

Multidimensional Schizotypy Scale

Multidimensional Schizotypy Scale-Brief

Scale and Manual v2.9

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This manual and the MSS and MSS-B scales can be downloaded from:

<https://kwapillab.weebly.com/multidimensional-schizotypy-scale.html>

SECTION 1. OVERVIEW

This manual provides information on the development and use of the Multidimensional Schizotypy Scale (MSS; Kwapil, Gross, Silvia, Raulin, & Barrantes-Vidal, 2018) and the Multidimensional Schizotypy Scale-Brief Edition (MSS-B, Gross, Kwapil, Raulin, Silvia, & Barrantes-Vidal, 2018). Note that complete information about the scales and their development can be found in the source articles for the scales.

Schizotypy offers a useful and unifying construct for understanding the etiology, development, and expression of schizophrenia-spectrum psychopathology. Questionnaire measures have been widely used to assess schizotypy and have greatly informed our understanding of the construct. The MSS and MSS-B are based upon current conceptual models of the construct to tap positive, negative, and disorganized dimensions of schizotypy. The scale development was based upon a large and diverse sample, and employed classical test theory, item response theory, and differential item function methodology. *Please note that this manual is a work-in-progress and will be updated as studies accrue.*

SECTION 2. SCHIZOTYPY

Although the descriptive psychopathology literature dating back to Kraepelin (1919) and Bleuler (1950) has described borderline or subclinical forms of schizophrenia, the construct of schizotypy emerged from the now classic writings of Paul Meehl (e.g., Meehl, 1962, 1990) and Gordon Claridge (e.g., 1997). Schizotypy represents the phenotypic manifestation of an underlying vulnerability for schizophrenia-spectrum psychopathology that is expressed across a broad range from subclinical expression to the prodrome to schizophrenia-spectrum personality disorders to full-blown psychosis (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010). Schizotypy, and by extension schizophrenia, is heterogeneous in terms of etiology, symptoms, and course. This heterogeneity can be captured by a multidimensional structure; specifically, there is good support for positive, negative, and disorganized dimensions (e.g., American Psychiatric Association, 2013; Tandon et al., 2009; Vollema & van den Bosch, 1995; Kwapil & Barrantes-Vidal, 2015). The positive or psychotic-like symptom dimension is characterized by disruptions in the content of thought (that range from magical ideation to full-blown delusions), perceptual oddities (including illusions and hallucinations), and suspiciousness/paranoia. The negative or deficit dimension involves diminution in experiences including alogia, anergia, avolition, anhedonia, flattened affect, and disinterest in others and the world. The cognitive-behavioral disorganization dimension is characterized by disturbances in the ability to organize and express thoughts and behavior, which range from mild disruptions in thinking and behavior to formal thought disorder and markedly disorganized actions. The reliable identification of these dimensions is necessary for parsing the heterogeneity of schizotypy and schizophrenia and for understanding the origins, development, and expression of these complex conditions.

Assessment of schizotypy. Numerous questionnaire measures have been developed to assess schizotypy (see reviews by Kwapil & Chun, 2015; Mason, 2015; Chapman, Chapman, & Kwapil, 1995; Mason, Claridge, & Williams, 1997). These measures offer advantages including being inexpensive, brief, and non-invasive to administer. They provide a valuable method for screening large numbers of clinical and nonclinical participants. Nevertheless, such measures suffer from the same limitations as all

questionnaires (e.g., self-report bias) and lack the precision of structured interviews. However, schizotypy questionnaires have provided valuable and widely used measurement tools.

Despite the contributions produced by studies employing schizotypy questionnaires, the currently available measures suffer from several limitations. First, many of the available measures do not map onto current multidimensional conceptualizations of schizotypy. Specifically, many of these measures fail to assess schizotypy as a multidimensional construct. Furthermore, scales that do map onto conceptual dimensions often differ in the number and the content of the factors – and in some cases contain factors that either do not map onto current conceptual models or do not adequately assess these factors. Likewise, scales that purport to measure the same factor often appear to be measuring different constructs (see Gross et al., 2014). In addition, many of the available measures are outdated in terms of measurement theory. These scales were typically developed using classical test theory, but more current tools, such as item response theory and differential item functioning, improve upon psychometric properties over and above classical test theory (Hambleton et al., 2000). Finally, some of the existing scales employ wording that is outdated and/or culturally biased.

SECTION 3. DEVELOPMENT OF THE MSS AND MSS-B SCALES

Overview of the scales. The MSS and MSS-B provide conceptually-based, multidimensional questionnaire measures of schizotypy that include subscales assessing positive, negative, and disorganized dimensions of schizotypy. The items tap experiences that occur across the schizotypy continuum. Many of the experiences are similar, albeit milder, forms of experiences that are seen in patients with schizophrenia-spectrum personality disorders and psychotic disorders. The positive schizotypy items tapped magical beliefs, referential thinking, mind reading and thought transmission, supernatural experiences, unusual perceptual and somatic experiences, paranoia and suspiciousness, and special powers. Negative schizotypy items assessed social disinterest, flat affect, anhedonia, alogia, anergia, and avolition. Considerable care was taken to generate items that tapped trait-like negative symptoms and did not simply tap depressive symptoms. The disorganized schizotypy items assessed disorganized thought and behavior, confusion, racing thoughts, loose associations, disrupted speech, difficulty following conversations, and slowness of thought.

Purpose of the scales and intended users. The MSS and MSS-B are intended for research purposes, not diagnosis or treatment planning. The scales are designed to provide dimensional assessments of positive, negative, and disorganized schizotypy. Schizotypy questionnaires are most commonly used in older adolescent and young adult samples. These ages are when schizotypic signs often first appear and represent the start of the greatest ages of risk for developing schizophrenia-spectrum disorders. The MSS was derived and cross-validated in a sample aged 18 to 59 years old. We recommend caution in using the MSS and MSS-B with participants outside of this age range until the scale's psychometric properties are established. The scales should be used and interpreted by administrators who have an advanced understanding of schizotypy and psychometric assessment methods.

Scale development procedures. The scale development procedures followed DeVellis' (2012) guidelines. Specifically, the scale development employed the following steps:

1. Development of trait specifications for the three schizotypy dimensions
2. Generation of a large pool of candidate items based upon the trait specifications
3. Review of the items by expert and non-expert reviewers
4. Repeated administrations of the candidate items to large pools of diverse participants from multiple sources – interspersed with evaluation, modification, and dropping of items
5. Selection of final items based upon content validity, CTT, IRT, and DIF
6. Evaluation of the psychometric properties of the items and subscales in a large independent sample of participants

All of the candidate schizotypy items had true-false response options. The goal was to develop relatively brief subscales that provided content coverage of each of the three schizotypy dimensions. The MSS-B was designed to provide a briefer alternative to the MSS, which offers comparable content coverage and consistent psychometric properties. Note that we did not develop facet scales within each of these domains (which would have necessitated longer scales to cover each facet adequately).

Derivation and cross-validation samples. A derivation sample of 6265 participants at four universities and on Amazon Mechanical Turk (MTURK) were administered the candidate items during a series of twelve assessments over a two-year period. A separate sample of 1000 participants from these same sources was used as a cross-validation sample (and were not included in the derivation analyses). Table 1 presents the demographic characteristics of the derivation and cross-validation samples.

	Derivation Sample (n = 6265)	Cross-Validation Sample (n = 1000)
Sex	1975 male, 4290 female	500 male, 500 female
Age in years: Mean (SD)	26.4 (10.4)	26.7 (10.2)
Age in years: range	18 – 59	18 - 59
Ethnicity/Race		
Caucasian	4429 (71%)	695 (70%)
Black/African American	763 (12%)	114 (11%)
Hispanic/Latino	371 (6%)	63 (6%)
Asian/Pacific Islander	434 (7%)	88 (9%)
Native American	42 (1%)	4 (<1%)
Other	225 (4%)	36 (4%)
English as first language	5890 (94%)	931 (93%)

Adapted from Kwapil et al. (2018)

During the scale development, participants completed the Infrequency scale (Chapman & Chapman, 1983), the Attentive Responding Scale (ARS; Maniaci & Rogge, 2014), and the NEO-FFI-3 neuroticism subscale (McCrae & Costa, 2010). Participants in the first three development phases completed the Social Desirability Scale (Crowne & Marlowe, 1960). Participants were dropped if they had elevated scores on the infrequency indices. Neuroticism and social desirability were assessed to determine the level of association of each of the candidate schizotypy items with these constructs. The Social Desirability Scale was dropped from the battery after the third development phase ($n=2174$) because none of the schizotypy items retained past that point had significant associations with social desirability.

The selection of items for the positive, negative, and disorganized schizotypy dimensions was based solely on data in the derivation sample. The cross-validation sample was used to assess the subscales' psychometric properties after the final item selection. Classical test theory, item response theory, and differential item functioning statistics, along with content validity, were used for the item selection process. Classical test theory statistics included mean endorsement frequency, correlation of the item with its schizotypy dimension, correlations with the other two schizotypy dimensions, and correlations with neuroticism. Two-parameter logistic item response theory models were computed that produced discrimination and difficulty parameters, as well as item response curves. Differential item functioning was assessed for sex and racial/ethnic differences.

Retention and final selection of items was based upon the following factors.

1. Efforts were made to ensure content validity by generating and retaining items that covered the full range of the constructs described in the three trait specifications.
2. In terms of classical test theory, preference was given to items that had relatively low endorsement frequency (.05 to .35), high item-scale correlation with the pool of items for that dimension, and relatively lower correlations with the other two schizotypy dimension item pools.
3. Preference was given to negative schizotypy items with low correlations with neuroticism. Preference was given to positive and disorganized schizotypy items with low to medium correlations with neuroticism.
4. Items with low endorsement frequency were selected given the relative rarity of schizotypy in the general population and to maximize discrimination at the high end of the scale. In terms of item response values, preference was given to items with high discrimination. Given that schizotypy is expected to be relatively rare (and consistent with preference for low endorsement frequency items), it was expected that items would have difficulty values of approximately .5 to 2.5.
5. Items with markedly elevated differential item functioning for sex or ethnicity were not included in the final scale.

Selection of Items for the Three Dimensions. The MSS is comprised of 26 positive schizotypy, 26 negative schizotypy, and 25 disorganized schizotypy items (see Section 6). Ten of the items were taken directly from other scales (five from the Magical Ideation Scale, three from the Perceptual Aberration

Scale, and one each from the Revised Social Anhedonia and Physical Anhedonia Scales) and eight items were modified from items in other scales (three each from the Revised Social Anhedonia and Cognitive Slippage [Miers & Raulin, 1987] Scales, and two from the Schizotypal Personality Questionnaire [Raine, 1991]). Based upon five reading level indices, the average reading grade level of the items was 8.2 (Readable.io).

The MSS-B contains 13 positive, 13 negative, and 12 disorganized schizotypy items (see Section 7). Six of the items were taken directly from other scales (three from the Magical Ideation, and one each from the Perceptual Aberration, Revised Social Anhedonia, and Physical Anhedonia Scales) and four items were modified from other scales (two from the Cognitive Slippage Scale, and one each from the Revised Social Anhedonia Scale and the Schizotypal Personality Questionnaire). The average reading grade level of the items was 8.7 (Readable.io).

The MSS and MSS-B subscales are scored by summing the number of items on each subscale answered in the schizotypic direction. Note some items are reversed scored (see answer key for scoring direction).

SECTION 4. PSYCHOMETRIC PROPERTIES OF THE MSS

Statistics for the final versions of the three MSS subscales in the derivation and cross-validation samples are presented in Table 2. The psychometric properties were comparable in the two samples, and have been closely comparable across subsequent studies. As expected given the selection of items with relatively low endorsement frequency, the subscales exhibited marked positive skew and kurtosis. All three subscales demonstrated excellent internal consistency reliability with either Cronbach's alpha or binary alpha methods in both samples.

Table 2. Descriptive Statistics, Reliability, and Correlations of the MSS Subscales in the Derivation ($n=6265$) and Cross-Validation ($n=1000$) Samples

<u>Subscale</u>	<u>Items</u>	<u>Sample</u>	<u>Mean (SD)</u>	<u>Skew (SE)</u>	<u>Kurtosis (SE)</u>	<u>Alpha</u>	<u>Binary</u>
Positive Schizotypy	26	Derivation	3.58 (4.41)	1.86 (.03)	3.75 (.06)	.89	.89
		Cross-Validation	3.71 (4.50)	1.70 (.08)	2.88 (.16)	.89	.89
Negative Schizotypy	26	Derivation	3.53 (4.36)	1.83 (.03)	3.45 (.06)	.88	.87
		Cross-Validation	3.78 (4.61)	1.66 (.08)	2.51 (.16)	.89	.88
Disorganized Schizotypy	25	Derivation	4.05 (5.81)	1.77 (.03)	2.44 (.06)	.94	.95
		Cross-Validation	3.88 (5.69)	1.83 (.08)	2.64 (.16)	.94	.94

Alpha = Coefficient alpha reliability; Binary = binary alpha reliability
Adapted from Kwapil et al. (2018)

Table 3 presents the intercorrelations of the MSS subscales and the correlations with neuroticism and sex in the two samples. The pattern of correlations was invariant across the samples, and across subsequent samples. Positive and negative schizotypy were modestly correlated, whereas disorganized schizotypy had moderate positive correlations with the other two dimensions. Positive and disorganized schizotypy were unassociated with sex, whereas negative schizotypy had a modest correlation – indicating that men scored slightly higher than women, consistent with the longstanding finding of greater negative symptoms in men than in women (e.g., Tandon et al., 2009). Neuroticism had a modest correlation with negative schizotypy, medium correlation with positive schizotypy, and a large correlation with disorganized schizotypy. ANOVAs were computed comparing the racial/ethnic groups on scores on the three subscales. None of the analyses were significant: positive schizotypy, $F(5,994) = 1.50$; negative schizotypy, $F(5,994) = 2.62$; disorganized schizotypy, $F(5,994) = 1.26$.

Table 3. Correlations of the MSS Subscales in the Derivation (n=6265) and Cross-Validation (n=1000) Samples

<u>Subscale</u>	<u>Positive Schizotypy</u>	<u>Negative Schizotypy</u>	<u>Disorganized Schizotypy</u>	<u>Sex</u>	<u>Neuroticism</u>
Positive Schizotypy		.19*	.48*	-.01	.37*
Negative Schizotypy	.16*		.34*	-.11*	.24*
Disorganized Schizotypy	.43*	.34*		-.01	.55*
Sex	.02	-.12*	.02		.15*
Neuroticism	.32*	.24*	.55*	.18*	

* $p < .001$

Results for the Derivation sample are listed above the diagonal and for the cross validation sample are listed below the diagonal. Positive correlations with sex indicate higher scores in women. Medium effect sizes are in bold, large effect sizes in bold and italics

Adapted from Kwapil et al. (2018)

Kemp, Gross, and Kwapil (2020) reported on the test-retest reliability of the MSS and MSS-B subscales across a three to seven-week interval. Test-retest reliability (intraclass correlation) was .84 for the MSS positive schizotypy subscale, .90 for the MSS negative schizotypy subscale, and .85 for the MSS disorganized schizotypy subscale. Test-retest reliability was unaffected by the length of the retest interval.

Exploratory factor analyses with geomin rotation computed on both the derivation and cross-validation samples indicated that each subscale was unidimensional. As was intended by the scale development, maximum test information (greatest discrimination) and minimal error occurred at high levels of the traits. The multidimensional structure of the MSS was also demonstrated by network analyses (see Christensen et al., 2019).

SECTION 5. VALIDITY OF THE MSS

Although the MSS was only recently released, an increasing number of validity studies have been completed and published or are in preparation. These include studies examining the association of the MSS subscales with a) other measures of schizotypy, b) dimensions of normal personality, c) measures of affect and affective symptoms, d) interview ratings of psychopathology, and e) daily life experiences assessed using experience sampling methodology.

Association of the MSS subscales with other questionnaire measures of schizotypy. Kwapil, Gross, and Burgin et al. (2018) examined the association of the MSS subscales with the Schizotypal Personality Questionnaire-Brief (SPQ-B) in 1430 young adults. As expected, the MSS positive, negative, and disorganized subscales had the strongest zero-order associations with the analogous subscales of the SPQ-B (all large effect sizes). Wicht et al. (unpublished) examined the association of French translations of the MSS subscales and the Oxford-Liverpool Inventory of Feelings and Experiences (OLIFE) in 264 young adults. As expected the MSS positive schizotypy subscale was associated with the OLIFE unusual experiences subscale, MSS negative schizotypy was associated with the OLIFE introvertive anhedonia subscale, and MSS disorganized schizotypy was associated with the OLIFE disorganisation factor (all large effects).

Association of the MSS subscales with dimensions of normal personality. Kwapil, Gross, Burgin et al. (2018) examined the association of the MSS subscales with the dimensions of the Five-Factor Model of personality as assessed by the NEO-3-Five Factor Inventory in a sample of 1430 young adults. Consistent with previous findings for the Wisconsin Schizotypy Scales positive and negative schizotypy dimensions, MSS positive schizotypy was significantly associated with neuroticism and openness to experience and inversely with agreeableness, whereas MSS negative schizotypy was inversely associated with extraversion, openness to experience, and agreeableness. MSS disorganized schizotypy was significantly associated with neuroticism and inversely with conscientiousness. Furthermore, Kemp, Burgin et al. (2020) reported that the MSS subscales had unique associations with measures assessing both adaptive and maladaptive aspects of openness to experience.

Association of the MSS subscales with measures of affective symptoms and experiences. Kemp, Gross, Barrantes-Vidal, and Kwapil (2018) examined the association of the MSS subscales with measures of affective symptoms and experiences in 575 young adults. MSS disorganized schizotypy showed the strongest effects and was significantly associated with depressive symptoms (Beck Depression Inventory), anxiety symptoms (Beck Anxiety Inventory), social anxiety symptoms (social phobia scale), and hypomanic characteristics (Hypomanic Personality Scale). Furthermore, MSS disorganized schizotypy was associated with state negative affect and inversely with state positive affect (Positive and Negative Affect Schedule). MSS positive schizotypy had its strongest associations with hypomanic characteristics and MSS negative schizotypy had its strongest associations (inversely) with hypomanic characteristics and positive affect.

Association of the MSS subscales with interview measures of symptoms and impairment. Kemp, Bathery, Barrantes-Vidal, and Kwapil (2021) assessed the associations of the MSS positive, negative, and

disorganized schizotypy subscales with interview-rated symptoms and impairment in 177 young adults. As hypothesized, the MSS positive schizotypy subscale was associated with interview-rated positive symptoms, and schizotypal and paranoid personality traits. Negative schizotypy was associated with interview-rated negative symptoms and schizotypal and schizoid traits, and elevated rates of schizophrenia-spectrum personality disorders. Disorganized schizotypy was associated with disorganized symptoms and attentional deficits. All three subscales were associated with impaired functioning. Thus, the schizotypy dimensions are associated with unique patterns of symptoms and impairment.

Kwapil, Clark, Rbeiz, Bathery, Kemp, and Barrantes-Vidal (in press) examined the associations of MSS positive, negative, and disorganized schizotypy dimensions with five interview-rated personality disorder diagnoses and traits in 151 young adults. As hypothesized, all three schizotypy dimensions were associated with impaired functioning. Positive schizotypy was associated with schizotypal and borderline personality traits, negative schizotypy was associated with schizotypal, schizoid, paranoid, and avoidant personality traits, and disorganized schizotypy was associated with paranoid, borderline, and avoidant personality disorder traits. Negative schizotypy predicted broad diagnoses of Cluster A personality disorders. Both negative and disorganized schizotypy predicted the broad diagnosis of any of the five personality disorders.

Association of the MSS subscales with psychotic-like experiences in daily life. Kwapil, Kemp et al. (2020) examined the associations of positive, negative, and disorganized schizotypy with psychotic-like experiences, affect, and social functioning in daily life using experience sampling methodology (ESM) in 203 young adults. ESM offers a powerful approach for assessing schizotypy in real-world settings. Participants were signaled 8 times daily for 7 days to complete ESM questionnaires. As hypothesized, positive schizotypy was robustly associated with psychotic-like experiences in daily life, whereas negative schizotypy was associated with negative experiences, diminished positive affect, and social disinterest in both samples. Disorganized schizotypy was associated with disorganization in daily life, and with increased negative affect and diminished positive affect. Thus, positive, negative, and disorganized schizotypy were associated with unique, hypothesized patterns of experiences in daily life.

Association of the MSS subscales with hippocampal volume. Sahakyan et al. (2021) examined the associations of MSS positive, negative, and disorganized schizotypy dimensions with hippocampal subfield volumes in a large sample ($n = 195$) of nonclinically ascertained young adults. Hippocampal subfields were analyzed from high-resolution 3 Tesla structural magnetic resonance imaging scans testing anatomical models, including anterior vs posterior regions and the cornu ammonis (CA), dentate gyrus (DG), and subiculum subfields separately for the left and right hemispheres. They found spatial effects across anterior vs posterior hippocampus segments across the schizotypy dimensions. The interaction of negative and disorganized schizotypy robustly predicted left hemisphere volumetric reductions for the anterior and total hippocampus, and anterior CA and DG, and the largest reductions were seen in participants high in negative and disorganized schizotypy.

Use of the separate MSS separate subscales instead of a total MSS schizotypy score. Due to the conceptualization of schizotypy as a multidimensional construct, it is recommended that researchers use

the separate positive, negative, and disorganized schizotypy subscales rather than computing a total MSS schizotypy score. Schizotypy's multidimensional factor structure is made apparent by the repeated findings that MSS subscales have differential hypothesized patterns of associations with symptoms and impairment. Several studies have examined the extent to which the separate MSS schizotypy subscale scores account for more variance in outcome measures than a total schizotypy score. These studies have found that using a total schizotypy score as a predictor only accounts for about half of the variance accounted for by the three MSS subscales when assessing diverse outcomes including symptoms, personality, and cognitive functioning (e.g., Kemp et al., 2020; Kemp, Burgin, Raulin, & Kwapil, 2020; Sahakyan, Kwapil, Lo, & Jiang, 2019).

SECTION 6. PSYCHOMETRIC PROPERTIES OF THE MSS-B

Table 4 presents descriptive statistics from the derivation and cross-validation samples for the final versions of the three MSS-B subscales. The psychometric properties were closely comparable in the two samples, and in numerous subsequent samples. The subscales were positively skewed, consistent with the item selection strategy. All three subscales demonstrated good internal consistency reliability based on Cronbach's alpha and binary alpha in both samples. We also reported the predicted reliability for each subscale based upon the reliability for the full-length subscales using the Spearman-Brown Prophecy Formula. The estimated and actual coefficient alpha values are closely comparable, suggesting that the MSS-B retained items of comparable quality from the full-length MSS. Scree plots indicated that each subscale was unidimensional, consistent with the subscales in the full-length MSS.

Table 4. Descriptive Statistics, Reliability, and Correlations of the MSS-B Subscales in the Derivation ($n=6265$) and Cross-Validation ($n=1000$) Samples

<u>Subscale</u>	<u>Items</u>	<u>Sample</u>	<u>Mean (SD)</u>	<u>Skew (SE)</u>	<u>Kurtosis (SE)</u>	<u>Alpha</u>	<u>Binary</u>	<u>SBEA</u>
Positive Schizotypy	13	Derivation	1.85 (2.34)	1.74 (.03)	3.18 (.06)	.80	.81	.80
		Cross-Validation	1.93 (2.34)	1.60 (.08)	2.67 (.16)	.78	.78	.80
Negative Schizotypy	13	Derivation	1.76 (2.35)	1.79 (.03)	3.16 (.06)	.80	.78	.79
		Cross-Validation	1.86 (2.47)	1.62 (.08)	2.20 (.16)	.81	.79	.80
Disorganized Schizotypy	12	Derivation	1.82 (2.89)	1.88 (.03)	2.78 (.06)	.90	.91	.88
		Cross-Validation	1.73 (2.85)	1.94 (.08)	3.00 (.16)	.89	.91	.88

Alpha = Coefficient alpha reliability; Binary = binary alpha reliability; SBEA = Spearman Brown Estimated Alpha
Adapted from Gross et al. (2018)

Kemp, Gross et al. (2020) reported that the test-retest reliability was .77 for the MSS-B positive schizotypy subscale, .85 for the MSS-B negative schizotypy subscale, and .82 for the MSS-B disorganized schizotypy subscale. Test-retest reliability was unaffected by the length of the retest interval.

Kemp, Gross et al. (2020) also examined the concordance of the analogous MSS and MSS-B subscales at separate administrations three to seven-weeks apart. Note that this provides alternate forms reliability

(although it is likely an underestimate due to the extended time interval). The association between the same subscales of the MSS and MSS-B across the two assessments ranged from .73 to .84, indicating good correspondence between the MSS and MSS-B subscales.

Table 5 presents the intercorrelations of the MSS-B schizotypy subscales, as well as correlations with neuroticism and sex in the two samples. The pattern of correlations was invariant across the samples and was closely comparable with the findings from the full-length subscales. Positive and negative schizotypy were modestly correlated, whereas disorganized schizotypy had moderate positive correlations with the other two dimensions. Each of the subscales of the MSS-B had correlations of .95 or higher with their corresponding subscale from the full-length MSS. As expected, positive and disorganized schizotypy were unassociated with sex. However, consistent with the common finding of greater negative symptoms in men than in women, men scored slightly higher than women on the negative schizotypy subscale. Neuroticism had a modest correlation with negative schizotypy, medium correlation with positive schizotypy, and a large correlation with disorganized schizotypy. ANOVAs were computed comparing the racial/ethnic groups on the three subscale scores. None of the analyses were statistically significant: positive schizotypy, $F(5,994) = 1.68$; negative schizotypy, $F(5,994) = 3.55$; disorganized schizotypy, $F(5,994) = 1.23$.

Exploratory factor analyses with geomin rotation computed on both the derivation and cross-validation samples indicated that each subscale was unidimensional. The item response theory test information curve for the three MSS-B schizotypy subscales indicates that, as intended, maximum test information (greatest discrimination) and minimal error occurred at high trait levels. The multidimensional structure of the MSS-B was also demonstrated by network analyses (see Christensen et al., 2019).

Table 5. Correlations of the MSS-B Subscales in the Derivation (n=6265) and Cross-Validation (n=1000) Samples

<u>Subscale</u>	<u>Positive Schizotypy</u>	<u>Negative Schizotypy</u>	<u>Disorganized Schizotypy</u>	<u>Sex</u>	<u>Neuroticism</u>
Positive Schizotypy		.17*	.43*	-.00	.34*
Negative Schizotypy	.13*		.32*	-.12*	.20*
Disorganized Schizotypy	.39*	.32*		-.01	.53*
Sex	.04	-.13*	-.00		.15*
Neuroticism	.30*	.20*	.51*	.18*	

* $p < .001$

Results for the Derivation sample are listed above the diagonal and for the cross validation sample are listed below the diagonal.

Positive correlations with sex indicate higher scores in women.

Medium effect sizes are in bold, large effect sizes in bold and italics

Adapted from Gross et al. (2018)

SECTION 7. VALIDITY OF THE MSS-B

Although the MSS-B was only recently released, several validity studies have been completed and published or are in preparation. These include interview studies of psychopathology and impairment, and questionnaire studies examining the association of the MSS-B subscales with a) other measures of schizotypy, b) dimensions of normal personality, and c) measures of affect and affective symptoms.

Association of the MSS-B subscales with interview measures of symptoms and impairment. Kemp, Bathery, Barrantes-Vidal, and Kwapil (2020) assessed the associations of the MSS-B positive, negative, and disorganized schizotypy subscales with interview-rated symptoms and impairment in 177 young adults. As hypothesized, the MSS-B positive schizotypy subscale was associated with interview-rated positive symptoms, and schizotypal and paranoid personality traits. Negative schizotypy was associated with interview-rated negative symptoms and schizotypal and schizoid traits, and elevated rates of schizophrenia-spectrum personality disorders. Disorganized schizotypy was associated with disorganized symptoms and attentional deficits. All three subscales were associated with impaired functioning.

Association of the MSS-B subscales with other questionnaire measures of schizotypy. Sahakyan and Kwapil (unpublished) examined the association of the MSS-B subscales with the Wisconsin Schizotypy Scale-Brief positive and negative schizotypy factors in 282 adults. As expected, the MSS-B positive and negative subscales were associated with their analogous Wisconsin Schizotypy Scale-Brief factors on the order of large effects. Wicht et al. (unpublished) examined the association of French translations of the MSS-B subscales and the Oxford-Liverpool Inventory of Feelings and Experiences (OLIFE) in 264 young adults. As expected the MSS-B positive schizotypy subscale was associated with the OLIFE unusual experiences subscale, MSS-B negative schizotypy was associated with the OLIFE introvertive anhedonia subscale, and MSS-B disorganized schizotypy was associated with the OLIFE disorganisation factor (all large effects). Kwapil, Gross, Burgin et al. (2018) examined the association of the MSS-B subscales with the Schizotypal Personality Questionnaire-Brief (SPQ-B) in 2719 young adults. As expected the MSS-B positive, negative, and disorganized subscales had the strongest zero-order associations with the analogous subscales of the SPQ-B (all large effect sizes).

Association of the MSS-B subscales with dimensions of normal personality. Gross, Kwapil, Burgin et al. (2018) examined the association of the MSS-B subscales with the dimensions of the Five-Factor Model of personality as assessed by the NEO-3-Five Factor Inventory in a sample of 2719 young adults. Consistent with previous findings for the Wisconsin Schizotypy Scales positive and negative schizotypy dimensions, MSS-B positive schizotypy was significantly associated with neuroticism and openness to experience and inversely with agreeableness, whereas MSS-B negative schizotypy was inversely associated with extraversion, openness to experience, and agreeableness. MSS-B disorganized schizotypy was significantly associated with neuroticism and inversely with conscientiousness and extraversion.

Association of the MSS-B subscales with measures of affective symptoms and experiences. Kemp, Gross, Barrantes-Vidal, and Kwapil (2018) examined the association of the MSS-B subscales with measures of affective symptoms and experiences in 575 young adults. MSS-B disorganized schizotypy

showed the strongest effects and was significantly associated with depressive symptoms (Beck Depression Inventory), anxiety symptoms (Beck Anxiety Inventory), social anxiety symptoms (social phobia scale), and hypomanic characteristics (Hypomanic Personality Scale). Furthermore, MSS-B disorganized schizotypy was associated with state negative affect and inversely with state positive affect (Positive and Negative Affect Schedule). MSS-B positive schizotypy had its strongest associations with hypomanic characteristics and MSS-B negative schizotypy had its strongest associations (inversely) with hypomanic characteristics and positive affect.

SECTION 8. Multidimensional Schizotypy Scale (MSS; Kwapił, Gross, Raulin, Silvia, & Barrantes-Vidal)

Key indicates answers in the schizotypic direction (true or false). Labels are: P = positive schizotypy, N = negative schizotypy, D = disorganized schizotypy. Positive, negative, and disorganized dimensions are scored as the number of items answered in the schizotypic direction.

MSS

The following items inquire about a broad range of attitudes, experiences, and beliefs that people have. Please answer each item in the way that best describes you. Please note that there are no right or wrong answers – just answer in the way that is most like you.

<u>Item</u>	<u>label</u>	<u>key</u>	
1	N01	T	Throughout my life I have noticed that I rarely feel strong positive or negative emotions.
2	P01	T	I have sometimes felt that strangers were reading my mind.
3	D01	T	My thoughts and behaviors are almost always disorganized.
4	N02	F	Having a meal with other people is almost always better than eating alone.
5	P02	T	I believe that I could read other peoples' minds if I really tried.
6	D02	T	When people ask me a question, I often don't understand what they are asking.
7	N03	F	In general, it is important for me to have close relationships with other people.
8	P03	T	I often think that I hear people talking only to discover that there was no one there.
9	D03	T	Most of the time I find it is very difficult to get my thoughts in order.
10	N04	F	Just being with other people can make me feel good.
11	P04	T	I occasionally worry that people I see on the street are spying on me.
12	D04	F	Most of the time my thoughts seem clear and organized.
13	N05	T	I have always preferred to be disconnected from the world.
14	P05	T	I have felt that there were messages for me in the way things were arranged, like furniture in a room.
15	D05	T	I often have difficulty following what someone is saying to me.
16	N06	T	I rarely feel strong emotions even in situations in which other people usually do.
17	P06	T	I have worried that people on other planets may be influencing what happens on Earth.
18	D06	T	I have a hard time staying on topic while speaking.
19	N07	F	If given the choice, I would much rather be with another person than alone.
20	P07	T	I believe that dreams have magical properties.
21	D07	T	I often feel so mixed up that I have difficulty functioning.
22	N08	F	When I move to a new place, I feel a strong desire to make friends.
23	P08	T	I have felt that something outside my body was a part of my body.
24	D08	T	When I try to do one thing, I often become confused and start doing something else.
25	N09	T	Throughout my life, very few things have been exciting or interesting to me.
26	P09	T	I sometimes wonder if there is a small group of people who can control everyone else's behavior.
27	D09	T	My thoughts are so hazy and unclear that I wish that I could just reach up and put them into place.
28	N10	F	I often look forward to upcoming events.
29	P10	T	I believe that ghosts or spirits can influence my life.
30	D10	T	I often find that when I talk to people I don't make any sense to them.
31	N11	T	Having close friends is not as important as people say.
32	P11	T	I have had the momentary feeling that someone's place has been taken by a look-alike.
33	D11	T	My thoughts and behaviors feel random and unfocused.
34	N12	F	Although there are things I enjoy doing by myself, I usually have more fun when I do things with other people.

35	P12	T	I occasionally have the feeling that my thoughts are not my own.
36	D12	T	Things slip my mind so often that it's hard to get things done.
37	N13	T	Generally I do not have many thoughts or emotions.
38	P13	T	There are times when it feels like someone is touching me when no one is actually there.
39	D13	T	No matter how hard I try, I can't organize my thoughts.
40	N14	T	I have little or no interest in sex or romantic relationships.
41	P14	T	I often find hidden meanings or threats in things that people say or do.
42	D14	T	I often feel so disconnected from the world that I am not able to do things.
43	N15	T	Throughout my life, I have had little interest in dating or being in a romantic relationship.
44	P15	T	I have had experiences with seeing the future, ESP or a sixth sense.
45	D15	T	I find that I am very often confused about what is going on around me.
46	N16	F	I enjoy meeting new people and making new friends.
47	P16	T	Sometimes when I look at ordinary objects they seem strange or unreal.
48	D16	T	I often struggle to stay organized enough to complete simple tasks throughout the day.
49	N17	F	Most of the time I feel a desire to be connected with other people.
50	P17	T	I often worry that other people are out to get me.
51	D17	T	People find my conversations to be confusing or hard to follow.
52	N18	T	It has never been important to me to be involved with other people.
53	P18	T	Occasionally I have felt as though my body did not exist.
54	D18	T	My lack of organization often makes it hard to do the things that I am supposed to do.
55	N19	T	There are just not many things that I have ever really enjoyed doing.
56	P19	T	Some people can make me aware of them just by thinking about me.
57	D19	T	My thoughts are almost always hard to follow.
58	N20	F	I greatly enjoy traveling to new places.
59	P20	T	I have had the momentary feeling that I might not be human.
60	D20	T	Even when I have time, it is almost impossible to organize my thoughts.
61	N21	T	I generally am not interested in being emotionally close with others.
62	P21	T	I believe that there are secret signs in the world if you just know how to look for them.
63	D21	T	I often have difficulty organizing what I am supposed to be doing.
64	N22	T	I tend to have few interests.
65	P22	T	There are times when I think I see another person, but there is actually no one there.
66	D22	T	My thoughts almost always seem fuzzy and hazy.
67	N23	T	My emotions have almost always seemed flat regardless of what is going on around me.
68	P23	T	I often worry that someone or something is controlling my behavior.
69	D23	T	I have trouble following conversations with others.
70	N24	T	I have never really been interested in having close relationships.
71	P24	T	Sometimes I feel that a television show or movie has a special message just for me.
72	D24	T	My thoughts often feel so jumbled that I have difficulty doing anything.
73	N25	T	Throughout my life there have been very few things that interest me.
74	P25	T	I often wonder if everyone in the world is part of a secret experiment.
75	D25	F	It is usually easy for me to follow conversations.
76	N26	F	Spending time with close friends and family is important to me.
77	P26	T	At times I have wondered if my body was really my own.

Section 9. Multidimensional Schizotypy Scale-Brief Edition (MSS-B; Gross, Kwapil, Raulin, Silvia, & Barrantes-Vidal)

Key indicates answers in the schizotypic direction (true or false). Labels are: P = positive schizotypy, N = negative schizotypy, D = disorganized schizotypy. Positive, negative, and disorganized dimensions are scored as the number of items answered in the schizotypic direction.

MSS-B

The following items inquire about a broad range of attitudes, experiences, and beliefs that people have. Please answer each item in the way that best describes you. Please note that there are no right or wrong answers – just answer in the way that is most like you.

<u>Item</u>	<u>label</u>	<u>key</u>	
1	N01	T	Throughout my life I have noticed that I rarely feel strong positive or negative emotions.
2	P01	T	I have sometimes felt that strangers were reading my mind.
3	D01	T	My thoughts and behaviors are almost always disorganized.
4	N02	F	In general, it is important for me to have close relationships with other people.
5	P02	T	I often think that I hear people talking only to discover that there was no one there.
6	D02	T	Most of the time I find it is very difficult to get my thoughts in order.
7	N03	T	I have always preferred to be disconnected from the world.
8	P03	T	I have felt that there were messages for me in the way things were arranged, like furniture in a room.
9	D03	T	I often have difficulty following what someone is saying to me.
10	N04	F	If given the choice, I would much rather be with another person than alone.
11	P04	T	I believe that dreams have magical properties.
12	D04	T	I often feel so mixed up that I have difficulty functioning.
13	N05	T	Throughout my life, very few things have been exciting or interesting to me.
14	P05	T	I sometimes wonder if there is a small group of people who can control everyone else's behavior.
15	D05	T	My thoughts are so hazy and unclear that I wish that I could just reach up and put them into place.
16	N06	T	Having close friends is not as important as people say.
17	P06	T	I have had the momentary feeling that someone's place has been taken by a look-alike.
18	D06	T	My thoughts and behaviors feel random and unfocused.
19	N07	T	Generally I do not have many thoughts or emotions.
20	P07	T	There are times when it feels like someone is touching me when no one is actually there.
21	D07	T	No matter how hard I try, I can't organize my thoughts.
22	N08	T	Throughout my life, I have had little interest in dating or being in a romantic relationship.
23	P08	T	I have had experiences with seeing the future, ESP or a sixth sense.
24	D08	T	I find that I am very often confused about what is going on around me.
25	N09	F	Most of the time I feel a desire to be connected with other people.
26	P09	T	I often worry that other people are out to get me.
27	D09	T	People find my conversations to be confusing or hard to follow.
28	N10	T	There are just not many things that I have ever really enjoyed doing.
29	P10	T	Some people can make me aware of them just by thinking about me.
30	D10	T	My thoughts are almost always hard to follow.
31	N11	T	I generally am not interested in being emotionally close with others.
32	P11	T	I believe that there are secret signs in the world if you just know how to look for them.
33	D11	T	I often have difficulty organizing what I am supposed to be doing.
34	N12	T	My emotions have almost always seemed flat regardless of what is going on around me.
35	P12	T	I often worry that someone or something is controlling my behavior.

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|----|-----|---|---|
| 36 | D12 | T | I have trouble following conversations with others. |
| 37 | N13 | F | Spending time with close friends and family is important to me. |
| 38 | P13 | T | At times I have wondered if my body was really my own. |

SECTION 10. REFERENCES (*denotes empirical studies using the MSS or MSS-B)

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC: Author.

Bleuler, E.P. (1950). *Dementia praecox or the group of schizophrenias* (J. Zinkin, Trans.). New York: International Universities Press. (Original work published in 1911).

Chapman, L.J., & Chapman, J.P. (1983). *Infrequency scale for personality measures*. Unpublished scale available from T.R. Kwapil, UIUC Department of Psychology, Champaign, IL 61802.

Chapman, J.P., Chapman, L.J., & Kwapil, T.R. (1995). Scales for the measurement of schizotypy. In A. Raine, T. Lencz, & S. Mednick (eds.) *Schizotypal Personality Disorder*, Cambridge, England: Cambridge University Press.

*Christensen, A.P., Gross, G.M., Golino, H.F., Silvia, P.J., & Kwapil, T.R. (2019). Exploratory graph analysis of the Multidimensional Schizotypy Scale. *Schizophrenia Research*, *206*, 43-51.

Claridge, G. (1997). *Schizotypy: Implications for illness and health*. New York, NY US: Oxford University Press.

Crowne, D.P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology*, *24*, 349-354.

DeVellis, R.F. (2012). *Scale development: Theory and Applications* (3rd ed.). Washington, DC: SAGE Publications.

*Gross, G.M., Kwapil, T.R., Burgin, C.J., Raulin, M.L., Silvia, P.J., Kemp, K.C., Barrantes-Vidal, N. (2018). Validation of the Multidimensional Schizotypy Scale-Brief in two large samples. *Journal of Psychopathology and Behavioral Assessment*, *40*, 669-677.

*Gross, G.M., Kwapil, T.R., Raulin, M.L., Silvia, P.J., & Barrantes-Vidal, N. (2018). The Multidimensional Schizotypy Scale-Brief: Scale development and psychometric properties. *Psychiatry Research*, *216*, 7-13.

Gross, G.M., Mellin, J., Silvia, P.J., Barrantes-Vidal, N., & Kwapil, T.R. (2014). Comparing the factor structure of the Wisconsin Schizotypy Scales and the Schizotypal Personality Questionnaire. *Personality Disorders: Theory, Research, and Treatment*, *5*, 397-405.

Hambleton, R.K., Robin, F., & Xing, D. (2000). Item response models for the analysis of educational and psychological test data. In: H.E.A Tinsley, & S.D. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling*. Academic, San Diego, pp. 553–585.

*Kemp, K.C., Bathery, A.J., Barrantes-Vidal, N., & Kwapil, T.R. (2021). Positive, negative, and disorganized schizotypy predict differential patterns of interview-rated schizophrenia-spectrum symptoms and impairment. *Assessment*, *28*, 141-152.

*Kemp, K.C., Bathery, A.J., Barrantes-Vidal, N., & Kwapil, T.R. (2020). A brief questionnaire measure of multidimensional schizotypy predicts interview-rated symptoms and impairment. *PLOS ONE*, *15*(8):e0237614. <https://doi.org/10.1371/journal.pone.0237614>

- *Kemp, K.C., Burgin, C.J., Raulin, M.L., & Kwapil, T.R. (2020). Using multiple measures of openness to experience to capture positive, negative, and disorganized dimensions of schizotypy. *Personality Disorders: Theory, Research, and Treatment*, *11*, 260-269.
- *Kemp, K.C., Gross, G.M., Barrantes-Vidal, N. & Kwapil, T.R. (2018). Association of positive, negative, and disorganized schizotypy dimensions with affective symptoms and experiences. *Psychiatry Research*, *270*, 1143-1149.
- *Kemp, K.C., Gross, G.M., & Kwapil, T.R. (2020). Psychometric properties of the Multidimensional Schizotypy Scale and Multidimensional Schizotypy Scale-Brief: Item and scale test-retest reliability and concordance of original and brief forms. *Journal of Personality Assessment*, *102*, 508-515.
- Kraepelin, E. (1919). *Dementia praecox and paraphrenia*. Edinburgh, Scotland: Livingstone. (Original work published 1913).
- Kwapil, T.R., & Barrantes-Vidal, N. (2015). Schizotypy: Looking back and moving forward. *Schizophrenia Bulletin*, *41* (suppl 2): S366-S373 doi:10.1093/schbul/sbu186
- Kwapil, T.R., & Chun, C.A. (2015). The psychometric assessment of schizotypy. In O. Mason & G. Claridge, Ed., *Schizotypy: New Dimensions*. London: Routledge.
- *Kwapil, T.R., Clark, H.E., Rbeiz, K.S., Bathery, A.J., Kemp, K.C., & Barrantes-Vidal, N. (in press). Association of positive, negative, and disorganized schizotypy with cluster a, borderline, and avoidant personality disorders and traits. *Personality Disorders: Theory, Research, & Treatment*.
- *Kwapil, T.R., Gross, G.M., Burgin, C.J., Raulin, M.L., Silvia, P.J., & Barrantes-Vidal, N. (2018). Validity of the Multidimensional Schizotypy Scale: Associations with schizotypal traits and normal personality. *Personality Disorders: Theory, Research, & Treatment*, *9*, 458-466.
- *Kwapil, T.R., Gross, G.M., Silvia, P.J., Raulin, M.L., & Barrantes-Vidal, N. (2018). Development and psychometric properties of the multidimensional schizotypy scale: A new measure for assessing positive, negative, and disorganized schizotypy. *Schizophrenia Research*, *193*, 209-217.
- *Kwapil, T.R., Kemp, K.C., Mielock, A., Sperry, S.H., Chun, C.A., Gross, G.M., & Barrantes-Vidal, N. (2020). Association of multidimensional schizotypy with psychotic-like experiences, affect, and social functioning in daily life: Comparable findings across samples and schizotypy measures. *Journal of Abnormal Psychology*, *129*, 492-504.
- Lenzenweger, M.F. (2010). *Schizotypy and Schizophrenia: The View from Experimental Psychopathology*. New York: Guilford Press.
- *Li, L.Y., Meyer, M.S, Martin, E.A., Gross, G.M, Kwapil, T.R., & Cicero, D.C. (2020). Differential item functioning of the Multidimensional Schizotypy Scale and Multidimensional Scale-Brief. *Psychological Assessment*, *32*, 383-393.
- Maniaci, M.R., & Rogge, R.D. (2014). Caring about carelessness: Participant inattention and its effects on research. *Journal of Research in Personality*, *48*, 61-83.
- Mason, O. (2015). The assessment of schizotypy and its clinical relevance. *Schizophrenia Bulletin*, *41* suppl 2, S374-S385.

- Mason, O., Claridge, G., Williams, L., 1997. Questionnaire measurement. In G. Claridge, (Ed.), *Schizotypy: Implications for illness and health* (pp. 19-37). Oxford University Press, New York.
- McCrae, R.R., & Costa, P.T. (2010). *NEO inventories for the NEO Personality Inventory-3 NEO-PI-3, NEO Five-Factor Inventory-3 NEO-FFI-3 Professional Manual*. PAR, Lutz, FL
- Meehl, P.E. (1962). Schizotaxia, schizotypy, schizophrenia. *American Psychologist*, *17*, 827-831.
- Meehl, P.E. (1990). Toward an integrated theory of schizotaxia, schizotypy, and schizophrenia. *Journal of Personality Disorders*, *4*, 1-99.
- Miers, T.C., & Raulin, M.L. (1987) *Cognitive Slippage Scale*. In K. Corcoran, & J. Fischer (Eds.), *Measures for Clinical Practice: A Source Book*. Free Press, New York, pp. 125-127.
- Raine, A. (1991). The SPQ: A scale for the assessment of schizotypal personality based on DSM-III-R criteria. *Schizophrenia Bulletin*, *17*, 555-564.
- Readable.io [on-line program]. 2017. <https://readable.io/text/>
- *Sahakyan, L., Kwapil, T.R., & Jiang, L. (2020). Differential Impairment of Positive and Negative Schizotypy in List-Method and Item-Method Directed Forgetting. *Journal of Experimental Psychology: General*, 368-381.
- *Sahakyan, L., Kwapil, T.R., Lo, Y., & Jiang, L. (2019). Examination of relational memory in multidimensional schizotypy. *Schizophrenia Research*, *211*, 36-43.
- *Sahakyan, L.S., Meller, T., Evermann, U., Schmitt, S., Pfarr, J.K., Sommer, J., Kwapil, T.R., & Nenadić, I. (2021). Anterior vs. posterior hippocampal subfields in an extended psychosis phenotype of multidimensional schizotypy in a non-clinical sample. *Schizophrenia Bulletin*, *47*, 207-218.
- Tandon, R., Nasrallah, H.A., & Keshavan, M.S. (2009). Schizophrenia, “just the facts” 4. Clinical features and conceptualization. *Schizophrenia Research*, *110*, 1-23.
- Vollema, M.G., & van den Bosch, R.J. (1995). The multidimensionality of schizotypy. *Schizophrenia Bulletin*, *21*, 19–31.