

Comparing the factor structure of the Wisconsin Schizotypy Scales and the Schizotypal Personality Questionnaire

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Abstract:

Schizotypy is a multidimensional construct that captures the expression of schizophrenic symptoms and impairment from subclinical levels to full-blown psychosis. The present study examined the comparability of the factor structure of 2 leading psychometric measures of schizotypy: the Wisconsin Schizotypy Scales (WSS) and the Schizotypal Personality Questionnaire (SPQ). Both the SPQ and WSS purportedly capture the multidimensional structure of schizotypy; however, whether they are measuring comparable factors has not been empirically demonstrated. This study provided support for a 2-factor model with positive and negative factors underlying the WSS; however, contrary to previous findings, the best fit for the SPQ was for a 4-factor model using confirmatory factor analysis, and a 2-factor model using exploratory factor analysis. The WSS factors were relatively distinct, whereas those underlying the SPQ showed high overlap. The WSS positive and SPQ cognitive-perceptual factors appeared to tap comparable constructs. However, the WSS negative and SPQ interpersonal factors appeared to tap somewhat different constructs based on their correlation and their patterns of associations with other schizotypy dimensions and the Five-Factor Model—suggesting that the SPQ interpersonal factor may not adequately tap negative or deficit schizotypy. Although the SPQ offers the advantage over the WSS of having a disorganization factor, it is not clear that this SPQ factor is actually distinct from positive schizotypy. Existing measures should be used with caution and new measures based on a priori theories are necessary to further understand the factor structure of schizotypy.

Keywords: Factor structure | Schizophrenia | Schizotypal Personality Disorder | Schizotype | Questionnaires | Rating scales

Article:

The vulnerability for schizophrenia is expressed across a continuum of clinical and subclinical symptoms and impairment referred to as schizotypy (e.g., Kwapil & Barrantes-Vidal, 2012; Lenzenweger, 2010; Meehl, 1962). Schizotypy offers explanatory power for understanding the development and expression of schizophrenic psychopathology, and it encompasses a broad spectrum of conditions including schizophrenia and related disorders, personality disorders, the prodrome, and subclinical expressions. Schizotypy, and by extension schizophrenia, are heterogeneous in etiology, symptoms, and treatment response. This heterogeneity is captured in a multidimensional structure (e.g., Kwapil, Barrantes-Vidal, & Silvia, 2008; Vollema & van den Bosch, 1995) that includes positive, negative, and disorganized dimensions (Gross et al., 2014). Several significant problems limit schizotypy research and the utility of the construct. First, schizotypy and schizophrenia are often treated as homogenous; however, the dimensions are associated with unique, and sometimes contrasting, patterns of symptoms and impairment. Therefore, treating schizotypy and schizophrenia as homogenous impedes our ability to understand these complex phenotypes (Kwapil & Barrantes-Vidal, 2012). Many measures of schizotypy are multidimensional; however, it is unclear whether different questionnaires have comparable factor structures. For example, it would be difficult to draw conclusions about negative schizotypy if different measures of this dimension are tapping substantively different characteristics. Therefore, the present study examined the comparability of the factor structure of two widely used measures of schizotypy, the Wisconsin Schizotypy Scales (WSS) and the Schizotypal Personality Questionnaire (SPQ; Raine, 1991).

The WSS are comprised of four scales: Perceptual Aberration (Chapman et al., 1978), Magical Ideation (Eckblad & Chapman, 1983), Revised Social Anhedonia (Eckblad et al., 1982), and Physical Anhedonia (Chapman et al., 1976). A two-factor structure with positive and negative schizotypy dimensions underlies the WSS (e.g., Brown, Silvia, Myin-Germeys, Lewandowski, & Kwapil, 2008; Kwapil et al., 2008) and the two factors tend to be minimally associated. The dimensions are associated with differential patterns of symptoms and impairment in cross-sectional questionnaire (e.g., Brown et al., 2008), interview (e.g., Kwapil et al., 2008), cognitive (e.g., Tallent & Gooding, 2000), and experience sampling studies (e.g., Kwapil, Brown, Silvia, Myin-Germeys, & Barrantes-Vidal, 2012). Both dimensions predicted the development of schizophrenia-spectrum disorders in a 10-year follow-up study, and positive schizotypy predicted the development of psychotic disorders (Kwapil, Gross, Silvia, & Barrantes-Vidal, 2013). There are two notable limitations to the factor structure of the WSS. First, the scales include only two dimensions and do not assess disorganization. Second, the negative schizotypy dimension is generally limited to anhedonia and social disinterest, and does not cover other deficit features. However, the WSS negative dimension is significantly associated with interview ratings of other negative symptoms including alogia, avolition, anergia, and diminished affect (Kwapil, Gross, Chun, Silvia, & Barrantes-Vidal, 2014).

The SPQ was designed to measure schizotypal personality disorder using subscales for each of the nine schizotypal traits in the Diagnostic and Statistical Manual of Mental Disorders, third edition, revised (DSM-III-R; American Psychiatric Association, 1987). Raine (1991) reported that 55% of participants scoring in the upper decile met criteria for schizotypal personality disorder. Salokangas et al. (2013) reported that the SPQ subscales of ideas of reference and no close friends were associated with transition to psychosis in clinical high-risk patients. Numerous studies support the validity of the SPQ through associations with clinical, functional, and

cognitive deficits (e.g., Cohen, Callaway, Najolia, Larsen, & Strauss, 2012; Chen, Hsiao, & Lin, 1997; Park & McTigue, 1997; Raine et al., 1997). Although the SPQ was originally designed to assess schizotypal personality disorder, it is frequently used as a measure of schizotypy.

The factor structure of the SPQ has been widely investigated with the majority of support for a three-factor model. Using confirmatory factor analysis (CFA), Raine et al. (1994) reported a three-factor model with cognitive-perceptual, interpersonal, and disorganized factors. The factors showed modest to high intercorrelations (cognitive-perceptual and disorganized: $r = .71$ and $.75$ in Raine et al.'s two samples; disorganized and interpersonal: $.44$ and $.60$; and cognitive-perceptual and interpersonal: $.20$ and $.37$). The SPQ Manual (Raine, 2001) recommended that these factors could be computed using additive formulae that summed the subscales. Other studies have supported this three-factor model using exploratory (e.g., Fossati et al., 2003) and confirmatory (Chen et al., 1997; Rossi & Daneluzzo, 2002; Suhr & Spitznagel, 2001) factor analyses, and evidence for the construct validity of these factors has been demonstrated through studies of neurocognition (e.g., Daneluzzo et al., 1998), genetics (Raine & Baker, 1992), and clinical features (e.g., Axelrod et al., 2001). However, other studies reported good fit for a three-factor model only after employing modification indices or model revisions (Bora & Arabaci, 2009; Reynolds et al., 2000; Wuthrich & Bates, 2006), which is problematic when claiming support for an a priori model. Several studies have suggested alternative factor structures to this three-factor model, including a four-factor model with a paranoid factor (Bora & Arabaci, 2009; Compton et al., 2009; Stefanis et al., 2004). Finally, research using item-level factor analyses has failed to support Raine's three-factor model (e.g., Chmielewski & Watson, 2008; Cohen et al., 2010).

There is consistent support for the two-factor structure underlying the WSS and strong, but not unequivocal, support for a three-factor model of the SPQ. The present study examined the latent structure of both measures and the comparability of their factors. Both the SPQ cognitive-perceptual and the WSS positive schizotypy factors are presumed to tap a dimension of positive or psychotic-like schizotypy. Likewise, the SPQ interpersonal and the WSS negative schizotypy factors are presumed to assess negative or deficit components of schizotypy. It is unclear whether the SPQ disorganized factor will be associated with the WSS dimensions. In addition, we examined the comparability of the factors by considering their associations with the Five-Factor Model of Personality (FFM; Costa & McCrae, 1992). Specifically, we examined (a) the factor structure of the SPQ and the WSS by testing a series of competing models, (b) the extent to which factors within each measure were distinct, (c) the extent to which factors across models were associated, (d) the FFM composition of the factors, and (e) the extent to which the FFM composition was comparable across the measures.

Method

Participants

Questionnaires were completed by 1445 participants (out of approximately 3100 candidate subjects) in mass screening sessions during five semesters. Eight participants were dropped because of elevated infrequency scores. The mean age of the sample was 19.5 years ($SD = 3.2$). The sample was 77% female with 67% Caucasian, 22% African American, 2% Hispanic, 3%

Asian/Pacific Islander, <1% Native American, 2% other (3% not reported). An unselected subset of 880 participants also completed a personality questionnaire. This subsample was comparable to the original sample in demographic characteristics.

Materials and Procedures

The Perceptual Aberration Scale includes 35 items measuring perceptual and bodily distortions, and the Magical Ideation Scale has 30 items tapping belief in implausible causality. The Revised Social Anhedonia Scale consists of 40 items measuring asociality, and the Physical Anhedonia Scale has 61 items assessing deficits in sensory and aesthetic pleasure. The SPQ consists of 74 items tapping schizotypal personality disorder using subscales for each of the nine DSM–III–R schizotypal traits. The WSS items were intermixed with a 13-item infrequency scale (Chapman & Chapman, 1983) to screen out invalid responders. A subset of participants completed the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992). Participants received course credit. The study was approved by the UNCG Institutional Review Board, and all participants provided informed consent before taking part in the study.

Results

Descriptive statistics for the WSS and the SPQ subscales and factors using Raine et al.'s (1994) additive formulae (Supplemental Table 1) were consistent with reports from other large samples (e.g., Kwapil et al., 2008; Raine, 1991). Supplemental Table 2 presents the correlations of the WSS and the SPQ subscales. Alpha was set at .001 because of the large sample size and number of analyses, to minimize Type I error and the likelihood of reporting statistically significant but inconsequential findings. Table 1 presents the correlations of the SPQ factor scores and WSS dimension scores (computed using formulae in Kwapil et al., 2013). The WSS positive and negative dimensions are distinct; however, the SPQ factors are highly correlated (large effect sizes). The WSS negative schizotypy dimension shows a unique association with the SPQ interpersonal factor, whereas all three SPQ factors correlate highly with the WSS positive schizotypy dimension, suggesting a lack of differentiation among the SPQ factors.

Table 1
Correlations of the Wisconsin Schizotypy Scales (WSS) and Schizotypal Personality Questionnaire (SPQ) Dimension Scores Based on Additive Formulae (n = 1,437)

| | WSS Positive Schizotypy | WSS Negative Schizotypy | SPQ Cognitive Perceptual | SPQ Interpersonal |
|----------------------|-------------------------|-------------------------|--------------------------|-------------------|
| WSS | | | | |
| Positive Schizotypy | | | | |
| Negative Schizotypy | .12* | | | |
| SPQ | | | | |
| Cognitive-Perceptual | .68* | .14* | | |
| Interpersonal | .41* | .49* | .57* | |
| Disorganized | .53* | .18* | .54* | .49* |

Note. Medium effect sizes in bold, large effect sizes in bold and italics.

* $p < .001$.

Correlations of the Wisconsin Schizotypy Scales (WSS) and Schizotypal Personality Questionnaire (SPQ) Dimension Scores Based on Additive Formulae (n = 1,437)

To better explore the WSS and SPQ factor structures, we conducted a series of CFA, exploratory factor analyses (EFA), and structural equation models (SEM). First, we sought to replicate the two-factor structure of the WSS by testing the three models used by Kwapil et al. (2008). We hypothesized best fit for a two-factor model in which the Revised Social Anhedonia Scale cross-loaded. This factor structure has been demonstrated in numerous studies and a rationale for this cross-loading can be found in Kwapil et al. (2008). Next we tested the fit of a default unidimensional model and two frequently used models for the SPQ: Raine et al.'s (1994) three-factor model and Stefanis et al.'s (2004) four-factor model. Note that we did not test models that were based upon the post hoc use of modification indices (e.g., Wuthrich & Bates, 2006). Given inconsistency in the literature about the factor structure of the SPQ, we also computed an EFA to examine whether an alternative model provided appropriate fit.

The sample size was sufficient for conducting CFA, with each sample having greater than a 20:1 participant to observed variable ratio (Bentler & Chou, 1987) and well above the 200 participant minimum recommended by Barrett (2007). Following the recommendations of Little, Rhemtulla, Gibson, and Schoemann (2013) and Coffman and MacCallum (2005), each of the WSS scales was divided into three "parcels" to produce more robust estimates. Parcels were computed by distributing groups of three items to the parcels in sequential order to ensure that each parcel contained a comparable proportion of items from the beginning, middle, and end of the scales. The residuals from each parcel within a schizotypy scale were allowed to correlate given the common source. Goodness of fit was assessed using indicators listed in Table 2. Adequate fit is indicated by fit indices greater than .95 and RMSEA less than .05. Models with smaller values of AIC and BCC have better fit than competing models (Kline, 2011). In the case of nested models, change in chi-square and degrees of freedom across models were examined.

Table 2
Confirmatory Factor Analyses for the Wisconsin Schizotypy Scales (WSS) and Schizotypal Personality Questionnaire (SPQ) (n = 1,437)

| Model | GFI | AGFI | CFI | RMSEA | 90% CI | AIC | BCC | χ^2 (df) | p value | $\Delta\chi^2$ (Δdf) | p value |
|-------------------------|-----|------|-----|-------|-----------|--------|--------|---------------|---------|--------------------------------|---------|
| WSS CFA | | | | | | | | | | | |
| Unidimensional | .90 | .82 | .91 | .110 | .103–.116 | 855.8 | 856.5 | 785.8 (43) | <.001 | | |
| Two-factor ^a | .98 | .96 | .98 | .054 | .047–.061 | 288.0 | 288.7 | 216.0 (42) | <.001 | | |
| Two-factor ^b | .99 | .98 | .99 | .029 | .021–.038 | 165.7 | 157.4 | 87.7 (39) | <.001 | 128.3 (3) | <.001 |
| SPQ CFA | | | | | | | | | | | |
| Unidimensional | .79 | .64 | .69 | .197 | .189–.206 | 1572.5 | 1572.8 | 1536.5 (27) | <.001 | | |
| Raine three-factor | .94 | .88 | .92 | .106 | .097–.115 | 435.4 | 435.7 | 391.4 (23) | <.001 | | |
| Stefanis four-factor | .98 | .96 | .98 | .063 | .052–.073 | 177.6 | 178.0 | 125.6 (19) | <.001 | | |

^a Positive schizotypy factor = Perceptual Aberration, Magical Ideation; Negative schizotypy factor = Physical Anhedonia, Social Anhedonia. ^b Positive schizotypy factor = Perceptual Aberration, Magical Ideation, Social Anhedonia; Negative schizotypy factor = Physical Anhedonia, Social Anhedonia.
Confirmatory Factor Analyses for the Wisconsin Schizotypy Scales (WSS) and Schizotypal Personality Questionnaire (SPQ) (n = 1,437)

Three models were tested to examine factor structure of the WSS. The first model had all variables loading on a generic schizotypy factor and, as shown in Table 2, the fit for this model was poor. The second model included a positive schizotypy factor with loadings from the Perceptual Aberration and Magical Ideation Scales, and a negative schizotypy factor with loadings from the anhedonia scales. The factors were allowed to correlate in this and the subsequent model. This model provided improved fit for the data. The final model was the same as the previous, except that the Revised Social Anhedonia Scale was allowed to load on both of the schizotypy factors. This model provided excellent fit for the data. Given that the final two models were nested, the change in chi-square and degrees of freedom were evaluated. The final model provided significantly improved fit over the second model (see Figure 1). Note that we did

not test additional CFA models of the WSS, as there are not theoretically supported alternative models and exploratory factor models of this and other samples support a two-factor structure.

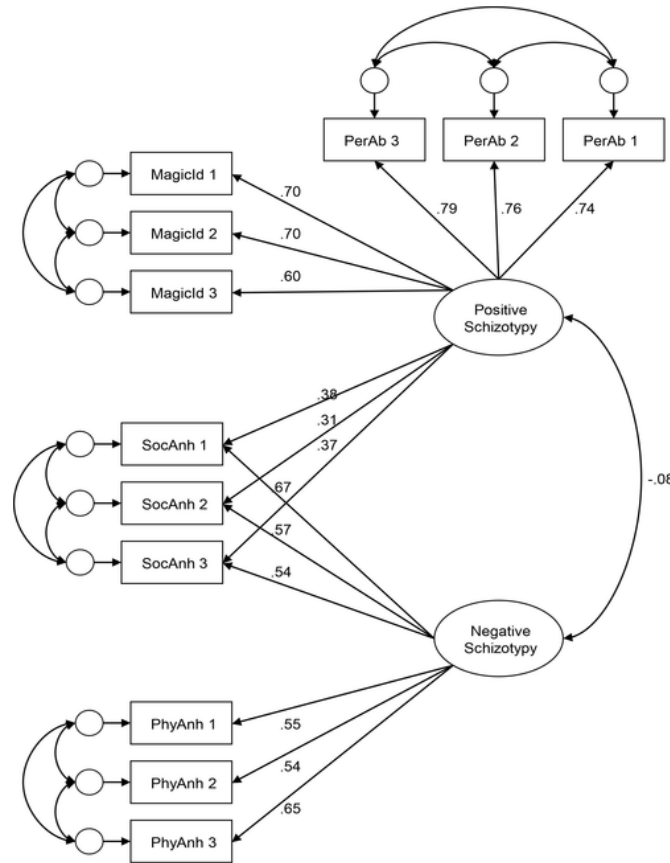


Figure 1. Confirmatory factor analysis of the Wisconsin Schizotypy Scales. 1, 2, and 3 represent that each of the scales was divided into three parcels to produce more robust estimates. Magicl d = Magical Ideation; PerAb = Perceptual Aberration; SocAnh = Social Anhedonia; PhyAnh = Physical Anhedonia.

Three CFA models examined the factor structure of the SPQ using the nine subscales. The first model had all the subscales loading on a generic schizotypy factor. As shown in Table 2, fit for this model was poor. The second model tested Raine et al.'s (1994) three-factor structure. This is a latent variable version of the additive model reported in Table 1. This model's fit was greatly improved over the default model but relatively poor overall. As shown in Figure 2, the factors were moderately to strongly associated, with the cognitive-perceptual and disorganized factors correlating .69. The third analysis tested the four-factor model of Stefanis et al. (2004). This model provided the best fit; however, as shown in Figure 3, the social anxiety subscale had a low loading on the paranoia factor and the correlations among the factors tended to be quite high.

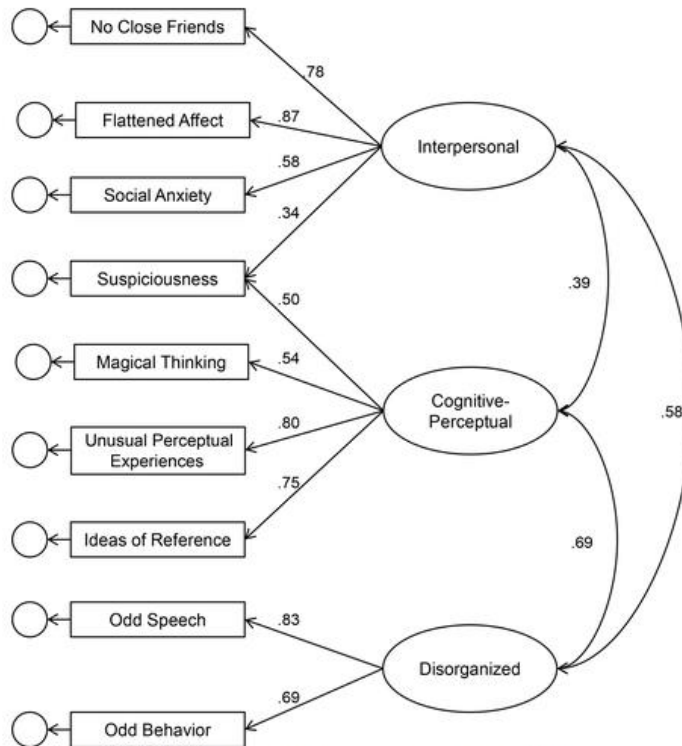


Figure 2. Confirmatory factor analysis of three-factor model of the Schizotypal Personality Questionnaire. Boxes represent each of the 9 SPQ subscales.

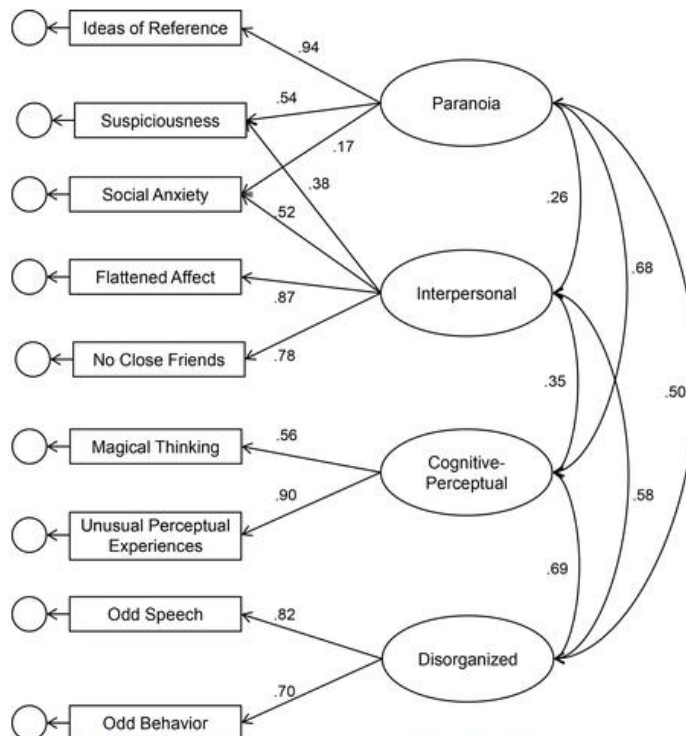


Figure 3. Confirmatory factor analysis of four-factor model of the Schizotypal Personality Questionnaire. Boxes represent each of the 9 SPQ subscales.

Finally, we computed an EFA with a geomin rotation of the nine SPQ subscales. The EFA was computed with a parallel analysis with 50 random data sets that indicated that the optimum solution had two factors. The sample Eigenvalues for the first two factors (both >1.0) were

greater than the average Eigenvalues from the parallel analysis. The third Eigenvalue from the sample was less than 1.0 and smaller than the average value from the parallel analysis. The two retained factors accounted for 43.5% and 16.1% of the variance, respectively, and correlated .41, $p < .001$. As shown in Supplemental Table 3, there was considerable cross-loading of the subscales on the two factors, suggesting a lack of a clearly defined underlying structure.

Structural equation models were computed to examine the association between the best-fitting two-factor model of the WSS with the three- and four-factor CFA models and the two-factor EFA model of the SPQ. These findings are contrasted with the correlations of the WSS with the additive model of the SPQ reported in Table 1. Table 3 presents the correlations among the latent factors. The latent SPQ cognitive-perceptual factor and the WSS positive symptom dimension were largely overlapping. Likewise, there were strong associations of the WSS positive dimension with the SPQ paranoia and disorganized factors. The latent SPQ interpersonal factor was also strongly associated with the WSS negative schizotypy factor. The EFA solution for the SPQ provided a relatively close approximation of the two-factor structure of the WSS.

Table 3
Correlations of the Latent Schizotypy Dimensions (n = 1,437)

| | WSS Positive Schizotypy | WSS Negative Schizotypy |
|-------------------------------------|-------------------------|-------------------------|
| Three-factor SPQ model | | |
| Cognitive-perceptual factor | .87* | -.15 |
| Interpersonal factor | .34* | .68* |
| Disorganized factor | .64* | .09 |
| Four-factor SPQ model | | |
| Cognitive-perceptual factor | .90* | -.18* |
| Interpersonal factor | .33* | .69* |
| Disorganized factor | .65* | .09 |
| Paranoia factor | .62* | -.10 |
| Two-factor SPQ model (EFA solution) | | |
| Factor 1 | .87* | -.14 |
| Factor 2 | .29* | .72* |

Note. Medium effect sizes in bold, large effect sizes in bold and italics.
* $p < .001$.

Correlations of the Latent Schizotypy Dimensions (n = 1,437)

To further examine the comparability of the SPQ and WSS factors, we examined the FFM composition of the two-factor WSS solution and four of the SPQ solutions (three-factor additive, three- and four-factor CFA models, and two-factor EFA model). Consistent with Kwapil et al. (2008), WSS positive and negative schizotypy were differentiated by the FFM (see Table 4). WSS positive schizotypy was strongly associated with neuroticism, consistent with its hypothesized affective dysregulation. It was also associated with elevated openness to experience and with low agreeableness and conscientiousness. WSS negative schizotypy was strongly associated with introversion and with low openness and agreeableness. The differentiation of positive and negative schizotypy on openness is consistent with Costa and Widiger's (1994) suggestion that schizoid and schizotypal pathology are distinguished by this domain.

Table 4
Correlations of Five-Factor Model Domains With the Schizotypy Factors (n = 880)

| | N | E | O | A | C |
|-------------------------------------|-------------|--------------|-------------|--------------|--------------|
| Two-factor latent WSS model | | | | | |
| Positive Schizotypy | .43* | -.06 | .27* | -.29* | -.22* |
| Negative Schizotypy | .16* | -.49* | -.25* | -.30* | -.15 |
| Three-factor additive SPQ model | | | | | |
| Cognitive-perceptual factor | .41* | -.08 | .16* | -.34* | -.11 |
| Interpersonal factor | .48* | -.49* | .01 | -.30* | -.18* |
| Disorganized factor | .39* | -.10 | .33* | -.33* | -.37* |
| Three-factor latent SPQ model | | | | | |
| Cognitive-perceptual factor | .41* | -.07 | .20* | -.32* | -.15* |
| Interpersonal factor | .41* | -.51* | .04 | -.28* | -.22* |
| Disorganized factor | .45* | -.17* | .26* | -.34* | -.32* |
| Four-factor SPQ model | | | | | |
| Cognitive-perceptual factor | .37* | -.07 | .24* | -.27* | -.16* |
| Interpersonal factor | .41* | -.51* | .04 | -.28* | -.23* |
| Disorganized factor | .44* | -.18* | .27* | -.34* | -.32* |
| Paranoia factor | .35* | -.02 | .06 | -.26* | -.04 |
| Two-factor SPQ model (EFA solution) | | | | | |
| Factor 1 | .42* | -.05 | .27* | -.34* | -.21* |
| Factor 2 | .46* | -.51* | .03 | -.29* | -.23* |

Note. Medium effect sizes in bold, large effect sizes in bold and italics.

* $p < .001$.

Correlations of Five-Factor Model Domains With the Schizotypy Factors (n = 880)

The most striking feature of the association of the SPQ models with the FFM was that all of the SPQ dimensions in each model were associated with neuroticism. The FFM composition of the SPQ cognitive-perceptual factor was comparable to the disorganized factor, and both were similar to the composition of the WSS positive schizotypy. The WSS negative schizotypy and SPQ interpersonal factors were comparable in terms of their inverse associations with extraversion and agreeableness; however, they were distinguished by their associations with neuroticism and openness to experience. The SPQ interpersonal factor was strongly associated with neuroticism. This is puzzling given that affective dysregulation and reactivity are not part of negative schizotypy. Surprisingly, the SPQ interpersonal factor was not associated with low openness, as diminished interest and curiosity about the world characterize negative schizotypy.

Discussion

Schizotypy is a useful construct for understanding the development, expression, and treatment of schizophrenia. Schizotypy is multidimensional and clarification of the exact factor structure is essential. The field frequently operates without a clear operationalization of the structure of schizotypy and often defines factors on the basis of the measure of schizotypy used in a particular study. This raises concerns about the extent to which different scales purporting to measure comparable factors are in fact measuring the same thing. We limited our examination to the WSS and SPQ, but these issues should be examined in other measures of schizotypy.

CFA supported a two-factor model for the WSS, consistent with previous evidence that positive and negative dimensions underlie these measures. The factor structure of the SPQ was less clear. Using CFA, Stefanis' four-factor model emerged as superior to the traditional three-factor

model. EFA, on the other hand, revealed a two-factor model with a primarily positive factor (high loadings for ideas of reference, perceptual experiences, odd behavior and speech, magical thinking, and suspiciousness) and a primarily interpersonal factor (high loadings for social anxiety, flattened affect, and no friends). These results were somewhat incongruent with the literature, which consistently reports the superiority of three-factor models underlying the SPQ and poor fit for two-factor models (e.g., Chen et al., 1997; Raine et al., 1994; Rossi & Daneluzzo, 2002; Suhr & Spitznagel, 2001; Wuthrich & Bates, 2006). However, given the high degree of overlap among Raine's three factors, it is not entirely surprising that using EFA, fewer than three factors were adequate in explaining the variance in the SPQ.

In keeping with the conceptualization of schizotypy as a multidimensional construct with unique factors, measures should be comprised of dimensions that contribute nonoverlapping information. This study revealed a low correlation between the WSS positive and negative schizotypy factors, consistent with previous findings; however, schizotypy appears to involve more than two factors, so the WSS are limited in this regard. Nevertheless, the distinct factor structure of the WSS is supported by a body of validation studies (e.g., Kwapil et al., 2008, 2013). The latent and additive SPQ models exhibited high intercorrelations among the factors. One might argue that moderate correlations are expected among SPQ factors given that they are all tapping schizotypal personality traits; however, the high correlation between SPQ cognitive-perceptual and disorganized factors, coupled with their similar patterns of correlations with the WSS and FFM, and the lack of support for separate factors in the EFA, suggests that cognitive-perceptual and disorganization are not distinct dimensions. Not surprisingly, we found stronger support for a latent three-factor model for the SPQ than for an additive solution. Specifically, the latent SPQ model offered stronger associations of the SPQ cognitive-perceptual and WSS positive schizotypy factors and of the SPQ interpersonal and WSS negative schizotypy factors, along with a smaller association of the SPQ interpersonal and WSS positive schizotypy factors.

To further examine the comparability of these two measures, we investigated the FFM composition of the factors. The FFM clearly distinguished between the WSS positive and negative schizotypy factors (especially in terms of neuroticism, extraversion, and openness). In contrast, the SPQ factors from all the models were robustly associated with neuroticism (which likely drives the high correlations among the SPQ factors). The SPQ and WSS are reasonably comparable on assessing a positive or cognitive-perceptual schizotypy factor. Regardless of which SPQ model was used, the correlations between WSS positive and SPQ cognitive-perceptual were high and both factors were associated with neuroticism, openness, and low agreeableness. However, an important distinction between these two measures arises when considering negative or deficit schizotypy. The WSS negative and SPQ interpersonal factors were strongly correlated, suggesting a degree of overlap, and had comparable inverse associations with extraversion and agreeableness. However, WSS negative schizotypy was only modestly associated with neuroticism, whereas (in all of the SPQ models) the interpersonal factor was moderately associated with neuroticism, with correlations equal to or greater than those of the cognitive-perceptual factor and neuroticism. Furthermore, WSS negative schizotypy was associated with low openness to experience, whereas the SPQ interpersonal factor was unassociated with openness. These differences raise questions that are central to the definition and measurement of negative schizotypy. Simply put, neuroticism, which involves affective dysregulation, distress, emotionality, and urgent impulsiveness, is not part of the nomological

network of negative schizotypy, whereas low openness, characterized by a dearth of fantasy, emotions, values, and interests, nicely captures the schizoid nature of negative schizotypy.

Raine et al. (1994) described the SPQ interpersonal dimension as an analog to negative symptoms, and it is frequently referred to in the literature as a measure of negative schizotypy. Unfortunately, the present data suggest that the SPQ interpersonal and WSS negative factors are measuring overlapping but fundamentally different constructs—and the evidence suggests that the WSS provides a better assessment of negative schizotypy (although note the aforementioned limitations of this dimension). The SPQ interpersonal factor comprises social anxiety, no close friends, constricted affect, and paranoid ideation in the three- and four-factor models. The WSS do not include anxiety as a central component of schizotypy, and studies suggest that social anxiety is more strongly associated with positive schizotypy (e.g., Brown et al., 2008). Further, suspiciousness contributes to both the cognitive–perceptual and interpersonal dimensions in the SPQ three-factor model and the paranoia and interpersonal dimensions in the four-factor SPQ model. Theoretically, negative features are characterized by deficits in thought, emotion, interest, and engagement with the world; therefore, social anxiety and paranoia do not appear to be components of negative schizotypy. Paranoia involves ideation regarding the motives of others as threatening and as such should theoretically be included with the other ideational components in the positive dimension. Overall, the SPQ interpersonal dimension is highly correlated with neuroticism, WSS positive, and SPQ cognitive–perceptual and disorganization; therefore, it does not appear to provide unique information or to map onto negative schizotypy.

A key limitation of the WSS is that they do not measure disorganized schizotypy, whereas the SPQ has the potential to do so. We sought to investigate exactly what is measured by the disorganized dimension of the SPQ, which is comprised of the odd speech and odd behavior subscales. This dimension correlated highly with all the other SPQ factors in the three- and four-factor models. This raises the question as to how much unique information is being provided by this dimension. Furthermore, the EFA did not reveal a third disorganized dimension, and both odd speech and odd behavior loaded highly on the “positive” factor in this model. Finally, regardless of the model used, SPQ disorganization showed medium to high correlations with both the WSS positive factor and neuroticism (as do the other SPQ factors). One potential explanation is that this dimension is tapping into something other than disorganization. The strong relationship with WSS positive, but not negative, schizotypy, as well as the relationship with neuroticism, suggests that the disorganization factor taps positive schizotypy. A closer look at the specific questions comprising this factor indicates that they could readily be endorsed because of positive (instead of or in addition to) disorganized features. For example, items such as people sometimes comment on my unusual mannerisms and habits and people sometimes stare at me because of my odd appearance could be endorsed because of volitional behaviors resulting from positive symptoms, rather than cognitive and behavioral disorganization.

Overall, schizotypy is heterogeneous and we believe that there is support for a positive, negative, and disorganized structure (e.g., Gross et al., 2014). The current study raises key limitations of two prominently used schizotypy measures in capturing the multidimensional structure of schizotypy. We also recognize that item-level factor analyses may produce alternative models to the subscale based analyses reported in the present study (e.g., Chmielewski & Watson, 2008). We are not recommending that these measures are obsolete—in fact the wealth of published

studies clearly demonstrates their utility; however, we strongly urge researchers to consider their theoretical conceptualization of schizotypy and whether the measure they use maps onto this model, and to use precision when considering what these measures assess. Furthermore, given the limitations of the present sample (drawn from students at one university and predominately comprised of female participants), we encourage researchers to examine these issues and the generalizability of these findings in other samples. Finally, we believe that clearer conceptualization of the multidimensional structure of schizotypy should ultimately guide the development of new measures (and avoid the current situation of established measures defining the construct of schizotypy).

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