Psychometric properties and validity of short forms of the Wisconsin Schizotypy Scales in two large samples

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Abstract:

The Wisconsin Schizotypy Scales (WSS) have been widely used in the study of clinical and non-clinical samples. However, researchers often find the length of the scales prohibitive. The present study examined the reliability and validity of recently developed 15-item short forms of the Perceptual Aberration, Magical Ideation, Physical Anhedonia, and Revised Social Anhedonia Scales in two large samples of non-clinically ascertained young adults. The scales demonstrated good reliability and correlated highly with the original scales. The validity of the scales was assessed by comparing the association of the original and shortened WSS with interview measures of psychotic-like and schizophrenia-spectrum symptoms and impaired functioning, as well as with questionnaire measures of personality and social impairment. The associations of the shortened WSS with the interview and questionnaire measures were comparable in terms of statistical significance and effect size with the associations of the original scales. The present findings provide the first demonstration of the validity of the shortened WSS and support their use in the study of schizotypy.

Keywords: Schizotypy | Wisconsin Schizotypy Scales | Schizophrenia | Psychometric assessment | psychology

Article:

1. Introduction

More than 30 years have passed since the Chapmans and their colleagues began their landmark work on the Wisconsin Schizotypy Scales (WSS). Since that time, the measures–including 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–have been widely used with nonclinical and clinical samples. A recent Web of Science search indicated that the source article for the Physical Anhedonia Scale has been cited 625 times, the Magical Ideation Scale 526 times, and the Perceptual Aberration Scale 521 times. Furthermore, the measures have provided a useful example of the marriage of theoretically driven constructs with careful and rigorous measurement.

The Chapmans and their colleagues based their measures on Meehl's (1962) model of schizotypy and relied on characteristics in Meehl's (1964) schizotypy checklist as the basis of their trait specifications. The domains assessed by the scales appear consistent with current formulations that schizotypy reflects a broad, multidimensional phenotype that encompasses schizophrenia, schizophrenia-spectrum disorders, the prodrome, and non-clinical manifestations characterized by mild and transient versions of the symptoms and deficits seen in schizophrenia (e.g., [Claridge et al., 1996], [Lenzenweger, 2010] and [Kwapil and Barrantes-Vidal, in press]). Schizotypy provides a useful construct for identifying etiological factors relevant to schizophrenia, including risk and protective factors, without the confounding effects associated with clinical disorders.

The development of the WSS was based upon the idea that psychometric assessment of schizotypy provides an inexpensive and noninvasive method for screening numerous people that can be used in both general population and identified at-risk samples. The scales were rigorously constructed using Jackson's (1970) scale development methods and demonstrated sound psychometric properties using classical test theory metrics (e.g., [Chapman et al., 1982], [Kwapil et al., 2008] and [Winterstein et al., 2010]). Extensive cross-sectional research indicates that high scores on the scales are associated with psychological and physiological deficits similar to those seen in schizophrenia (see reviews in [Edell, 1995], [Fernandes and Miller, 1995] and [Fonseca-Pedrero et al., 2008]). For example, Blanchard et al. (2011) reported that high scorers on the Revised Social Anhedonia Scale exhibited elevated rates of schizophrenia-spectrum symptoms and impaired functioning. Gooding et al. (2006) reported that participants scoring high on the Perceptual Aberration, Magical Ideation, or Revised Social Anhedonia Scale exhibited impaired sustained attention. High scorers on the Perceptual Aberration Scale (Park et al., 1995) and the Revised Social Anhedonia Scale (Gooding and Tallent, 2003) demonstrated impaired spatial working memory performance. Longitudinal studies indicate that high scorers on the scales are at heightened risk for developing schizophrenia-spectrum disorders ([Chapman et al., 1994], [Kwapil et al., 1997], [Kwapil, 1998] and [Gooding et al., 2005]). Although longitudinal studies with the scales are limited in number, they produce effect sizes comparable to studies of consanguinity in the prediction of schizophrenia-spectrum disorders. For example, Kwapil (1998) reported that 24% of high scorers on the Revised Social Anhedonia Scale developed schizophrenia-spectrum disorders by age 30. Chapman et al. (1994) reported that 5% of participants identified by high scores on the Perceptual Aberration or Magical Ideation Scales

developed a psychotic disorder at a ten-year reassessment. However, this rate increased to 40% in participants identified by the combination of the Magical Ideation and Revised Social Anhedonia Scales, and who exhibited psychotic-like experiences at the initial assessment.

Although the WSS have been widely used, researchers often find their length to be prohibitive (especially if used in combination). Furthermore, recent investigations of the scales' psychometric properties using newer measurement models, such as item response theory (IRT) and differential item functioning, suggested that some items are inefficient and redundant. Using a two-parameter IRT model, Winterstein et al. (in press)indicated that the four WSS scales effectively assess schizotypy at the high end of the trait. However, they identified items on each of the scales with low discrimination values, indicating that they were not contributing unique information. They added that some items showed high differential item functioning, indicating that they did not function comparably across sex and ethnicity.

Based upon these findings, Winterstein et al. (2011) created short WSS forms by retaining items with high item difficulty, high discrimination, and low differential item functioning. They eliminated items with high endorsement frequencies, consistent with the notion that schizotypy is relatively rare in the general population. The authors retained items representative of the original content domains based on WSS literature and subjective item classifications. The four resulting short-form scales each contained 15 items. Note that Winterstein et al.'s shortened form of the Revised Social Anhedonia Scale overlapped considerably with the 17-item reduced form reported by Reise et al. (2011), sharing 11 items in common.

Winterstein et al. (2011) investigated the psychometric properties of the short-form scales among 1144 young adults in an on-line creativity study. They reported coefficient alpha values ranging from .62 to .83. These values were lower than values for the original scales, but higher than their respective Spearman–Brown expected alpha values suggesting that the short forms retained effective items from the original scales. Winterstein et al. (2011) provided preliminary validity for the shortened WSS scales. However, the study focused on measures of creativity and personality that were not ideal for assessing the validity of the WSS. Furthermore, they only administered the short forms of the scales; thus, they could not compare their performance against the original questionnaires. Therefore, additional evidence regarding the psychometric properties and validity of the shortened scales is needed.

The initial goal of the present study was to examine the psychometric properties of the short scales in two large samples of young adults. We hypothesized that, compared to the original WSS, the short forms would possess slightly lower reliability (due to the reduction in items). However, consistent with Winterstein et al. (2011), we expected that the alphas for the short scales would be acceptable and would exceed Spearman–Brown predicted values. We expected significant positive correlations between each of the original WSS and their short-form counterparts and that the pattern of intercorrelations among the four original scales would be mirrored by the intercorrelations among the shortened scales.

The second goal of the study was to demonstrate the validity of the short-form WSS using interview and questionnaire measures of constructs relevant to schizotypy (e.g., symptom ratings, personality, and impairment). We hypothesized that the short forms would mirror the pattern of relations found between these criteria and the original scales. Specifically, we predicted that Magical Ideation and Perceptual Aberration short forms would be related to

interview ratings of psychotic-like, schizotypal, and paranoid symptoms, as well as to mood disorders and substance abuse. It was expected that the anhedonia short forms would be related to negative, schizotypal, and schizoid symptoms, and poorer overall functioning, but not to mood disorders or substance abuse. It was also hypothesized that Magical Ideation and Perceptual Aberration short forms would relate to measures of neuroticism and openness, whereas the anhedonia short forms would be negatively related to extraversion and openness to experience. Finally, we expected that each of the short forms would correlate with impairment in social functioning. The anhedonia scales were not predicted to be associated with depressive episodes despite the fact that depression is characterized by state anhedonia. This is consistent with the previous cross-sectional (e.g., Kwapil et al., 2008) and longitudinal (e.g., [Chapman et al., 1994] and [Kwapil, 1998]) studies.

2. Method

2.1. Participants

To assess the psychometric properties of the shortened scales, data from two large samples of undergraduates at UNC—Greensboro were examined. Although college students are at a slightly lowered risk of developing psychosis (and therefore result in a more conservative test of the hypotheses), they are appropriate for examining the validity of the short forms of the WSS because students have been widely used in studies with the original scales and have just recently entered the age range of greatest risk for developing schizophrenia-spectrum disorders. The first sample contained 6137 participants (76% female). The mean age of the sample was 19.4 (*SD* = 3.7). Additional information regarding this sample can be found in Kwapil et al. (2008). The second sample consisted of 2171 participants (76% female). The mean age of the sample was 19.6 (*SD* = 3.3). Additional information regarding this sample can be found in Kwapil et al. (in press). Note that the first sample was the same sample used by Winterstein et al. (in press) to examine the psychometric properties of the original scales and their findings were used by Winterstein et al. (2011) to derive the short forms of the scales. Therefore, we used the second sample to provide an independent comparison of the findings from the original sample (rather than simply combining the two samples).

To examine the validity of the shortened scales, a random subset of 780 participants from the first sample completed questionnaires assessing personality and social adjustment. This subset was comparable to the original sample in terms of demographics and scores on the original and shortened schizotypy scales. An overlapping subset of 430 individuals was administered structured diagnostic interviews. They were comparable to the original sample in terms of demographic characteristics, but displayed slightly higher schizotypy scale means compared to the original sample. The 430 participants in the interview subsample completed the interview as part of several different studies (the interview was the same in all cases). These participants either volunteered through an electronic sign-up system or were oversampled based on elevated scores on the schizotypy scales to assure adequate representation of high schizotypy participants. There were 175 participants who were in both the interview and questionnaire subsamples.

2.2. Materials and procedures

All participants completed the original versions of the four WSS and an infrequency scale (Chapman and Chapman, 1983) during mass-screening sessions. The Perceptual Aberration Scale contains 35 items that tap psychotic-like perceptual experiences and bodily distortions. The Magical Ideation Scale contains 30 items that assess belief in improbable causality. The Revised Social Anhedonia Scale includes 40 items that tap asociality and diminished social pleasure. The Physical Anhedonia Scale contains 61 items that assess deficits in sensory and aesthetic pleasure. Winterstein et al. (2011) described the development and composition of the 15-item shortened versions of the scales. Scores on both original and shortened versions were computed for participants in the present study. Participants completed the NEO-PI-R (Costa and McCrae, 1992) and the Social Adjustment Scale (Weissman, 1999). The NEO-PI-R is a widely used self-report measure of the Five-Factor Model of personality. The Social Adjustment Scale is a self-report measure that assesses functioning in multiple social contexts.

The interview contained portions of the Structured Clinical Interview for DSM-IV (First et al., 1995) that assess mood episodes, substance use disorders, and demographics. Quantitative ratings of substance use and impairment were coded using the rating system described in Kwapil (1996). The International Personality Disorders Examination (IPDE; World Health Organization, 1995) modules assessing schizophrenia-spectrum personality disorders were administered. The IPDE provides personality disorder diagnoses and dimensional ratings.

The Wisconsin Manual for Assessing Psychotic-like Experiences (Chapman and Chapman, 1980) rated psychotic symptoms across clinical and subclinical deviancy. Kwapil et al. (1999) reported that the highest rating across seven classes of experiences provides a useful index that effectively predicts the development of psychotic disorders. Interrater reliability is .89 for the highest symptom rating. The Negative Symptom Manual (Kwapil and Dickerson, 2001) assesses six classes of negative symptoms of schizophrenia across a range of clinical and subclinical deviance. Interrater reliability is .94 for the total score. The Global Assessment of Functioning Scale (GAF; American Psychiatric Association, 2000) assesses overall functioning from marked psychopathology at the low end to superior functioning at the high end. Interrater reliability was .87 for the GAF ratings.

The interviews were conducted by a licensed psychologist and advanced graduate students in clinical psychology. The interviewers were unaware of participants' scores on the schizotypy questionnaires. Participants provided informed consent and received course credit for participation. The study was approved by the UNC—Greensboro Institutional Review Board.

3. Results

3.1. Descriptive statistics

Table 1 and Table 2 display descriptive statistics and reliability for the original and shortened WSS in the two samples. Descriptive statistics were comparable across the samples. Note that the skew and kurtosis were greater in the short forms compared to the originals, likely reflecting Winterstein et al.'s (2011) strategy of eliminating items with high endorsement frequencies. As expected, the reliability estimates were slightly lower in the shortened forms

relative to the original versions. However, the short-form reliabilities were not as low as predicted by the Spearman–Brown formula, suggesting that the shortened scales retained relatively better items. Because Cronbach's alpha underestimates internal consistency for binary items (particularly when items have low endorsement rates), we estimated alpha via categorical confirmatory factor analyses ([Hancock and Mueller, 2001] and [Liu et al., 2010]). Consistent with simulation research, accounting for the categorical nature of the items increased alpha estimates. Consistent with Winterstein et al. (2011), the short forms retained good internal consistency despite removing 50–75% of the original items.

Table 1. Descriptive statistics for the Wisconsin Schizotypy Scales' original and short forms in a sample of 6137.

	Item count	M	SD	Range	Skew	Std. error of skew	Kurtosis	Std. error of kurtosis	Alpha	Binary alpha	SBEA
Original Magical Ideation	30	9.36	5.60	0–30	0.63	.03	− 0.06	.06	.84	.90	
Short Magical Ideation	15	3.28	2.91	0–15	1.03	.03	0.76	.06	.76	.86	.72
Original Perceptual Aberration	35	5.81	5.54	0–35	1.83	.03	4.21	.06	.88	.95	
Short Perceptual Aberration	15	1.22	2.29	0–15	2.92	.03	10.00	.06	.84	.95	.76
Original Social Anhedonia	40	8.53	5.77	0–38	1.23	.03	1.95	.06	.84	.92	
Short Social Anhedonia	15	1.79	2.41	0–15	1.99	.03	4.53	.06	.79	.92	.66
Original Physical Anhedonia	61	12.96	7.06	0–50	0.83	.03	0.76	.06	.84	.92	
Short Physical Anhedonia	15	2.12	2.32	0–14	1.54	.03	2.58	.06	.73	.88	.56

SBEA = Spearman–Brown estimated alpha.

Table 2. Descriptive statistics for the Wisconsin Schizotypy Scales' original and short forms in a sample of 2171.

	Item count	M	SD	Range	Skew	Std. error of skew	Kurtosis	Std. error of kurtosis	Alpha	Binary alpha	SBEA
Original	30	9.01	5.5	0–29	0.69	.05	0.00	.11	.83	.90	

	Item count	M	SD	Range	Skew	Std. error of skew	Kurtosis	Std. error of kurtosis	Alpha	Binary alpha	SBEA
Magical Ideation			2								
Short Magical Ideation	15	3.19	2.87	0–15	1.06	.05	0.74	.11	.75	.86	.71
Original Perceptual Aberration	35	5.62	5.18	0–34	1.88	.05	4.80	.11	.87	.94	
Short Perceptual Aberration	15	1.13	2.15	0–15	3.13	.05	12.16	.11	.84	.94	.74
Original Social Anhedonia	40	9.25	5.83	0–39	1.14	.05	1.67	.11	.84	.91	
Short Social Anhedonia	15	1.96	2.42	0–15	1.79	.05	3.62	.11	.77	.90	.66
Original Physical Anhedonia	61	13.85	7.00	0–47	0.75	.05	0.49	.11	.83	.92	
Short Physical Anhedonia	15	2.26	2.28	0–14	1.34	.05	1.76	.11	.70	.91	.55

SBEA = Spearman–Brown estimated alpha.

3.2. Correlations of original and short scale forms

Table 3 and Table 4 display correlations between the original and short forms, as well as the intercorrelations among the schizotypy scales, in the two samples. Alpha level was set at .001 for all correlational analyses due to the large sample size and number of analyses computed, in order to minimize Type I error and reduce the likelihood of reporting statistically significant but inconsequential findings. Following Cohen (1992), medium and large effect sizes are denoted in the tables. The shortened scales correlated highly with the original measures (in fact, they correlated almost as highly as their reliabilities allowed). Furthermore, the same pattern of correlations occurred among the shortened scales as in the original scales.

Table 3. Pearson correlations between the original and short Wisconsin Schizotypy Scales in a sample of 6137.

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Original Magical Ideation	1							
Short Magical Ideation	***.92***	1						
Original Perceptual Aberration	***.69***	***.68***	1					
Short Perceptual Aberration	***.58***	***.60***	***.89***	1				
Original Social Anhedonia	.22	.22	.29	.24	1			
Short Social Anhedonia	.14	.14	.22	.19	***.88***	1		
Original Physical Anhedonia	−.10	−.09	−.03	−.01	**.42**	**.37**	1	
Short Physical Anhedonia	−.07	−.06	−.02	.01	**.33**	**.30**	***.81***	1

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

$p < .001$.

Table 4. Pearson correlations between the original and short Wisconsin Schizotypy Scales in a sample of 2171.

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Original Magical Ideation	1							
Short Magical Ideation	***.92***	1						
Original Perceptual Aberration	***.68***	***.65***	1					
Short Perceptual Aberration	***.56***	***.57***	***.88***	1				
Original	.22	.22	.29	.25	1			

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Social Anhedonia								
Short Social Anhedonia	.16	.16	.24	.22	***.88***	1		
Original Physical Anhedonia	−.13	−.13	−.05	−.03	**.41**	**.35**	1	
Short Physical Anhedonia	−.10	−.10	−.05	−.03	**.33**	.28	***.82***	1

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

$p < .001$.

3.3. Validity of the shortened scales

Table 5 displays the correlations of the original and short WSS with the interview measures of psychopathology and functioning. The findings for the shortened versions were virtually identical to the original scales. As expected, the shortened Perceptual Aberration and Magical Ideation Scales were associated with a) impaired functioning, b) psychotic-like and schizotypal symptoms, c) substance abuse, and d) mood episodes. Not only was the pattern of findings the same, but associations with the shortened scales displayed minimal shrinkage. Consistent with the original, the shortened Social Anhedonia Scale was significantly associated with impaired functioning, and psychotic-like, negative, and schizophrenia-spectrum personality disorder symptoms, but not mood disorders and substance use. The magnitude of the associations was relatively unchanged between the original and shortened versions. Consistent with its original version, the shortened Physical Anhedonia Scale was significantly associated with negative and schizoid symptoms. However, the shortened Physical Anhedonia Scale exhibited more shrinkage in the magnitude of the correlations relative to its original than did the other scales, perhaps reflecting that it had the greatest decline in reliability of the shortened scales relative to the original scales.

Table 5. Pearson correlations of the original and short Wisconsin Schizotypy Scales with interview measures of psychopathology (n = 430).

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Global assessment of functioning	−.26	−.27	**−.31**	**−.32**	**−.35**	**−.32**	−.09	−.03
Psychotic-like experiences	***.52***	***.51***	**.46**	**.46**	.19	.16	−.08	−.11

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Negative symptoms	−.01	.00	.06	.04	***.53***	***.51***	**.35**	.28
Schizotypal DS	**.40**	**.39**	**.36**	**.34**	.28	.24	.04	.00
Schizoid DS	.01	.02	.08	.06	**.48**	**.46**	.29	.21
Paranoid DS	.21	.21	.15	.12	.24	.23	.11	.05
Alcohol impairment	.19	.18	.21	.21	.03	−.01	−.14	−.07
Drug impairment	**.32**	**.32**	**.30**	**.31**	.02	−.01	−.15	−.09
Major depressive episode	.23	.22	.22	.22	.02	.04	−.13	−.10
Manic/hypomanic episode	.16	.15	.22	.21	.06	.06	−.08	−.05

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

$p < .001$.

Table 6 contains correlations of the original and shortened WSS with questionnaire measures of personality and social adjustment. The findings for the shortened scales were again comparable with the original scales, both in statistical significance and effect size. The shortened Perceptual Aberration and Magical Ideation Scales had the strongest association with neuroticism, the Social Anhedonia short form was most strongly associated with introversion, and the short Physical Anhedonia Scale was most strongly associated inversely with Openness. Consistent with the original versions, the short forms were all associated with social impairment.

Table 6. Pearson correlations of the original and short Wisconsin Schizotypy Scales with measures of personality and social adjustment (n = 780).

	Magical Ideation	Short Magic	Perceptual Aberration	Short PerAb	Social Anhedonia	Short SocAnh	Physical Anhedonia	Short PhyAnh
Neuroticism	**.34**	**.31**	**.31**	.23	.15	.15	.01	−.02
Extraversion	−.03	−.05	−.16	−.15	***−.56***	***−.54***	**−.37**	−.25
Openness to experience	.24	.23	.21	.17	−.12	−.10	**−.48**	**−.38**
Agreeableness	−.22	−.21	−.18	−.14	−.28	−.21	−.23	−.23
Conscientiousness	−.21	−.22	−.20	−.19	−.02	.01	.01	−.05
Social Adjustment Scale (SAS) total	.27	.26	.26	.19	.29	.29	.17	.13
SAS student	.24	.26	.18	.15	.09	.06	.04	.04
SAS social/leisure	.11	.10	.16	.12	**.34**	**.33**	.20	.13
SAS family	.26	.25	.23	.16	.20	.21	.09	.06

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

$p < .001$.

4. Discussion

Extensive cross-sectional and longitudinal research supports the construct validity of schizotypy. The construct encompasses conditions such as schizophrenia and the prodrome, as well as non-clinical manifestations. It provides a useful framework for studying vulnerability for schizophrenia, identifying risk and protective factors, elucidating the mechanisms that lead to psychotic symptoms, and identifying endophenotypes. Reliable assessment of schizotypy should increase the power of studies of genetic and neurophysiological markers of risk for schizophrenia. Traditionally, these studies often divide participants into affected (i.e., clinically disordered) and non-affected groups. This strategy risks misclassifying non-disordered schizotypes as non-affected. The identification of non-disordered schizotypes should reduce such misclassification. Finally, effective prophylactic treatment programs for schizophrenia-spectrum disorders require the accurate identification of at-risk individuals. Schizotypy provides a promising point of entry for all of these purposes and psychometric inventories provide a promising method of initial screening of schizotypy.

Since their development, the WSS have been widely used in the measurement of schizotypy in clinical and non-clinical samples. The scales have been used individually; however, use of the scales in combination offers advantages of enhanced predictive power (e.g., Chapman et al., 1994) and derivation of factor scores (e.g., Kwapil et al., 2008). Nevertheless, use of multiple scales is often problematic due to the length of the combined battery. Longer batteries are often feasible when conducting screening sessions with undergraduates, but may not be practical with patient and community samples. Some patients may experience cognitive difficulties that impair their ability to complete large inventories in a valid fashion. Furthermore, large-scale studies often involve the administration of numerous measures and simply cannot allot time for long questionnaires. Therefore, there is a clear need for abbreviated versions of the WSS.

Winterstein et al. (2011) provided a careful procedure for screening and selecting items for the shortened forms. The elimination of items with high endorsement frequencies and poorer discrimination should improve the scales' ability to differentiate between people high and low on schizotypy. However, the shortened scales require thorough assessment of their psychometric characteristics, validity, and comparability with the original scales before they are widely employed. Winterstein et al. (2011) provided preliminary evidence regarding reliability of the short forms, but were not able to examine validity with appropriate measures or to compare their performance with the original measures. The present study addressed these shortcomings, indicating that the short forms possess reliability and validity comparable to the original WSS. Note that the reliability of the short forms was especially striking given the considerable reduction in the number of items and the strategy of retaining items with low endorsement frequency (which tends to reduce true score variance and reliability).

Note that the finding that the anhedonia scales were not associated with depressive episodes may initially seem counter-intuitive given that anhedonia is a common feature of clinical depression. However, the finding is consistent with previous research that indicates that positive, not

negative, schizotypy is associated with mood disorders, including depression. For example, in the Chapmans' 10 year longitudinal studies ([Chapman et al., 1994] and [Kwapil, 1998]), the group identified by high scores on the Perceptual Aberration and Magical Ideation Scales reported significantly higher rates of depressive and manic symptoms and higher rates of major depressive disorder than the control subjects, whereas groups identified by the anhedonia scales did not report higher rates of mood disorders at the follow-up. Similarly, Kwapil et al. (2008)reported that positive schizotypy, but not negative schizotypy, was associated with both manic and depressive episodes. Negative schizotypy appears to be characterized by trait-like diminution of positive affect and pleasure, but not increased risk for mood disorders, whereas depressive disorders are characterized by state-like anhedonia accompanied by marked increases in negative affect.

The availability of shortened versions of the WSS offers several advantages. First, the study of schizotypy and schizophrenia is moving beyond limited designs with strict categorical definitions of schizotypy toward more comprehensive identification of risk factors and underlying dimensions. The need to assess multiple domains increases the need for more efficient measures. Further, in studies in which schizotypy is not the primary variable of interest, researchers will be more inclined to include the schizotypy scales if they contain 60 rather than 166 items. Finally, shorter forms of the scales are more feasible for inclusion in research with clinical samples. However, caution should be exercised in terms of clinical/diagnostic use as the scales appear to be effective at identifying risk at the group but not the individual level.

The present results are promising, but continued validation of the WSS short forms is needed. One limitation of the present research is that it relied on previously collected data. Future studies should examine the validity of the shortened scales in new samples. This includes research with non-student samples, such as community-based and clinically ascertained participants. Further research should also investigate the validity of the short forms in relation to other schizotypy measures, such as the SPQ (Raine, 1991) and the O-LIFE (Mason et al., 1995). Convergent and discriminant validity studies should examine the association of the shortened scales with interview and questionnaire measures (as in the present study), but also with measures from other domains such as neurocognitive, biobehavioral, genetic, and experience sampling assessments.

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Contributors

Georgina M. Gross, M.S., contributed to the design and analyses, and was lead author of the manuscript. Paul J. Silvia, PhD contributed to the analyses and writing of the manuscript. Neus Barrantes-Vidal, PhD, contributed to the writing of the manuscript and study design. Thomas R.

Kwapil, PhD, designed the study and contributed to the data analyses and writing of the manuscript.

Conflict of interest

None of the authors had a conflict of interest.

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References

American Psychiatric Association, 2000. Diagnostic and Statistical Manual of Mental Disorders. (fourth ed) (2000) text rev. Author, Washington, DC.

Blanchard et al., 2011. Social anhedonia and schizotypy in a community sample: the Maryland longitudinal study of schizotypy. Schizophr. Bull., 37 (3) (2011), pp. 587–602

Chapman and Chapman, 1980. Scales for rating psychotic and psychotic-like experiences as continua. Schizophr. Bull., 6 (3) (1980), pp. 476–489

Chapman and Chapman, 1983. Infrequency Scale for Personality Measures. Unpublished scale available from T.R. Kwapil Department of Psychology, University of North Carolina at Greensboro, Greensboro (1983) NC 27402

Chapman et al., 1976. Scales for physical and social anhedonia. J. Abnorm. Psychol., 85 (4) (1976), pp. 374–382

Chapman et al., 1978. Body image aberration in schizophrenia. J. Abnorm. Psychol., 87 (4) (1978), pp. 399–407

Chapman et al., 1982. Reliabilities and intercorrelations of eight measures of proneness to psychosis. J. Consult. Clin. Psychol., 50 (2) (1982), pp. 187–195

Chapman et al., 1994. Does the Eysenck Psychoticism Scale predict psychosis: a ten-year longitudinal study. Pers. Individ. Differ., 17 (3) (1994), pp. 369–375

Claridge et al., 1996. The factor structure of ‘schizotypal’ traits: a large replication study. Br. J. Clin. Psychol., 35 (1) (1996), pp. 103–115

Cohen, 1992. A power primer. Psychol. Bull., 112 (1) (1992), pp. 155–159

Costa and McCrae, 1992. NEO-PI-R Professional Manual. PAR, Odessa (1992)

Eckblad and Chapman, 1983. Magical ideation as an indicator of schizotypy. J. Consult. Clin. Psychol., 51 (2) (1983), pp. 215–225

Eckblad et al., 1982. The Revised Social Anhedonia Scale. Unpublished test copies available from T.R. Kwapil Department of Psychology, University of North Carolina at Greensboro, Greensboro (1982) NC 27402

Edell, 1995. The Wisconsin Psychosis-Proneness Scales. G.A. Miller (Ed.), The Behavioral High-Risk Paradigm in Psychopathology, Springer-Verlag, New York (1995), pp. 3–46

Fernandes and Miller, 1995. Compromised performance and abnormal psycho-physiology associated with the Wisconsin Psychosis-Proneness Scales. G.A. Miller (Ed.), The Behavioral High-Risk Paradigm in Psychopathology, Springer-Verlag, New York (1995), pp. 47–87

First et al., 1995. M.B. First, R.L. Spitzer, M. Gibbon, J.W. Williams. The Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II): I. Description. J. Pers. Disord., 9 (2) (1995), pp. 83–91

Fonseca-Pedrero et al., 2008. Schizotypy assessment: state of the art and future prospects. Int. J. Clin. Health Psychol., 8 (2) (2008), pp. 577–593

Gooding and Tallent, 2003. Spatial, object, and affective working memory in social anhedonia: an exploratory study. Schizophr. Res., 63 (3) (2003), pp. 247–260

Gooding et al., 2005. Clinical status of at-risk individuals 5 years later: further validation of the psychometric high-risk strategy. J. Abnorm. Psychol., 114 (1) (2005), pp. 170–175

Gooding et al., 2006. Sustained attention deficits in relation to psychometrically identified schizotypy: evaluating a potential endophenotypic marker. Schizophr. Res., 82 (1) (2006), pp. 27–37

Hancock and Mueller, 2001. Rethinking construct reliability within latent variable systems. R. Cudeck, S. du Toit, D. Sörbom (Eds.), Structural Equation Modeling: Present and Future, Scientific Software International, Lincolnwood (2001), pp. 195–216

Jackson, 1970. A sequential system for personality scale development.
C.D. Spielberger (Ed.), Current Topics in Clinical and Community Psychology, Vol. 2, Academic, San Diego (1970), pp. 61–96

Kwapil, 1996. A longitudinal study of drug and alcohol use by psychosis prone and impulsive-nonconforming individuals. J. Abnorm. Psychol., 105 (1) (1996), pp. 114–123

Kwapil, 1998. Social anhedonia as a predictor of the development of schizophrenia-spectrum disorders. J. Abnorm. Psychol., 107 (4) (1998), pp. 558–565

Kwapil and Barrantes-Vidal, in press. Schizotypal personality disorder: An integrative review, in: T.A. Widiger (Ed.), The Oxford Handbook of Personality Disorders, University Press, Oxford.

Kwapil and Dickerson, 2001. Negative Symptom Manual. Unpublished interview manual

Kwapil et al., 1997. Magical ideation and social anhedonia as predictors of psychosis proneness: a partial replication. J. Abnorm. Psychol., 106 (3) (1997), pp. 491–495

Kwapil et al., 1999. Validity and usefulness of the Wisconsin Manual for assessing psychotic-like experiences. Schizophr. Bull., 25 (2) (1999), pp. 363–375

Kwapil et al., 2008. The dimensional structure of the Wisconsin Schizotypy Scales: factor identification and construct validity. Schizophr. Bull., 34 (3) (2008), pp. 444–457

Kwapil et al., in press. Factor invariance of psychometric schizotypy in Spanish and American samples. J. Psychopath. Beh. Assessment.

Lenzenweger, 2010. Schizotypy and Schizophrenia: the View from Experimental Psychopathology. Guilford Press, New York (2010)

Liu et al., 2010. The impact of outliers on Cronbach's coefficient alpha estimate of reliability: ordinal/rating scale item responses. Educ. Psychol. Meas., 70 (1) (2010), pp. 5–21

Mason et al., 1995. New scales for the assessment of schizotypy. Pers. Individ. Differ., 18 (1) (1995), pp. 7–13

Meehl, 1962. Schizotaxia, schizotypy, schizophrenia. Am. Psychologist., 17 (2) (1962), pp. 827–838

Meehl, 1964. Manual for Use with Checklist of Schizotypic Signs. (No. PR-73-5). U. of Minnesota Research Laboratories of the Dept. of Psychiatry, Minneapolis, MN (1964)

Park et al., 1995. Individual differences in spatial working memory in relation to schizotypy. J. Abnorm. Psychol., 104 (2) (1995), pp. 355–363

Raine, 1991. The SPQ: a scale for the assessment of schizotypal personality based on DSM-III-R criteria. Schizophr. Bull., 17 (4) (1991), pp. 555–564

Reise et al., 2011. The challenges of fitting an Item Response Theory model to the Social Anhedonia Scale. J. Pers. Assess., 93 (3) (2011), pp. 213–224

Weissman, 1999. The Social Adjustment Scale-Self Report. MHS, New York (1999)

Winterstein et al., 2010. Assessment of score dependability of the Wisconsin Schizotypy Scales using generalizability analysis. J. Psychopath. Beh. Assessment, 32 (4) (2010), pp. 575–585

Winterstein et al., 2011. Brief assessment of schizotypy: developing short forms of the Wisconsin Schizotypy Scales. Pers. Individ. Differ., 51 (8) (2011), pp. 920–924

Winterstein et al., in press. Psychometric properties of the Wisconsin Schizotypy Scales: Classical test theory, item response theory, and differential item functioning. J. Psychopath. Beh. Assessment.

World Health Organization, 1995. International Personality Disorder Examination (IPDE) Manual DSM-IV Module. Cambridge University Press, New York (1995)