Validation of the Multidimensional Schizotypy Scale-Brief in Two Large Samples

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Abstract:

This study reports on an initial examination of the construct validity of the Multidimensional Schizotypy Scale-Brief (MSS-B) and the first investigation of its psychometric properties outside of its derivation samples. The MSS-B contains 38 items that assess positive, negative, and disorganized schizotypy and has comparable content coverage and psychometric properties as the original 77-item Multidimensional Schizotypy Scale. Two large samples ($n = 1430$ and 1289) completed the MSS-B, as well as measures of schizotypal personality traits and the Five-Factor Model of Personality. MSS-B scores were computed from the full-length scale in sample 1, whereas participants in sample 2 were administered the MSS-B. The psychometric properties and intercorrelations of the MSS-B subscales were consistent with findings from the original derivation samples, with no shrinkage in reliability. In terms of relations with schizotypal traits, the MSS-B positive schizotypy dimension had its strongest association with cognitive-perceptual schizotypal traits, MSS-B negative schizotypy had its strongest association with interpersonal schizotypal traits, and MSS-B disorganized schizotypy had its strongest association with disorganized schizotypal traits. The schizotypy dimensions were characterized by hypothesized patterns of distinct associations with the Five-Factor Model. The present findings are consistent with results from the full-scale MSS.

Keywords: Schizotypy | Schizotypal | Personality | Schizophrenia-spectrum

Article:

Schizophrenia is the most severe manifestation of schizotypy, a continuum of symptoms and impairment ranging from subclinical features, to the prodrome, to schizophrenia-spectrum personality disorders, to full-blown psychosis (Kwapil and Barrantes-Vidal 2012; Lenzenweger 2010; Meehl 1990). Schizotypy is a useful construct that unifies the study of diagnostic and subclinical conditions that likely share underlying etiological factors.

Furthermore, the study of schizotypy allows for the examination of trajectories of risk and protective factors through the identification of non-disordered schizotypes (Kwapil and Barrantes-Vidal 2015). Schizophrenia is a heterogenous disorder (e.g., Andreasen and Carpenter 1993; Mueser and Jeste 2008), and this heterogeneity is observed across levels of the schizotypy continuum. This heterogeneity can be captured in a multidimensional structure that includes positive or psychotic-like, negative or deficit, and disorganized schizotypy dimensions.

Several questionnaire measures of schizotypy have been developed dating back to the 1970s. Cross-sectional and longitudinal studies employing these measures have greatly enhanced our understanding of schizotypy and the development of schizophrenia-spectrum disorders (see reviews by Chapman et al. 1995; Kwapil and Chun 2015; Mason 2015; Mason et al. 1997). However, many of these schizotypy questionnaires suffer from limitations, which include development using older measurement methodology, lack of a clear theoretical basis, and the fact that many appear to be measuring qualitatively different constructs (e.g., different and inconsistent factor structures, inclusion of irrelevant constructs, different patterns of associations with theoretically-related constructs; e.g., Gross et al. 2014). Furthermore, some scales include items with outdated or culturally biased wording, and demonstrate differential item functioning for sex and ethnicity.

Kwapil et al. (2017b) developed the Multidimensional Schizotypy Scale (MSS) to address these limitations and build upon the rich history of the psychometric assessment of schizotypy. The MSS was developed following the scale construction recommendations of DeVellis (2012). Classical test theory, item response theory (IRT), and differential item functioning (DIF) were employed to build a 77-item measure with three subscales measuring positive, negative, and disorganized schizotypy. Kwapil et al. (2017b) reported good psychometric properties, good item discrimination and fit to the IRT model, and minimal item bias (DIF) for gender and race/ethnicity in large derivation ($n = 6265$) and cross-validation ($n = 1000$) samples. Kwapil et al. (2017a) replicated these properties in a large independent sample and provided initial evidence for construct validity of the MSS through associations with measures of schizotypal personality traits and the Five-Factor Model of Personality.

The MSS is comparable in length or shorter than commonly used schizotypy measures (e.g., the 72-item Schizotypal Personality Scale [SPQ; Raine 1991], the 104-item Oxford-Liverpool Inventory of Feelings & Experiences [O-LIFE; Mason et al. 1995], and the 166-item Wisconsin Schizotypy Scales [WSS], comprised of the Perceptual Aberration [Chapman et al. 1978], Magical Ideation [Eckblad and Chapman 1983], Physical Anhedonia [Chapman et al. 1976], and Revised Social Anhedonia [Eckblad et al. 1982] Scales). However, 77 items may still be impractical for some purposes. Brief versions of prominent schizotypy measures have been developed and used successfully (e.g., 22-item SPQ-B [Raine and Benishay 1995], 43-item O-LIFE-B [Mason et al. 2005], and 60-item WSS-B [Winterstein et al. 2011]); however, these short forms likely inherited the same problems discussed above from their original versions. Furthermore, the practical benefits of brief measures must be balanced with the potential loss of reliability and content coverage (i.e., does the brief form adequately capture the multidimensional model of schizotypy?). Therefore, Gross et al. (2018) developed the 38-item MSS-Brief version (MSS-B) using the same large samples and modern measurement methodologies as the MSS. The MSS-B had high internal-consistency reliability, good item-fit

and model-fit, good test information functions, and expected patterns of intercorrelations and associations with neuroticism, sex, and race/ethnicity. Furthermore, the pattern of findings was almost identical between the derivation and cross-validation samples. Given the evidence supporting the psychometric properties of the MSS-B, examination of its construct validity is a necessary next step.

Goals of Present Study

The goal of the present study was to provide the first examination of the construct validity of the MSS-B through associations with a questionnaire measure of schizotypal traits (the Schizotypal Personality Questionnaire-Brief; SPQ-B; Raine and Benishay 1995) and a gold standard measure of normal personality dimensions (the NEO-Five Factor Inventory; NEO-FFI; McCrae and Costa 2010). This study follows the work of Kwapil et al. (2017a) who examined the construct validity of the full-length MSS using the same measures. As stated by Smith et al. (2000), evidence for the validity of the original measure does not automatically apply to the brief form. Even given high correlations between the two versions, the reduction in items may endanger the content coverage of the construct; therefore, the short form's validity must be tested in independent samples (i.e., not just samples in which the full form was administered). Note that the MSS-B was developed to retain the same content coverage of positive, negative, and disorganized schizotypy as the original scale. Furthermore, it was expected that the MSS-B subscales would demonstrate similar associations with schizotypal personality traits and normal personality dimensions as seen for the MSS.

The SPQ-B is reported to have three underlying factors that measure cognitive-perceptual, interpersonal, and disorganized aspects of schizotypal personality disorder (Raine and Benishay 1995). Following Kwapil et al. (2017a), it was hypothesized that each MSS-B subscale would have the strongest association with its corresponding SPQ-B subscale (MSS-B positive with SPQ-B cognitive-perceptual, MSS-B negative with SPQ-B interpersonal, and MSS-B disorganized with the SPQ-B disorganized factor). We expected that the association of MSS-B positive schizotypy and SPQ-B cognitive-perceptual factor would be a large effect size, given that both tap positive schizotypy. We expected moderate effect sizes for the latter two associations, given that the SPQ interpersonal factor taps neuroticism and social anxiety, in addition to negative schizotypy, and the SPQ-B disorganized factor more broadly taps oddness and eccentricity, as opposed to specifically assessing cognitive and behavioral disorganization.

Regarding the Five-Factor Model composition of the MSS subscales, it was hypothesized that the MSS-B positive subscale would be positively associated with neuroticism and openness to experience and negatively associated with agreeableness and conscientiousness. It was expected that the MSS-B negative subscale would be characterized by decreased extraversion, openness, and agreeableness following previous findings (e.g., Gross et al. 2014; Kwapil et al. 2008; Kwapil et al. 2017a). Finally, it was hypothesized that the MSS-B disorganized subscale would be associated with increased neuroticism and decreased conscientiousness.

Methods

Participants

Two independent samples were assessed for the study. Sample 1 enrolled 1789 participants from three universities (UNC-Greensboro, Tennessee Tech University, Youngstown State University) and Amazon Mechanical Turk (MTurk). Usable data were obtained from 1430 participants. Participants were dropped for invalid (based on elevated infrequency scores, $n = 221$ or 12%) or incomplete ($n = 99$ or 6%) protocols. Following recommendations from Kwapil et al. (2017b), 39 participants (2%) age 60 to 89 years old were excluded from analyses because: a) the scales were developed on participants aged 18 to 59, b) the study of schizotypy tends to focus on younger participants at or near the age of greatest risk for developing schizophrenia-spectrum disorders, c) we wanted to avoid age-related cognitive disruptions in examining disorganized schizotypy. Sample 2 included 1498 participants recruited from MTurk. Usable data were retained from 1289 subjects (125 or 8.3% were dropped due to invalid protocols and 84 or 5.6% were dropped for being over age 59). In sample 1, mean age was 26.5 years (SD = 10.2, range 18 to 59 years), 65% were female, and 96% indicated that English was their first language. The racial/ethnic composition of sample 1 was 12% Black/African American, 4% Asian/Pacific Islander, 75% Caucasian, 6% Hispanic/Latino, .4% Native American, and 3% other. In sample 2, mean age was 34.4 years (SD = 9.3, range 18 to 59 years), 60% were female, and 98% indicated that English was their first language. The racial/ethnic composition of sample 2 was 7% Black/African American, 7% Asian/Pacific Islander, 78% Caucasian, 5% Hispanic/Latino, .4% Native American, and 2% other.

Materials

Participants in sample 1 completed the full-length Multidimensional Schizotypy Scale. Scores for the MSS-B were computed from these items (as all of the MSS-B items are included in the full-length version of the scale). Participants in sample 2 completed the MSS-B. Participants in both samples also completed demographic questions, the SPQ-B, and the NEO-FFI. The MSS-B contains 38 true-false items designed to assess positive, negative, and disorganized dimensions of schizotypy. The SPQ-B contains 22 items that tap schizotypal personality traits. Raine (2001) reported that coefficient alpha reliability for the three SPQ-B factors ranges from .72 to .80. The NEO-FFI contains 60 items that assess five domains of normal personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. McCrae and Costa (2010) report that coefficient alpha reliability for the domains range from .78 to .86. A 13-item infrequency questionnaire (Chapman and Chapman 1983) was included to screen out invalid responders. Participants who endorsed more than two infrequency items were omitted from the analyses.

Procedures

Participants completed the questionnaires online using Qualtrics software. University participants were recruited electronically and received course credit. MTurk participants were recruited via the MTurk website and received $1.00 upon completion of the survey. The project received IRB approval at each institution. The survey started with the informed consent document and demographic items. The MSS/MSS-B, SPQ-B, and infrequency items (which have dichotomous response format) were intermixed and presented in five blocks administered in

random order, followed by the NEO-FFI items (which were not intermixed with the other items because they have a 5-point Likert response format).

Results

Descriptive Statistics

Descriptive statistics for the MSS-B, SPQ-B, and the NEO-FFI for each sample are presented in Table 1 and are in line with reports from other large samples (e.g., Gross et al. 2018; McCrae and Costa 2010; Raine 2001). The reliabilities for the MSS-B subscales were nearly identical to values reported in the MSS derivation and cross-validation samples (Gross et al. 2018), indicating no shrinkage across four large and diverse samples. Table 2 presents the zero-order correlations of the MSS-B, SPQ-B, and NEO-FFI subscales. Alpha was set at .001 to minimize Type I error and the likelihood of reporting statistically significant but inconsequential findings due to the large sample size and number of analyses. Effect sizes are noted following Cohen (1992). The correlations among the three MSS-B subscales were closely comparable to correlations for the MSS-B derivation and cross-validation samples. Note that consistent with the MSS-B derivation and cross-validation samples, males and females did not differ on the MSS positive ($t(2717) = -1.04$, Cohen's $d = .04$) or disorganized ($t(2717) = -.55$, $d = .02$) schizotypy subscales, but males did score higher on the negative schizotypy subscale ($t(2717) = 5.92$, $p < .001$, $d = .22$), as expected.

Table 1. Descriptive statistics for the Multidimensional Schizotypy Scale-Brief, Schizotypal Personality Questionnaire-Brief, and NEO-Five Factor Inventory

Criterion	Sample 1 (*n = 1430*)			Sample 2 (*n = 1289*)		
	Mean	S.D.	Coefficient alpha	Mean	S.D.	Coefficient alpha
Multidimensional Schizotypy Scale-Brief						
Positive Schizotypy	1.91	2.33	.78	2.08	2.44	.78
Negative Schizotypy	1.77	2.37	.80	2.15	2.60	.81
Disorganized Schizotypy	1.70	2.77	.89	1.79	2.94	.90
Schizotypal Personality Questionnaire-Brief						
Cognitive-Perceptual	3.04	2.18	.71	3.22	2.20	.70
Interpersonal	3.88	2.38	.77	4.38	2.50	.80
Disorganized	2.10	1.87	.74	2.24	1.92	.75
NEO-Five Factor Inventory						
Neuroticism	36.76	8.89	.88	36.12	10.20	.91
Extraversion	39.44	7.69	.86	36.21	8.02	.87
Openness to experience	43.16	6.56	.79	44.80	6.37	.78
Agreeableness	43.59	6.55	.78	44.15	6.62	.79
Conscientiousness	43.43	7.39	.87	44.99	7.53	.89

Table 2. Correlations of the Multidimensional Schizotypy Scale-Brief, Schizotypal Personality Questionnaire-Brief, and NEO-Five Factor Inventory

	MSS-Pos	MSS-Neg	MSS-Dis	SPQ-CP	SPQ-I	SPQ-D	NEO-N	NEO-E	NEO-O	NEO-A
Multidimensional Schizotypy Scale-Brief										
Positive Schizotypy										
Negative Schizotypy	.18*/.22*									
Disorganized Schizotypy	*.43*/.41*	*.31*/.30*								
Schizotypal Personality Questionnaire-Brief										
Cognitive-perceptual	*.71*/.69*	.17*/.16*	*.40*/.38*							
Interpersonal	*.30*/.24*	*.49*/.51*	*.43*/.43*	*.36*/.34*						
Disorganized	*.45*/.37*	*.36*/.39*	*.56*/.55*	*.47*/.43*	*.51*/.52*					
NEO-Five Factor Inventory										
Neuroticism	*.37*/.28*	.21*/22*	*.52*/.54*	*.44*/.39*	*.47*/.54*	*.45*/.49*				
Extraversion	−.07/−.08	*−.53*/−.54*	−.23*/−.28*	−.09/−.15*	*−.60*/−.66*	−.28*/*−.35*	*−.35*/−.51*			
Openness to experience	.22*/.13*	−.14*/−.18*	.08/−.03	.21*/.15*	.02/−.07	.21*/.15*	.12*/.05	.04/.16*		
Agreeableness	−.24*/−.19*	*−.31*/−.38*	−.17*/−.22*	−.21*/−.19*	−.23*/*−.30*	−.28*/*−.30*	−.19*/−.26*	.13*/.24*	.16*/.17*	
Conscientiousness	−.20*/−.13*	−.20*/−.24*	*−.51*/−.49*	−.24*/−.19*	*−.30*/−.32*	*−.38*/−.38*	*−.54*/−.58*	.31*/.39*	−.05/.08	.15*/.25*

Sample 1 ($n = 1430$) correlations on left, Sample 2 (n = 1289) correlations on the right
*$p < .001$
Note: medium effect sizes in bold, large effect sizes in bold and italics

Table 3. Linear regressions examining prediction by the Multidimensional Schizotypy Scale-Brief factors in Sample 1 ($n = 1430$)

	MSS-B Positive Schizotypy			MSS-B Negative Schizotypy			MSS-B Disorganized Schizotypy			
Criteria	β	ΔR^2	f^2	β	ΔR^2	f^2	β	ΔR^2	f^2	Total R^2
SPQ-B										
Cognitive-perceptual	*.661*	*.355*	*.733*	−.017	.000	.000	.110*	.009	.016	.517
Interpersonal	.126*	.013	.020	**.389***	**.137**	**.207**	.255*	.049	.076	.339
Disorganized	.239*	.046	.077	.199*	.036	.060	**.396***	**.119**	**.200**	.401
NEO-FFI										
Neuroticism	.178*	.026	.037	.043	.002	.003	**.433***	**.142**	**.203**	.302
Extraversion	.065	.003	.006	**−.516***	**.240**	**.342**	−.095*	.007	.010	.293
Openness	.238*	.059	.049	−.191*	.033	.036	.035	.001	.002	.081
Agreeableness	−.191*	.030	.034	−.269*	.065	.075	−.006	.000	.000	.129
Conscientiousness	.027	.001	.001	−.043	.002	.003	**−.504***	**.192**	**.260**	.258

*$p < .001$
Note: medium effect sizes (f^2) in bold, large effect sizes in bold and italics
Each row represents a separate regression analysis in which the three MSS factors were entered simultaneously as predictors to examine their unique prediction of each of the SPQ-B and NEO-FFI factor scores

Table 4. Linear regressions examining prediction by the Multidimensional Schizotypy Scale-Brief factors in sample 2 ($n = 1289$)

	MSS-B Positive Schizotypy			MSS-B Negative Schizotypy			MSS-B Disorganized Schizotypy			
Criteria	β	ΔR^2	f^2	β	ΔR^2	f^2	β	ΔR^2	f^2	Total R^2
SPQ-B										
Cognitive-perceptual	*.647*	*.344*	*.683*	−.017	.000	.001	.125*	.012	.026	.494
Interpersonal	.029	.001	.000	**.414***	**.153**	**.232**	.290*	.066	.100	.341
Disorganized	.148*	.018	.029	.225*	.045	.072	**.422***	**.140**	**.224**	.374
NEO-FFI										
Neuroticism	.072	.004	.006	.051	.002	.003	**.491***	**.189**	**.268**	.294
Extraversion	.101	.008	.011	**−.509***	**.232**	**.338**	−.169*	.023	.032	.313
Openness	.188*	.029	.031	−.212*	.040	.043	−.037	.001	.001	.063
Agreeableness	−.084	.006	.007	−.334*	.100	.119	−.086	.006	.007	.162
Conscientiousness	.102*	.009	.012	−.108*	.010	.014	**−.502***	**.198**	**.268**	.260

*$p < .001$
Note: medium effect sizes (f^2) in bold, large effect sizes in bold and italics
Each row represents a separate regression analysis in which the three MSS factors were entered simultaneously as predictors to examine their unique prediction of each of the SPQ-B and NEO-FFI factor scores

Association of MSS-B and SPQ-B Factors

A series of linear regressions were computed in which each of the three MSS-B subscales were simultaneously entered to examine their unique prediction of each of the SPQ-B scores (Table 3). The standardized regression coefficient (β), change in R^2, and effect size f^2 were reported for each predictor in the linear regressions. According to Cohen (1992), f^2 values above .15 are medium and above .35 are large effect sizes. Note that change in R^2 and f^2 were computed for each predictor by rerunning the analyses with the specific MSS-B predictor entered at the second step, over and above the other two MSS-B subscales. Consistent with our predictions and Kwapil et al. (2017a) findings for the MSS, each of the MSS-B subscales had its strongest association with the corresponding factor from the SPQ-B (in fact, the only medium or large effect sizes were for those associations). The pattern of associations was generally consistent across the two samples, with the only notable difference being that MSS-B positive schizotypy predicted the SPQ-B interpersonal factor in the first sample, but not in the second sample.

Association of MSS and the Five-Factor Model Domains

Additional linear regressions simultaneously regressed each of the NEO-FFI domain scores on the three MSS-B subscales (see Table 3). The results for MSS-B negative schizotypy were comparable in the two samples, and similar to the findings from Kwapil et al. (2008) for the Wisconsin Schizotypy Scales negative schizotypy factor. MSS-B negative schizotypy was inversely associated with extraversion, openness to experience, and agreeableness. The findings for MSS-B disorganized schizotypy were comparable in the two samples. Disorganized schizotypy had large associations with elevated neuroticism and diminished conscientiousness, as well as a small inverse association with extraversion, not seen in Kwapil et al. (2017a) findings for the full-length MSS. The associations of positive schizotypy with the NEO-FFI domains in the first sample closely mirrored the findings from Kwapil et al. (2017a), as well as Kwapil et al.'s (2008) findings for the Wisconsin Schizotypy Scales positive schizotypy dimension. Specifically, positive schizotypy was significantly associated with increased neuroticism and openness to experience, and decreased agreeableness. The differentiation of positive schizotypy (high openness) and negative schizotypy (low openness) appears to be a robust finding (Edmundson and Kwapil 2013). The associations of MSS-B positive schizotypy with the NEO-FFI domains generally appeared to be dampened in sample 2, despite the fact that the primary association of positive schizotypy with the SPQ cognitive-perceptual factor was a consistently large effect in both samples. In sample 2, positive schizotypy accounted for unique variance in openness to experience, but not neuroticism or diminished agreeableness. Surprisingly, positive schizotypy had a significant positive association with conscientiousness after partialing out negative and disorganized schizotypy, despite having a significant inverse zero-order correlation. This seems to suggest a suppression effect driven by the overlap of both positive schizotypy and conscientiousness with disorganized schizotypy (Table 4).

Discussion

The MSS and MSS-B were developed to build upon the extensive history of psychometric assessment of the construct of schizotypy, which was introduced in the 1960s (Meehl 1962) and

has flourished since the 1970s, with the publications of the first high-quality self-report measures of schizotypal symptoms. This body of work is based on the premise that the psychometric identification of individuals on the schizotypy spectrum is a powerful research method for elucidating the mechanisms of risk and protection for schizophrenia-spectrum psychopathology. The MSS and MSS-B were developed to improve upon limitations of the widely-used measures of schizotypy and were developed with rigorous scale development methodology. Initial examinations of both measures in large samples indicate stable psychometric properties with basically no shrinkage in reliability across several large samples. Thus, there is a need to examine the construct validity of the scales using a wide array of measures and diverse samples. Kwapil et al. (2017a) recently provided initial evidence of the construct validity of the MSS; however, it cannot be assumed that brief forms of measures retain the same psychometric properties as their original counterparts.

The present study provided the first examination of the MSS-B outside of its derivation samples. Examination of associations with questionnaire measures of relevant constructs provides an appropriate starting place for examining the construct validation of the MSS and MSS-B, as large and diverse samples can be quickly assessed (whereas laboratory and interview studies, which may be able to provide more stringent tests of the validity of the scales, typically take longer to complete). In addition to employing large samples, the present study examined the performance of the MSS-B when the items were embedded in the full MSS (sample 1) and when only the brief scale was administered (sample 2). All-in-all, the MSS-B performed comparably in both samples. This study provided further evidence for the reliability of the MSS-B, with coefficient alphas ranging from .78 to .90 across the two samples (consistent with Gross et al.'s 2018 findings for the derivation samples). Not only were the subscale reliabilities stable, the reduction in items did not appear to adversely impact reliability (which is a key concern when creating brief measures). Similarly, correlations among the MSS-B subscales and with demographic variables were closely comparable to findings for the original MSS.

The SPQ-B was chosen for inclusion in this study (as well as in Kwapil et al. 2017a) as it is a widely-used measure of schizotypal personality disorder traits. The original (72-item) SPQ was designed to measure schizotypal personality disorder traits using a subscale for each of the nine diagnostic criteria from the Diagnostic and Statistical Manual of Mental Disorders, 3rd edition-revised (American Psychiatric Association 1987). As discussed by Gross et al. (2014), schizotypal personality disorder represents one piece of the schizotypy spectrum, but the SPQ is limited to measuring this aspect and not other manifestations of schizotypy, such as subclinical features or the prodrome. Therefore, we expected significant associations, but not perfect overlap, between the two measures. The results from this study were largely consistent with this conceptualization, providing evidence for the construct validity of the MSS-B. Consistent with Kwapil et al. (2017a), each of the MSS-B subscales showed the highest association (zero-order correlation and regression coefficient) with its corresponding SPQ-B subscale.

Positive schizotypy encompasses disruptions or excess in normal experiences/functioning, and the MSS positive subscale items were selected/written to cover the following domains: magical beliefs, the supernatural, special powers, passivity, thought transmission, ideas of reference, paranoia, and perceptual aberrations. Likewise, items were retained for the MSS-B positive subscale to maintain coverage of these domains. The inclusion of suspiciousness and passivity

experiences represents content areas not assessed by previous measures (such as the WSS) and that represent key features of positive schizotypy. Consistent with this conceptualization, the MSS-B positive subscale had its largest association (large effect size) with the SPQ-B cognitive-perceptual factor, which measures unusual perceptual experiences, odd beliefs, mild thought transmission, referential ideas, and suspiciousness. In terms of the Five-Factor Model, the findings for MSS-B positive schizotypy (increased neuroticism and openness to experience, decreased agreeableness) mirrored previous findings (Kwapil et al. 2017a; Kwapil et al. 2008) in sample 1; however, in sample 2 positive schizotypy failed to account for unique variance in neuroticism or diminished agreeableness. Given the robustness of these associations in previous work, future studies should investigate whether the MSS-B positive schizotypy scale retains the same associations as the MSS; however, findings from sample 1 in this study suggest that it does.

As hypothesized, the association of the MSS-B positive schizotypy subscale and NEO-FFI openness to experience factor was statistically significant, but represented a small effect size, in both samples. Recent literature has raised concerns about the extent to which Costa and McCrae's five-factor model of personality adequately captures deviantly high openness that is expected to characterize positive schizotypy and schizotypal personality disorder (Crego and Widiger 2017; Gore and Widiger 2013; Moorman and Samuel 2018). Consequently, alternative models and measures have been developed in an attempt to provide better coverage of deviantly high openness, such as Lee and Ashton's (2004) HEXACO-Personality Inventory, the Unconventionality factor of the Inventory of Personal Characteristics (Tellegen and Waller 2008), the Experiential Permeability Index (Piedmont et al. 2009), and the Five-Factor Schizotypal Inventory (Edmundson et al. 2011). Therefore, future studies should examine the association of the MSS and MSS-B subscales with these alternative measures of openness to experience.

Negative schizotypy encompasses deficits in normal functioning, and at its core is characterized by deficits in thought, emotion, interest, and engagement with the world. Thus, the MSS/MSS-B negative subscale was designed to comprehensively tap the following content domains: flattened affect, alogia, avolition, anhedonia, and social anhedonia. The inclusion of avolition, alogia, and flattened affect (key features of negative schizotypy) represent content areas missed by many previous measures (e.g., the WSS). The SPQ-B interpersonal factor appears to measure negative schizotypy characteristics such as social anhedonia and withdrawal; however, it also includes items tapping social anxiety, guardedness, and interpersonal discomfort. The MSS-B did not include these latter constructs based on the idea that they are not part of the definition of negative schizotypy. Therefore, the MSS-B negative and SPQ-B interpersonal subscales tap overlapping but different constructs and the medium association between the two reflects this. The Five-Factor Model pattern of relationships for the MSS-B negative subscale (inverse associations with extraversion, openness to experience, and agreeableness) were similar to findings for the MSS (Kwapil et al. 2017a) and the Wisconsin Schizotypy Scales (Kwapil et al. 2008), and are consistent with the deficit definition of negative schizotypy. The MSS-B negative subscale showed small associations with neuroticism, whereas the SPQ-B interpersonal factor showed medium to large associations.

Finally, disorganized schizotypy encompasses disruption in normal cognitive functioning, including disruptions in thought, speech, and behavior; therefore, the specific domains

underlying the MSS-B disorganized subscale were cognitive slowing, racing/loose associations, confusion, difficulty understanding and producing speech, disorganized thoughts, and disorganized behavior. The MSS-B disorganization subscale showed the strongest association with the SPQ-B disorganized factor, and also uniquely predicted the SPQ-B cognitive perceptual and interpersonal factors. This is consistent with previous findings (for disorganized schizotypy's relationship with positive and negative schizotypy [e.g., Gross et al. 2014]) and likely reflects the fact that disruptions in cognition and functional impairment are inherent in positive and negative schizotypy. The pattern of relationships for the MSS-B disorganized subscale (elevated neuroticism and diminished conscientiousness) was similar to findings for the MSS (Kwapil et al. 2017a). The small association of MSS-B disorganized with decreased extraversion was not found for the full-length MSS, but it follows that introversion or avoidance of people may result from cognitive disruption. Overall, the MSS-B subscale pattern of associations with SPQ-B and the Five-Factor model of personality are consistent with findings for the full-length MSS (and findings using other measures to tap similar constructs, such as the WSS) and support the underlying theoretical formulation of the three-factor model of schizotypy.

In summary, this is the first study to examine the psychometric properties of the MSS-B outside of its derivation samples, to include an independent sample in which only the MSS-B (not the full scale) was administered, and to examine the construct validity of the MSS-B positive, negative, and disorganized subscales. Findings suggest the MSS-B performs in a way that is largely comparable with the full measure, but with half the items. As with the MSS, we do not recommend summing the MSS-B items for a total schizotypy score, rather the subscales should be examined independently to capture the underlying multidimensional model of schizotypy. The MSS-B is recommended for use in screening large numbers of people, for example through online administration, and identifying risk for schizophrenia-spectrum psychopathology. Further, the MSS-B can easily be used in conjunction with larger study protocols, and initial results suggest that the total score for each of the three subscales maintains good reliability and validity for examining correlates of the multidimensional model of schizotypy. Finally, examinations of the validity of the MSS-B should continue through a process of construct validation. The use of validated questionnaires in large and diverse samples provides a promising starting point in the validation process, and future studies should include participants across the schizotypy continuum by oversampling for schizotypic features and including patient samples. Further, these results suggest that the use of structured diagnostic interviews is a warranted next step as the gold-standard procedure for assessing validity.

Conflict of Interest. Georgina Gross, Thomas Kwapil, Chris Burgin, Michael Raulin, Paul Silvia, Kathryn Kemp, and Neus Barrantes-Vidal declare that they have no conflict of interest.

Experiment Participants. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable

ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent. Informed consent was obtained from all individual participants included in the study.

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