorder and Perceptual Illusion subscales, but inversely related to the Physical Anhedonia and Social Anhedonia subscales. By contrast, the MSTQ-R Negative Symptoms subscales show significant small positive correlations with the Social and Physical Anhedonia subscales. The MSTQ-R Impulsive-Nonconformity subscale does not show clear convergence with any TPSQ subscale.

Finally, we carried out a principal components analysis with Varimax rotation using the TPSQ and MSTQ-R subscales. The KMO was 0.81 and the Bartlett sphericity index was 4174.4 ($P < 0.001$). The results are shown in Table 6. Only four of the factors had eigenvalues above 1. The analyses indicated that the four-factor solution explained 69.01% of the total variance. The first factor grouped subscales related to the positive symptoms of schizotypy. The second factor corresponded to aspects assessing Social Disorganisation. The third factor referred to aspects related to the Negative dimension (anhedonia) of schizotypy. Finally, the fourth factor corresponded to the INC subscale of the MSTQ-R.

4. Discussion

The main objective of this research was to examine the psychometric properties of the TPSQ (Linscott and Knight, 2004) and the MSTQ-R (Martínez-Suárez et al., 1999) in a sample of non-clinical adolescents. This objective is important for three reasons: first, because in-depth knowledge of the psychometric properties of these two self-reports for assessing schizotypy in adolescents is crucial;

second, because such knowledge helps an understanding of the structure of schizotypy in this age group; and third, because adolescence is a risk period for the development of schizophrenia, involving a range of neurodevelopmental changes (Feinberg, 1982; Harrop and Trower, 2003; Walker and Bollini, 2002), a period that permits the examination of schizophrenia vulnerability markers without the side effects of medication or iatrogenic effects present in schizophrenia patients. The results show that the TPSQ and MSTQ-R are both appropriate self-reports for assessing schizotypal traits in adolescent population, and that schizotypy has a multidimensional structure.

First of all, both the TPSQ and the MSTQ-R showed adequate psychometric properties. In the TPSQ, consistency levels for the subscales ranged from 0.78 to 0.89, whilst in the MSTQ-R, they ranged between 0.62 and 0.81. In the case of the MSTQ-R, the NSs and INC subscales had low consistency level (0.62), possibly due to the small number of items making up these subscales and the response format (dichotomic). Previous studies using the JSS (MSTQ) or the TPSQ found similar consistency levels to those obtained in the present work (DiDuca and Joseph, 1999; Linscott and Knight, 2004; Paino et al., 2008; Rawlings and MacFarlane, 1994).

Second, the physical anhedonia and social anhedonia subscales of the TPSQ correlated positively with one another and negatively with the remaining subscales of the TPSQ. Similar results were obtained in previous studies, using the TPSQ in samples of college students (Linscott and Knight, 2004; Paino et al., 2008). The physical anhedonia and social anhedonia subscales of the TPSQ were constructed on the basis of the Chapmans' anhedonia scales (Chapman et al., 1995). In this regard, analysis of the correlation between the Chapmans' scales yields similar results (Fonseca-Pedrero et al., 2008b), even if it is true that the revised social anhedonia scale tends to show a positive correlation, albeit low, with the positive dimension of schizotypy (Kwapil et al., 2008).

Third, and in accordance with the relevant literature, schizotypy in adolescents is a multidimensional construct, similar to that found in adults and in schizophrenia patients (Fonseca-Pedrero et al., 2007). However, it is important to mention that the comparison between the different factorial models is quite difficult. Methodological differences among these factor analytic studies, such as in the type of sample population, number of participants, quantity and type of measurement instruments and methodological analyses employed, may account for some of the variability in the results of these studies. Construct validity analysis at the level of the TPSQ subscales found a three-dimensional solution based on the factors: social Disorganisation, aberrant processing, and anhedonia. Linscott and Knight (2004) and Paino et al. (2008) found

Table 6
Factor analysis of the Thinking and Perceptual Style Questionnaire subscales and Multidimensional Schizotypal Traits Questionnaire-Reduced subscales.

Subscales	Factors				
	I	II	III	IV	h^2
Magical Ideation	0.84				0.72
Self-reference Ideation	0.84				0.71
Positive Symptoms	0.66	0.39			0.63
Perceptual Illusion	0.63				0.57
Hallucination	0.48	0.43		0.36	0.61
Negative Evaluation		0.84			0.73
Social Paranoia		0.83			0.73
Thought Disorder	0.37	0.58		0.47	0.71
Negative Symptoms		0.57	0.47		0.59
Social Anhedonia			0.88		0.78
Physical Anhedonia			0.79		0.69
Impulsive-Nonconformity				0.88	0.81
Eigenvalues	4.20	1.69	1.38	1.01	
Accumulated explained variance	35.05	49.12	60.65	69.01	

h^2: commonalities.
Note: Loadings below 0.35 have been excluded.

four factors: aberrant beliefs (magical ideation and self-reference ideation), social fear and paranoia (social paranoia and negative evaluation), anhedonia (physical and social anhedonia) and aberrant information processing (hallucination, thought disorder and perceptual illusion).

This finding is in accordance with previous factor analyses carried out in adolescents and young adults (Cyhlarova and Claridge, 2005; Rawlings and MacFarlane, 1994; Stefanis et al., 2004; Suhr and Spitznagel, 2001; Venables and Bailes, 1994). Cyhlarova and Claridge (2005), employing the Schizotypal Traits Questionnaire (STA) for children, found a three-factor (unusual experiences, paranoid ideation/social anxiety and magical thinking) solution similar to that of the two positive dimensions emerging in this study. Nevertheless, it is not possible to compare the data with respect to the negative factor, since the STA does not contain relevant item content. Likewise, Venables and Bailes (1994), in a sample of British adolescents, found four factors (unusual experiences, disorganisation/social anxiety, physical anhedonia and social anhedonia) similar to those found in our study. The three TPSQ factors are also somewhat similar to the disorganised model proposed by Raine et al. (1994), since in both cases there is a positive (cognitive-perceptual) factor, a negative (interpresonal) factor and a disorganisation factor, even if their content varies slightly.

Fourth, the second-order factor analysis at the item level of the TPSQ yielded a four-factor solution based on the factors social disorganisation, anhedonia, aberrant beliefs and perceptual illusion. These factors are quite similar to those found in the construct validity study at the level of the TPSQ subscales, even though an Illusion factor is added. Recently, Paino et al. (2008), carrying out a second-order factor analysis at the item level of the TPSQ in a sample of college students, found the same number and content of second-order factors, albeit in a different order.

Fifth, construct validity analysis of the MSTQ-R found that the three-dimensional solution based on the factors PSs, NSs and INC presented an adequate fit to the data. Previous studies in samples of adolescents have found similar results using the MSTQ-R (Fonseca-Pedrero et al., 2008c; Martínez-Suárez et al., 1999).

Finally, in sixth place, the combined factor analysis of the TPSQ and MSTQ-R subscales yielded a four-dimensional solution based on the positive, social disorganisation, negative (anhedonia) and impulsive-nonconformity

These results, on the one hand, coincide with the three-dimensional model of the TPSQ, with the addition of an Impulsive-Nonconformity dimension, and on the other, they are convergent with the four-dimensional model proposed in O-LIFE (Mason et al., 1995). In this regard, Mason et al. (1995), analysing the structure of schizotypy in adults, have found a four-dimensional structure made up of the factors: unusual experiences, impulsive-nonconformity, disorganisation and introvertive anhedonia. Likewise, it was observed that the NSs dimension of the MSTQ-R saturates in both the negative factor and the social disorganisation factor. It is worth mentioning that the NSs scale of the MSTQ-R presents a larger number of items related to the social anhedonia facet. This finding, in line with those of Brown and collegues (2008), suggests that social anhedonia, more than being a pure facet of the Negative dimension, is actually a multidimensional dimension of schizotypy itself.

In the light of the present results, the TPSQ and the MSTQ-R show acceptable psychometric properties and schizotypy is a multidimensional structure based on three or four dimensions. However, some limitations should be taken into account in the interpretation of the data found in this study. First, the study covers an age period in which personality traits can be seen as a common part of the developmental process; a developmental stage involving the quest for autonomy from the family, egocentrism and feelings of uniqueness (Harrop and Trower, 2003), not forgetting all the cerebral and hormonal changes of neurodevelopment (Feinberg, 1982; Walker and Bollini, 2002).

Second, the use of self-reports is not free of limitations: on the one hand, the adolescent's capacity to self-report or self-consciousness regarding his/her own behavior and feelings must be considered; on the other, the exclusive use of paper-and-pencil self-reports could be identifying a mix of schizotypal and non-schizotypal subjects: therefore, the simultaneous employment of laboratory measures would be advantageous. Finally, it should be borne in mind that no information was obtained about the presence of psychological problems in the family antecedents of participants.

Future research should determine the relationship between schizotypy and genetic polymorphisms, endophenotypes and other constructs (e.g., OCD), with a view to delimiting the construct. Taxometric analyses should be carried out to clarify its dimensional or categorical nature in the adolescent population using other comprehensive instruments. Methodological aspects of psychometric measures of schizotypy should be improved in relation to the application of different statistical methods and studies with large and random samples.

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