

MULTIDIMENSIONAL FACTOR STRUCTURE OF POSITIVE SCHIZOTYPY

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Schizotypy refers to traits similar to schizophrenia symptoms and is related to cluster A personality disorders. Previous factor analytic studies have found a positive schizotypy factor distinct from a negative factor. However, some evidence suggests that the positive factor may itself be multidimensional, but the factor structure of positive schizotypy is still unclear. The current study provided converging evidence through four different analyses that positive schizotypy is multidimensional. First, a factor model with three positive schizotypy factors (paranoia, referential thinking, and cognitive-perceptual) fit the data better than models with fewer than three factors. Second, a factor model with a second-order (i.e., higher-order) positive schizotypy factor fit the data significantly worse than a factor model without a second-order factor in which first-order factors were allowed to correlate freely, suggesting that the second-order factor does not completely account for relations among the first-order factors. Third, a Schmid-Leiman transformation found that even after accounting for the second-order factor that meaningful variance was attributed to the first-order factors. Finally, the three positive schizotypy factors displayed differential relations with five-factor model personality traits. Overall, results suggest that positive schizotypy is composed of correlated but distinct factors.

Schizotypy refers to traits or symptoms that are similar to symptoms of schizophrenia but in a diminished form, and research on schizotypy may provide insight into liability for schizophrenia while removing confounds associated with schizophrenia research (e.g., Chapman, Chapman, Raulin, & Edell, 1978; Neale & Oltmanns, 1980). Schizotypy traits are also associated with several personality disorders including schizotypal, schizoid, and paranoid personality disorders, which have overlapping diagnostic criteria and are often comorbid (Lenzenweger, Lane, Loranger, & Kessler, 2007). Dimensional models of personality disorders (e.g., the five-factor model; Widiger & Trull, 2007) have been unclear as to how well they can

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account for cluster A personality disorders (Tackett, Silberschmidt, Krueger, & Sponheim, 2008). Potentially, research on schizotypy could help inform the conceptualization and assessment of schizophrenia-spectrum personality disorders (Raine, 2006). For example, understanding the factor structure of schizotypy could help refine dimensional models of cluster A personality disorders.

However, previous schizotypy research has not identified a clear dimensional factor structure of schizotypy traits. Most previous research on the factor structure of schizotypy has found that it is multidimensional, composed of several highly correlated factors (e.g., Kwapil, Barrantes-Vidal, & Silvia, 2008; Raine et al., 1994; Stefanis et al., 2004). Like research on schizophrenia symptoms (e.g., Liddle, 1987), most studies have found a positive (i.e., psychotic) factor that is distinct from a negative (i.e., loss of function) factor (e.g., Kerns, 2006; Kwapil et al., 2008). However, many studies have also found that the positive factor may itself be multidimensional (Bergman et al., 1996; Fogelson et al., 1999; Stefanis et al., 2004), but the factor structure of positive schizotypy is unclear. Positive schizotypy is composed of traits that are similar to the positive symptoms of schizophrenia but in a diminished form and could include magical beliefs (similar to delusions), perceptual aberrations (similar to hallucinations), referential thinking (interpreting innocuous stimuli as self-relevant), and paranoia (suspicion of other people). Several factor analytic studies have reported finding at least two positive factors: (a) a cognitive-perceptual factor, comprised of magical beliefs and perceptual aberrations; and (b) a paranoia factor. However, it has been unclear whether referential thinking should load on the cognitive-perceptual factor (e.g., Raine et al., 1994), or on the paranoia factor (e.g., Stefanis et al., 2004). Furthermore, some models have included nonintuitive and atheoretical cross-loadings, such as a paranoia scale loading on multiple factors (including a "negative" factor), and a referential thinking scale loading much more strongly than a paranoia scale on a "paranoia" factor (Stefanis et al., 2004).

Although the factor structure of positive schizotypy is unclear, one potentially intuitive factor solution that has yet to be tested would include three distinct factors: cognitive-perceptual, schizotypy, referential thinking, and paranoia. Previous confirmatory factor analytic (CFA) studies on positive schizotypy have not been able to test this three-factor solution because they have included only one scale for some of these factors (e.g., only one referential thinking and only one paranoia scale), making it impossible with scale-level analyses to test a three-factor solution. The current study used several different scales for each of these three constructs to examine the model fit of a three-factor model of positive schizotypy. Additionally, the current research included several measures of negative schizotypy to test whether paranoia could be discriminated from negative schizotypy since other studies have found that paranoia loads on both a paranoia and negative factor (Stefanis et al., 2004).

As mentioned, positive schizotypy scales and factors have been found to

be highly correlated. This suggests that a second-order (i.e., higher-order) positive schizotypy factor could account for the high correlations among positive schizotypy scales (Rubio, Berg-Weger, & Tebb, 2001). Hence, another possible explanation for the lack of clarity in the factor structure of positive schizotypy is that associations between positive schizotypy factors as well as much of the variance in positive schizotypy scales could be accounted for by a single second-order factor. However, this possibility has not been tested in previous research. In the current study, we compared the statistical fit of a model with a second-order schizotypy factor to a model in which the first-order schizotypy facets were allowed to correlate freely with each other. If schizotypy is multidimensional (i.e., composed of several correlated but distinct factors), then a model with a second-order schizotypy factor would fit the data less well than a model in which the first-order factors are allowed to correlate freely (Rubio et al., 2001).

Another way to assess whether positive schizotypy is multidimensional is to examine the amount of variance that can be attributed to the first-order and second-order factors (Steer, Clark, Beck, & Ranieri, 1995; Wolff & Preising, 2005). To examine this, we used a Schmid-Leiman transformation (Schmid & Leiman, 1957), which has not been used in previous schizotypy research but has been used in previous psychopathology research, such as in examining second-order and first-order factors as predicted by the tripartite model of depression and anxiety (Steer et al., 1995), and in examining the factor structure of anxiety disorders (Zinbarg & Barlow, 1996). If a substantial amount of the variance in schizotypy scales can be attributed to first-order positive schizotypy factors even after removing shared variance with the second-order factor, then this suggests that the first-order factors are important for conceptualizing schizotypy (Wolff & Preising, 2005).

Another way to test whether positive schizotypy is multidimensional is to examine whether positive schizotypy factors are differentially associated with other important individual difference variables (Rubio et al., 2001). In the current research, we examined whether positive schizotypy factors would be differentially associated with five-factor model (FFM) personality traits. Researchers have suggested that personality disorders are related to extremes of FFM traits (e.g., Widiger & Trull, 2007). For example, it has been suggested that Schizotypal Personality Disorder is associated with elevated openness to experience, but research is unclear whether and how schizophrenia-spectrum personality disorders are related to FFM traits (Tackett et al., 2008). There is some evidence suggesting that facets of positive schizotypy might be differentially related to FFM traits (Ross, Lutz, & Bailey, 2002). In particular, there is some evidence that paranoia might be associated with high neuroticism and low agreeableness (Lynam & Widiger, 2001; Trull, Widiger, & Burr, 2001). In addition, some other studies have found an association between the cognitive-perceptual factor and openness to experience (Camisa et al., 2005; Kwapil et al., 2008; Lynam & Widiger, 2001; Trull et al., 2001), although evidence for this association

has been mixed (e.g., Chmielewski & Watson, 2008). However, at the same time, most previous studies have not examined whether positive schizotypy factors are associated with FFM traits after removing variance shared with other positive schizotypy factors (Kerns, 2006). In addition, it is also possible that it is not the specific variance associated with each positive schizotypy factor but instead the common variance among positive schizotypy factors that might be associated with FFM traits like openness to experience. Thus, we expected to find that paranoia would be associated with high neuroticism and low agreeableness and cognitive-perceptual would be associated with increased openness to experience. We did not make specific predictions about how referential thinking would be associated with FFM personality.

Overall, the current research examined whether positive schizotypy is multidimensional in four different ways. First, we examined whether a factor model with three positive schizotypy factors (paranoia, referential thinking, cognitive-perceptual) would fit the data better than models with fewer than three positive schizotypy factors. Second, we tested whether a model with a second-order schizotypy factor would fit the data less well than a model in which the first-order factors were allowed to correlate freely. Third, we used a Schmid-Leiman transformation to test whether first-order factors would account for a meaningful proportion of variance after removing variance shared with the second-order factor. Fourth, we examined whether positive schizotypy factors would be differentially associated with FFM traits after removing variance shared among schizotypy factors. In addition, we also examined whether the common variance among positive schizotypy factors (i.e., the second-order factor) might be associated with FFM traits, in particular with openness to experience (Lynam & Widiger, 2001).

METHOD

PARTICIPANTS

Participants ($n = 347$) were native English-speaking undergraduate college students at a large Midwestern public university who completed the study as partial completion of a course requirement. Following previous research, participants ($n = 35$) were excluded due to Chapman infrequency scores of 3 or greater (Chapman & Chapman, 1983). In addition, 17 participants were excluded due to missing several pages of the questionnaire, resulting in 295 useable participants. Participants ranged from 18–42 years old, with an average age of 18.87 ($SD = 1.85$). Participants were 59% female, 90.1% European-American, 5.8% African-American, 2.0% Asian-American, and 1.7% other. One participant declined to specify ethnicity.

MEASURES

Paranoia. Four measures of paranoia were administered in the current research. The Paranoia and Suspiciousness Questionnaire (PSQ; Rawlings & Freeman, 1996) is a 47 item yes-no questionnaire designed to measure

paranoia in a nonpsychiatric sample. A second paranoia measure was the 8-item Suspiciousness subscale from the Schizotypal Personality Questionnaire (SPQ-S; Raine, 1991). Overall, the full Schizotypal Personality Questionnaire (SPQ; Raine, 1991) is a 74-item yes-no questionnaire designed to measure DSM-III-R schizotypal personality disorder. The SPQ has been the most frequently used scale in studies examining the factor structure of schizotypy traits (e.g., Stefanis et al., 2004). A third paranoia measure was the Suspiciousness subscale of the Dimensional Assessment of Personality Pathology-Basic Questionnaire (DAPP-BQ-S; Livesley & Jackson, 2002), which includes 14 items. The fourth paranoia measure was the Paranoid Personality Disorder Features Questionnaire (PPDFQ; Ueda & Trull, 2002), a 23-item questionnaire that, to our knowledge, is the only scale specifically designed to measure DSM-IV paranoid personality disorder. Table 1 shows the correlations, means, standard deviations, and internal reliabilities for all the scales used in the current study.

Referential Thinking. Participants completed two different measures of referential thinking. The Referential Thinking Scale (REF; Lenzenweger, Bennett, & Lilienfeld, 1997) is a 34-item true-false questionnaire that includes a variety of referential thoughts and experiences. In addition, the 9-item Ideas of Reference Subscale of the SPQ was used (SPQ-IR; Raine, 1991).

Cognitive-Perceptual Schizotypy. The Magical Ideation Scale (MagID; Eckbald & Chapman, 1983) is a 30-item true/false questionnaire designed to measure "beliefs in forms of causation that by conventional standards are invalid" (Eckbald & Chapman, 1983, p. 215). A second cognitive-perceptual scale was the 8-item Magical Ideation subscale of the Schizotypal Personality Questionnaire (SPQ-MI). A third cognitive-perceptual scale we used was the Perceptual Aberration Scale (PerAb; Chapman, Chapman, & Raulin, 1978), a 35-item true/false scale that includes 28 items designed to measure schizophrenic-like distortions in perception of one's own body and seven items for other perceptual distortions, which has been frequently used in previous schizotypy research (for a review, see Edell, 1995). A fourth cognitive-perceptual scale was the Unusual Perceptual Experiences subscale of the SPQ (SPQ-UPE; Raine, 1991), a 9-item scale with a yes-no format.

Constricted-Asociality. Participants completed four scales assessing what we will refer to as "constricted-asociality" (we chose this label rather than negative schizotypy because we did not measure all potential aspects of negative schizotypy such as decreased verbal output). The Revised Social Anhedonia Scale (SocAnh; Eckbald, Chapman, Chapman, & Mishlove, 1982) is a 40-item true-false questionnaire designed to measure lack of relationships and lack of pleasure from relationships. A second measure of constricted-asociality was the Restricted Expression subscale of the Dimensional Assessment of Personality Pathology-Basic Questionnaire (DAPP-BQ-RE; Livesley & Jackson, 2002), a 16-item subscale designed to measure reduced expression of emotions. A third measure of constricted-

TABLE 1. Pearson Correlation Coefficients for All Measures Used in Structural Equation Models

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Paranoia Scales																			
1. PSQ	.90																		
2. SPQ-S	.75*	.71																	
3. DAPP-BQ-S	.38*	.38*	.91																
4. PPDFQ	.76*	.70*	.48*	.89															
Referential Thinking Scales																			
5. REF	.61*	.57*	.23*	.53*	.73														
6. SPQ-IR	.60*	.55*	.25*	.50*	.70*	.73													
Peculiarity Scales																			
7. MagicId	.47*	.37*	.27*	.43*	.46*	.51*	.83												
8. SPQ-MI	.30*	.23*	.13*	.21*	.31*	.37*	.61*	.75											
9. PerAb	.50*	.41*	.28*	.43*	.40*	.39*	.67*	.47*	.85										
10. SPQ-UPE	.54*	.41*	.23*	.41*	.45*	.55*	.61*	.46*	.67*	.63									
Constricted-Asociality Scales																			
11. SocAnh	.47*	.46*	.36*	.49*	.33*	.36*	.29*	.22*	.37*	.31*	.86								
12. DAPP-BQ-RE	.20*	.21*	.69*	.28*	.06	.12*	.10	.06	.15*	.07	.44*	.88							
13. SPQ-NCF	.46*	.47*	.31*	.44*	.25*	.32*	.21*	.19*	.35*	.27*	.66*	.49*	.73						
14. SPQ-CA	.43*	.38*	.32*	.37*	.26*	.27*	.14*	.15*	.25*	.27*	.52*	.62*	.64*	.66					
Five-Factor Model Personality																			
15. Neuroticism	.64*	.45*	.32*	.54*	.36*	.31*	.30*	.17*	.33*	.31*	.33*	.16*	.31*	.29*	.91				
16. Agreeableness	-.36*	-.27*	-.30*	-.41*	-.17*	-.16*	-.12*	-.05	-.17*	-.14*	-.43*	-.28*	-.37*	-.31*	-.37*	.82			
17. Extroversion	-.26*	-.21*	-.16*	-.30*	-.11	-.14*	-.01	-.01	-.16*	-.15*	-.45*	-.41*	-.61*	-.54*	-.35*	.44*	.93		
18. Conscientiousness	-.33*	-.20*	-.22*	-.28*	-.14*	-.15*	-.19*	-.06	-.26*	-.27*	-.23*	-.24*	-.23*	-.23*	-.34*	.34*	.25*	.90	
19. Openness	-.11	-.08	-.11	-.15*	-.06	-.03	.01	.08	-.07	.01	-.04	-.14*	-.12*	-.18*	-.21*	.43*	.42*	.22*	.86
Mean	15.12	1.99	2.06	30.65	2.84	2.19	5.45	0.96	3.37	1.96	6.83	2.44	1.92	1.75	3.22	3.80	3.38	3.40	3.54
Standard Deviation	8.52	1.89	0.67	12.96	2.70	2.15	4.63	1.51	4.07	1.84	5.60	0.66	2.01	1.69	0.66	0.50	0.71	0.59	0.53

Notes. DAPP-BQ-S = Dimensional Assessment of Personality Pathology Brief Questionnaire Suspiciousness Subscale; DAPP-BQ-RE = Dimensional Assessment of Personality Pathology Brief Questionnaire Restricted Expression Subscale; MagicId = The Magical Ideation Scale; PerAb = The Perceptual Aberration Scale; PPDFQ = Paranoid Personality Disorders Features Questionnaire; PSQ = Paranoia and Suspiciousness Questionnaire; REF = The Referential Thinking Scale; SocAnh = Social Anhedonia Scale; SPQ-CA = Schizotypal Personality Questionnaire Constricted Affect Subscale; SPQ-IR = Schizotypal Personality Questionnaire Ideas of Reference Subscale; SPQ-MI = Schizotypal Personality Questionnaire Magical Ideation Subscale; SPQ-NCF = Schizotypal Personality Questionnaire No Close Friends Subscale; SPQ-S = Schizotypal Personality Questionnaire Suspiciousness subscale; SPQ-UPE = Schizotypal Personality Questionnaire Unusual Perceptual Experiences Subscale. Neuroticism, Agreeableness, Extroversion, Conscientiousness, and Openness to Experience were measured with the International Personality Item Pool.

* $p < .05$.

asociality was the No Close Friends subscale from the Schizotypal Personality Questionnaire (SPQ-NCF; Raine, 1991), a 9-item yes-no scale designed to measure the absence of close friends. A fourth measure of constricted-asociality was the Constricted Affect subscale from the SPQ (SPQ-CA; Raine, 1991), an 8-item yes-no scale that was designed to measure lack of expression of emotions.

Participants also completed the Chapman Infrequency scale which measures careless or invalid responding (e.g., I cannot remember a time when I talked to a person wearing eyeglasses). This scale is composed of questions that should rarely be endorsed (sometimes reverse keyed) if the participant is paying attention and answering truthfully. Based on previous research, participants endorsing three or more items were excluded from the analysis (Chmielewski, Fernandes, Yee, & Miller, 1995).

Five-Factor Model Personality. Participants completed the 100-item International Personality Item Pool (Goldberg, 1999), which includes 20-item subscales for neuroticism, agreeableness, extroversion, openness to experience, and conscientiousness.

PROCEDURE

Participants first completed the Referential Thinking Scale, Schizotypal Personality Questionnaire, and the Paranoia and Suspiciousness Questionnaire randomly mixed together. Then participants completed the International Personality Item Pool, Paranoid Personality Disorders Features Questionnaire, Survey of Attitudes and Experiences (composed of the Magical Ideation Scale, Perceptual Aberration Scale, Revision Social Anhedonia Scale, and Infrequency Scale), and the DAPP-BQ Restricted Expression and Suspiciousness subscales. Participants completed filler questionnaires in between schizotypy scales to disguise the true purpose of the study.

RESULTS

Factor Structure of Schizotypy. First, we examined the factor structure of positive schizotypy. As can be seen in Table 2, we tested six different models: one 4-factor model involving three distinct positive schizotypy factors (Model 1: paranoia, referential thinking, cognitive-perceptual, & constricted-asociality); three 3-factor models each involving paranoia scales loading on one of the three other schizotypy factors (e.g., Model 3: referential thinking/paranoia, cognitive-perceptual, & constricted-asociality); one 3-factor model involving referential thinking loading on the cognitive-perceptual factor (Model 6: paranoia, referential thinking/cognitive perceptual, constricted asociality); and one 2-factor model (Model 2: paranoia/referential thinking/cognitive-perceptual, constricted-asociality). Model fitting was done using Mplus3 software (Muthen & Muthen, 2004). As in previous research (Kerns, 2006), due to large gender differences on some schizotypy measures, all analyses were conducted using scores standard-

**TABLE 2. Fit Statistics for Confirmatory Factor Analysis
Measurement Models of Schizotypy**

Model	χ^2	df	CFI	RMSEA	SRMR	χ^2 diff (vs. Model 1)
Model 1	176.86	71	0.95	0.07	0.04	—
Model 2	471.36	76	0.81	0.13	0.08	120.37***
Model 3	254.24	74	0.91	0.09	0.06	58.80***
Model 4	295.24	74	0.89	0.10	0.06	89.70***
Model 5	407.34	74	0.84	0.12	0.08	151.69***
Model 6	295.25	74	0.89	0.10	0.05	55.55***
Model 7	193.10	73	0.94	0.08	0.05	10.31**

Note. Model 1 = paranoia, referential thinking, cognitive-perceptual, constricted-asociality (see Figure 1); Model 2 = paranoia/referential thinking/cognitive-perceptual, constricted-asociality; Model 3 = paranoia/referential thinking, cognitive-perceptual, constricted-asociality; Model 4 = paranoia/cognitive-perceptual, referential thinking, constricted-asociality; Model 5 = paranoia/constricted-asociality, referential thinking, cognitive-perceptual; Model 6 = paranoia, referential thinking/cognitive-perceptual, constricted-asociality; Model 7 = second-order positive schizotypy factor, paranoia, referential thinking, cognitive-perceptual, constricted-asociality first-order factors; CFI = comparative fit index, RMSEA = root mean squared error of approximation, SRMR = standardized root mean square residual, χ^2 diff = Satorra-Bentler chi-square difference test. Statistical significance indicates poorer model fit. *** $p < .001$; ** $p < .01$.

ized within gender. Models were fit using maximum likelihood parameter estimates with standard errors and a mean-adjusted chi-square statistic that is robust to nonnormality (the Satorra-Bentler χ^2 ; Satorra & Bentler, 1994). χ^2 difference tests of model comparisons were done using a scaled-difference test statistic (Satorra & Bentler, 2001). Four test statistics were used to assess whether models provide a good fit to the data (Hu & Bentler, 1998): (a) χ^2/df ratio < 2.5 , (b) CFI (comparative fit index) $> .95$, (c) RMSEA (root mean squared error of approximations) $< .08$, and (d) SRMR (standardized root mean square residual) $< .05$.

As can be seen in Table 2, the four-factor model (Model 1) that included three distinct positive schizotypy factors exhibited good model fit. Moreover, this four-factor model fit significantly better than each of the models with less than three positive schizotypy factors (i.e., Models 2–6), $ps < .001$. Hence it appears that paranoia, referential thinking, and cognitive-perceptual factors might be distinct facets of positive schizotypy. At the same time, as can be seen in Figure 1, in the best-fitting model, all facets of positive schizotypy were moderately to strongly associated with each other (mean $r = .60$).

First- vs. Second-Order Model Fit. In the second set of analyses, we tested whether a model in which the correlations among the factors were represented by a second-order factor (model 7) would fit the data worse than the best-fitting model from the first set of analyses in which the factors were allowed to correlate freely. As can be seen in Table 2, model 7 fit the data significantly worse than did model 1, in which the first-order factors were allowed to freely correlate with each other. This suggests that positive schizotypy is a multidimensional construct composed of highly correlated, but distinct factors (Rubio et al., 2001).

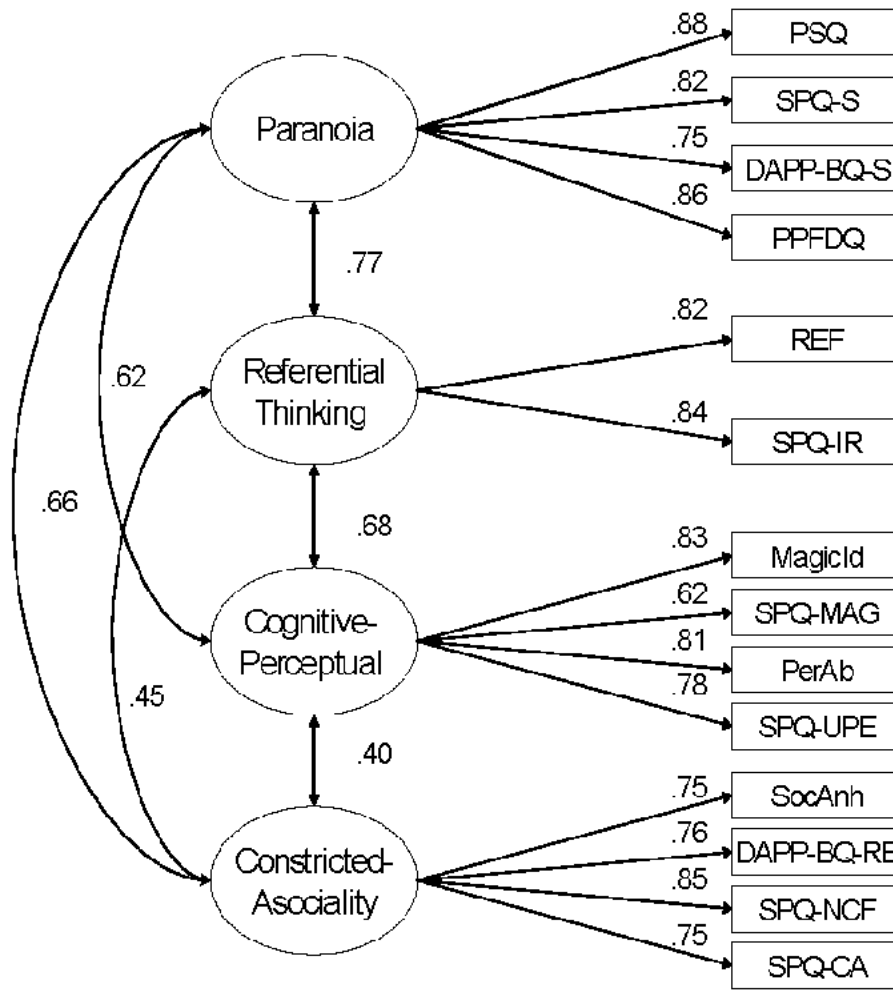


FIGURE 1. Four-Factor Confirmatory Factor Analysis with Paranoia, Referential Thinking, Cognitive-Perceptual, and Constricted-Asociality on separate Factors. Ellipses represent latent variables; rectangles represent observed variables. PSQ = Paranoia and Suspiciousness Questionnaire, SPQ-S = Schizotypal Personality Questionnaire Suspiciousness Subscale; DAPP BQ-S = Dimensional Assessment of Personality Pathology-Basic Questionnaire Suspiciousness Subscale; PPDFQ = Paranoid Personality Disorder Features Questionnaire; REF = Referential Thinking Scale; SPQ-IR = Schizotypal Personality Questionnaire Idease of Reference Subscale; SPQ-UPE = Schizotypal Personality Questionnaire Unusual Perceptual Experiences Subscale; PerAb = Perceptual Aberration Scale; MagicId = Magical Ideation Scale; SPQ-MI = Schizotypal Personality Questionnaire Magical Ideation Subscale; DAPP BQ-RE = Dimensional Assessment of Personality Pathology-Basic Questionnaire Restricted Emotional Expression Subscale; SPQ-NCF = Schizotypal Personality Questionnaire No Close Friends Subscale; SPQ-CA = Schizotypal Persaonality Questionnaire Constricted Affect Subscale; SocAnh = Revised Social Anhedonia Scale

Variance Attributed to First-Order and Second-Order Factors. In the third set of analyses, we used a Schmid-Leiman transformation to examine the amount of the variance in the manifest variables that can be attributed to first-order vs. second-order factors (Schmid & Leiman, 1957). In a Schmid-Leiman transformation, shared variance between first-order and second-order factors is attributed to the second-order factor. Based on previous research (Steer et al., 1995; Steer, Clark, Beck, & Ranieri, 1999; Zinbarg & Barlow, 1996; Zinbarg, Brown, Barlow, & Rapee, 2001), we used two criteria to evaluate whether the first-order factors account for a sizable amount of variance even when assuming a second-order factor. One criterion was whether the first-order factors cumulatively account for at least 30% of variance across all of the manifest variables. The second criterion was whether the loading of each manifest variable on its positive schizotypy factor was at least .30 or larger. As in previous research (Wolff & Preising, 2005), we used the completely standardized second-order factor solution as a starting point for the Schmid-Leiman transformations.

In the Schmid-Leiman transformation, 32% of the total variance among all of the manifest variables can be attributed to the first-order factors, while 68% of the variance in the scales can be attributed to the second-order factor. In addition, all of the first-order factor loadings in the Schmid-Leiman transformation were greater than .30. This suggests that the first-order factors are accounting for meaningful variance in the manifest variables even when assuming a second-order factor.

Differential Associations among Schizotypy Facets and FFM Personality. In the fourth set of analyses, we examined whether the first-order schizotypy factors would exhibit differential associations with FFM traits (see Table 3). In this analysis, FFM traits were regressed on the first-order factors and shared variance among schizotypy factors was removed. In addition, we also examined whether the common variance among positive schizotypy factors (i.e., the second-order factor) might be associated with FFM traits, especially openness to experience. In this analysis, FFM traits were regressed on the second-order positive schizotypy factor.

As can be seen in Table 3, paranoia was associated with increased neu-

TABLE 3. Standardized Parameter Estimates (Betas) for the Relations Among First-Order Schizotypy Factors, the Second-Order Positive Schizotypy Factor, and Five-Factor Traits

Five-Factor Traits	First Order Factors				Second-Order Factor
	Positive		Negative		Positive Schizotypy
	Paranoia	Referential Thinking	Cognitive-Perceptual	Constricted-Asociality	
Neuroticism	0.91**	0.29*	-0.03	0.10	0.59**
Agreeableness	-0.45**	0.22*	0.08	-0.30**	-0.48**
Openness to Experience	-0.18	0.05	0.11	-0.12	-0.15*
Conscientiousness	-0.33*	0.24*	-0.20*	-0.11	-0.33**
Extraversion	-0.19*	0.02	0.11	-0.88**	-0.48**

* $p < .05$; ** $p < .01$

roticism, but decreased agreeableness, conscientiousness, and extraversion. In contrast, referential thinking was associated with increased neuroticism, agreeableness, and conscientiousness. The cognitive-perceptual factor was associated with decreased conscientiousness, while constricted-asociality was associated with decreased extraversion and agreeableness. Hence, it appears that the four first-order schizotypy factors exhibit unique associations with FFM traits. Notably, none of the facets were associated with increased openness to experience. In addition, as can also be seen in Table 3, the second-order positive schizotypy factor was also not positively associated with increased openness to experience, actually being associated with decreased openness. Moreover, the second-order factor was also associated with high neuroticism, low agreeableness, low conscientiousness, and low extraversion.

DISCUSSION

In the current study, four sets of analyses provided converging evidence that positive schizotypy is a multidimensional construct composed of distinct facets. First, a model with three positive schizotypy factors (paranoia, referential thinking, & cognitive-perceptual) fit better than models with fewer than three positive schizotypy factors. Second, a second-order positive schizotypy factor could not completely account for the correlations among the first-order positive schizotypy factors (Kwapil et al., 2008; Raine et al., 1994; Stefanis et al., 2004). Third, the Schmid-Leiman transformation found that meaningful variance can be attributed to the first-order factors even when assuming a second-order factor. Fourth, the first-order schizotypy factors exhibited differential relations with FFM personality characteristics. Hence, overall, the current results suggest that positive schizotypy involves multiple distinct but correlated constructs.

The current study is arguably the first CFA study to clearly discriminate the positive schizotypy factors from each other as well as from a negative schizotypy factor (i.e., constricted-asociality). In particular, the inclusion of multiple measures of paranoia and referential thinking made it possible, for the first time, to examine whether separate paranoia and referential thinking facets were distinct from other schizotypy facets. Previous positive schizotypy factor models have not had acceptable levels of model fit, with the exception of models that have included atheoretical or nonintuitive cross-loadings (Battaglia, Cavallini, Macciardi, & Bellodi, 1997; Stefanis et al., 2004). Hence, the current model results appear to achieve better model fit and/or to be more parsimonious than in previous studies. Additionally, the higher-order factor model (Model 7) fit significantly better than did the three-factor models (Models 3–6) even if a higher-order positive schizotypy factor was included in these models. Although, Model 7 fit significantly worse than Model 1, it still fit the data reasonably well, and future research could examine the nature of a second-order positive schizotypy factor. However, the finding that positive schizotypy is multidimen-

sional suggests that future research on the associations between positive schizotypy and other individual difference variables should not examine positive schizotypy globally, but instead should measure each facet individually. For example, referential thinking should not be included in measurements of paranoia or cognitive-perceptual factors, and paranoia should not be included with the cognitive-perceptual factor. Hence, the current results suggest that positive schizotypy factors might be associated with some distinct etiological factors and that measuring positive schizotypy as a single dimension may obscure relations between positive schizotypy factors and other variables.

Additionally, the constricted-asociality factor was as highly correlated with the positive schizotypy factors as they were with each other. This suggests that there may be overlap between positive and negative dimensions of schizotypy. For example, paranoia appears to be distinct from both other positive factors and constricted-asociality. However, it may contain aspects of positive schizotypy reflecting paranoid ideation as well as aspects of negative schizotypy reflecting withdrawal or disinterest in social relationships. Future research could continue to address the overlap among these symptom domains.

One limitation of the current research is that it was confined to college students and participants were not specifically selected for high schizotypal traits. Few participants in the current research would be considered to have high schizotypal traits. Thus, one issue for future research would be to examine whether similar results would be found in different populations. Previous research has found evidence of similar factor structures in clinical and nonclinical samples for psychotic and psychotic-like symptoms and traits (Bilder, Mukherjee, Rieder, & Pandurangi, 1985; Crow, 1980; Liddle, 1987). Nevertheless, future research should examine whether a similar structure of positive schizotypy is found in people with personality disorders and in people with psychotic disorders. Additionally, a potential limitation of the current research, and other CFA research, is that the factor structure is dependent on the scales used to measure the constructs. It is possible that the inclusion of more scales could result in the best fitting model including more factors. Conversely, the exclusion of some scales could result in one of the three-factor models (i.e., Models 3–6) providing the best fit. Future research could replicate the factor structure found in the current study with alternative measures. Moreover, the inclusion of a fourth factor would almost invariably improve the fit of the model over a three-factor model. However, the chi-square difference test and multiple different tests of the multidimensionality of positive schizotypy protect against erroneously finding a four-factor model to be the best fitting. Future research could replicate the factor structure found in the current study with alternative measures.

It is possible that further research on the factor structure of positive schizotypy could have some relevance for the classification of schizophre-

nia-spectrum or cluster A personality disorders (PD). For example, there are some ways that the current results seem both consistent as well as inconsistent with the three cluster A personality disorders, Paranoid, Schizoid, and Schizotypal, included in the DSM-IV. The current research found a distinct paranoia factor, which is consistent with the DSM-IV classification of a separate paranoid personality disorder. At the same time, the current study found a constricted-asociality factor distinct from the three positive factors, consistent with a distinct Schizoid PD reflecting these constricted-asociality traits.

On the other hand, the current results also seem inconsistent with some aspects of DSM-IV cluster A classification. The current results found evidence of distinct cognitive-perceptual and referential thinking factors; however, these factors are not represented by distinct DSM-IV PDs. Instead, the other DSM-IV cluster A disorder is Schizotypal PD with diagnostic criteria that includes items from all four of the schizotypy factors identified in the current research (and even some other items as well). The current results suggest that it might be possible to further refine the conceptualization of Schizotypal PD, which could be incorporated into DSM-V (First et al., 2002; Krueger, Skodol, Livesley, Shrout, & Huang, 2008).

The factors identified in the current study are also fairly similar to personality pathology defined by the Dimensional Assessment for Personality Pathology (DAPP-BQ; Livesley & Jackson, 2002) and the Schedule for Non-Adaptive and Adaptive Personality (SNAP; Clark, 1993). In particular, the current study included the DAPP-BQ Suspiciousness subscale loading on the paranoia factor and the Inhibited Emotional Expression subscale loading on the constricted-asociality factor. On the DAPP-BQ, the Pessimistic Anhedonia, Social Apprehensiveness, and Low Affiliations facets may also be similar to the current constricted-asociality factor, while the Cognitive Dysregulation facet may be similar to the current cognitive-perceptual factor (Krueger et al., 2008). On the SNAP, the mistrust trait may be similar to the current paranoia factor, while eccentric perceptions may be similar to the cognitive-perceptual factor, and detachment may be similar to constricted asociality. However, neither the DAPP-BQ nor the SNAP contains subscales that could discriminate referential thinking from a paranoia or cognitive-perceptual factor, which was found in the current study.

In addition to evidence that positive schizotypy is multidimensional, the current research suggests that schizotypy factors might be distinctly related to FFM traits. Previous research has been inconsistent as to whether cluster A personality disorders can be understood from a FFM framework (Tackett et al., 2008). The current findings suggest that paranoia (and possibly Paranoid PD) might be strongly associated with some FFM traits, in particular being strongly associated with high neuroticism and low agreeableness as hypothesized. In addition, constricted-asociality (and possibly Schizoid PD) might also be strongly related to FFM traits, in particular decreased extraversion and decreased agreeableness. These results for

paranoia and constricted-asociality appear to be generally consistent with some previous research on schizotypy and FFM traits (Kerns, 2006; Lynam & Widiger, 2001; Trull et al., 2001).

In contrast to paranoia and constricted-asociality, the current research did not find evidence that the cognitive-perceptual factor was strongly associated with FFM traits as hypothesized. It has been suggested that cognitive-perceptual distortions might be associated with openness to experience (Camisa et al., 2006; Kwapil et al., 2008). However, in the current research, the cognitive-perceptual factor was not significantly associated with openness to experience, consistent with some other research (e.g., Chmielewski & Watson, 2008). One potential limitation of the current research is that only one measure of openness to experience was used which prevented analyses of the relations among specific facets of openness to experience and positive schizotypy factors. Measuring FFM traits on a global level may miss the relations among specific facets and personality disorders (Samuel & Widiger, 2008). Relatedly, some research has found that schizotypal PD is not associated with the broad openness trait, but is instead associated with specific facets of openness to experience (Lynam & Widiger, 2001; Ross et al., 2002; Trull et al., 2001). Another possibility is that the cognitive-perceptual factor would be associated with openness to experience if openness to experience was assessed using maladaptive variants of the openness items (Samuel & Widiger, 2008). Additionally, some researchers have suggested that dimensional models of PDs may need to include an "oddity" factor that is similar to, but separate from, an openness factor (Watson, Clark, & Chmielewski, 2008). Future schizotypy research could include measures of openness to experience that allow for the measurement of specific facets as well as maladaptive variants.

Although the cognitive-perceptual factor was not associated with openness to experience, we also examined the possibility that it is the variance common among all positive schizotypy factors that is associated with openness to experience. However, the second-order positive schizotypy factor was actually weakly but significantly negatively associated with openness to experience. Hence, it does not appear that positive schizotypy factors in general are positively associated with the broad openness to experience trait. Instead, the second-order factor was associated with what many would consider to be maladaptive personality traits: high neuroticism, low agreeableness, low extraversion, and low conscientiousness (Coker, Samuel, & Widiger, 2002). This suggests that it is unclear if the common positive schizotypy variance represents personality traits specific to positive schizotypy or instead to personality pathology in general. One issue for future research might be to examine whether the common variance among positive schizotypy factors is better represented by a general oddity factor or instead by personality pathology in general.

Another issue for future research could be to further validate the discriminability of paranoia, referential thinking, and cognitive-perceptual factors. Although these four factors displayed differential associations

with FFM personality characteristics in the current research, it is not clear if these domains are the best way to validate these factors. Previous research has suggested that facets of positive schizotypy are associated with self-relevant information processing (e.g., self-esteem, attributional style, self-consciousness; Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Fenigstein & Venable, 1992; Freeman, 2007). Additionally, some research by the current authors suggests that these paranoia, referential thinking, and constricted asociality factors may be differentially associated with facets of self-relevant information processing (Cicero & Kerns, in review). Future research could examine the relations among facets of positive schizotypy and self-processing.

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