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The placement of anomalous self-experiences within schizotypal personality in a nonclinical sample

David C. Cicero^{a,*}, Łukasz Gawęda^b, Barnaby Nelson^{c,c}

^a University of North Texas, United States of America

^b Experimental Psychopathology Lab, Institute of Psychology, Polish Academy of Sciences, Warsaw, Poland.

^c Orygen, Parkville, Victoria, Australia

^d Centre for Youth Mental Health, The University of Melbourne, Parkville, Victoria, Australia

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ABSTRACT

Anomalous self-experiences are disturbances in the subjective experience of the self and have been shown to be related to the premorbid, prodromal, acute, and chronic phases of schizophrenia-spectrum disorders. Despite having a long history in psychopathology research, anomalous self-experiences are not explicitly represented in any major nosology of mental disorders. Previous research suggests that anomalous self-experiences are correlated, but distinct from other aspects of schizotypal personality, but this has not been examined with confirmatory factor analysis. The current research aimed to examine where anomalous self-experiences fit within the structure of schizotypal personality including cognitive-perceptual, interpersonal, disorganized, and paranoid factors. It also examined the measurement invariance of the factor structure across ethnicity and between sexes. Seven hundred forty-four participants completed multiple measures of anomalous self-experiences and schizotypal personality. The best fitting model was a five-factor model with anomalous self-experiences, cognitive-perceptual, interpersonal, disorganized, and paranoid factors. This model fit better than models with anomalous self-experiences loading on any of the four schizotypal personality factors. The structure had configural, metric, and scalar invariance across race/ethnicities, but lacked scalar invariance between sexes. Anomalous self-experience scores did not differ among race/ethnicity or between sexes. These results suggest that anomalous self-experiences are highly correlated with but distinct from other facets of schizotypal personality. Future research may examine whether anomalous self-experiences should be added to nosologies of psychotic-spectrum disorders.

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1. The placement of anomalous self-experiences within schizotypal personality

Anomalous self-experiences (ASEs) are disturbances in the subjective experience of the self (Parnas et al., 2005), and have a long history in descriptive psychiatry (Parnas, 2011). Early conceptualizations of schizophrenia suggested ASEs are core features of the disorder (Bleuler, 1911). Despite this history, disturbances in self-processing are not included in any current major nosology of psychotic-spectrum disorders, such as the International Classification of Diseases (ICD-10; World Health Organization, 2004) or the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013; Park and Nasrallah, 2014). However, the beta version of the ICD-11 includes “disturbances in the self-experience” (World Health Organization, 2016))” along with delusions and hallucinations in its

description of schizophrenia. This suggests that nosologists are increasingly recognizing the importance of ASEs in diagnosing schizophrenia spectrum disorders. At the same time, it is not clear whether ASEs are distinct from other symptoms of schizophrenia-spectrum disorders, which share considerable conceptual overlap.

In addition to the ICD, the Alternative Model of Personality Disorders (AMPD) in Section 3 of the DSM places an emphasis on self-function in its diagnosis of personality disorders (American Psychiatric Association, 2013, 2013). Criterion A includes an “impairment in (personality/self) functioning,” which can be further broken down into impairment in identity and self-direction. For schizotypal personality disorder (SPD), Criterion A includes “confused boundaries between self and others (p. 769)” and “distorted self-concept,” while Criterion B includes similar personality traits to earlier versions of the DSM such as cognitive and perceptual dysregulation, unusual beliefs and experiences, and eccentricity. However, it is unclear where ASEs fit within the structure of schizotypal personality. Thus, the primary goal of the current research was to examine whether ASEs fit within the structure of schizotypal personality or whether they form a distinct, separate, factor.

* Corresponding author: Department of Psychology, University of North Texas, 1155 Union Circle #311280, Denton, TX 76203-5017, United States of America.
E-mail address: david.cicero@unt.edu (D.C. Cicero).

Psychotic-spectrum disorders are thought to exist on a continuum from full-blown psychotic disorders on one end to SPD and schizotypy on the other (Linscott and van Os, 2010; van Os et al., 2009). Previous work on SPD has found that it has four-factor structure including cognitive-perceptual, paranoid, interpersonal, and disorganized factors (Cicero and Kerns, 2010; Stefanis et al., 2004). ASEs may also be early markers for premorbid psychosis (Brent et al., 2014) and are prevalent in nonclinical populations (Gawęda et al., 2017; Torbet et al., 2015). Moreover, several studies have found that ASEs are as prevalent in people with SPD as people with schizophrenia (e.g., Nordgaard and Parnas, 2014; Raballo and Parnas, 2012).

One prominent model of ASEs is the ipseity disturbance model, which is also referred to as a disturbance in minimal self (Sass and Parnas, 2003). Based on the phenomenological literature, this model suggests that ASEs are related to hyper reflexivity (i.e., an exaggerated self-consciousness in which attention is paid to things that would normally be implicitly experienced) and diminished self-presence (i.e., a loss of the subjective feeling of being the one inhabiting one's body and affecting action). ASEs can manifest in several different ways including disturbances in consciousness/cognition (e.g., feeling like thoughts belong to someone else), bodily disturbances (e.g., believing a part of the body is deteriorating or decaying), and self-awareness and presence (e.g., feeling unreal or not a part of the world).

Many of these ASEs can be viewed as similar to positive symptoms of schizophrenia-spectrum disorders. For example, this conceptualization of schizophrenia comprising ASEs is similar to Schneider's first rank symptoms. Feelings of thoughts being repeated or echoed, thought insertion, and thought withdrawal would be classified as disturbances in cognition, and passivity experiences such as feeling like an external force is controlling the body would be classified as a disturbance in bodily experiences (Parnas et al., 2005).

Several previous studies have examined the correlations among ASEs and positive symptoms of schizophrenia spectrum disorders. ASEs have been shown to be moderately to strongly correlated with positive symptoms in a number of different types of samples including: 1) non-help seeking adolescents and young adults from the general population (Cicero et al., 2017b; Koren et al., 2016), 2) help-seeking, but non-psychotic adolescents (Koren et al., 2013), 3) clinical/ultra-high risk (Comparelli et al., 2016; Nelson et al., 2019; Raballo et al., 2016), 4) First-episode psychosis (Nordgaard and Parnas, 2014; Raballo and Parnas, 2012), and 5) Chronic schizophrenia (Cicero et al., 2016). Thus, there is strong evidence that ASEs and positive symptoms are highly correlated, but potentially distinct constructs.

In addition to finding moderate to strong correlations with schizophrenia-spectrum symptoms, at least two studies have examined the component structure of ASEs and prodromal psychosis symptoms with principal components analysis (Comparelli et al., 2016; Koren et al., 2013). For example, Comparelli et al. found a two component structure with ASEs and global functioning on one component and positive, negative, disorganized, and general symptoms on another component. Similarly, Koren et al. found an ASE component that was distinct from a component for prodromal symptoms and a component for psychosocial functioning. At the same time, a long line of research has examined the factor structure of schizotypal personality, often in non-clinical samples (see Kwapil and Barrantes-Vidal, 2015, for a review). The current research aims to bridge the gap between these two literatures by examining where ASEs fit within the well-established structure of schizotypal personality. One way to examine how constructs fit together is confirmatory factor analysis (Rubio et al., 2001). If a factor model with constructs forming separate factors fits better than models in which the constructs load together, then one can conclude that the constructs can be discriminated from each other. Thus, in the current research, we tested various combinations of models in which ASEs loaded on factors along with positive, negative, disorganized, and paranoid factors or formed its own separate factor. We expected to find that a factor model with five separate factors would fit the data better than models with only four factors.

A second goal of the current research was to examine whether the structure of ASEs and schizotypal personality varied across race/ethnicity and between sexes. One method for testing whether the factor structure is equivalent between groups is measurement invariance analysis (Chen, 2008). Previous research examining the measurement invariance of schizotypal measures across different ethnicities and cultures has produced mixed results. One very large study comprising over 27,000 participants across 12 countries found that the Schizotypal Personality Questionnaire-Brief (SPQ-B) had configural invariance, but lacked strong measurement invariance, suggesting that the scale measures the same construct across groups, but that scores may represent different latent levels of schizotypal personality across groups (Fonseca-Pedrero et al., 2018a; Fonseca-Pedrero et al., 2018b). Other studies have found similar results in an undergraduate sample including Asian, Pacific Islander, White, and Multiracial participants using both the SPQ and the brief Wisconsin Schizotypy Scales (Cicero, 2016; Cicero et al., 2017a). In contrast to schizotypal personality, most research on ASEs has included primarily participants of European ancestry, and relatively little is known about ASEs across cultures. With respect to sex, some research suggests that schizotypal personality is invariant (Fonseca-Pedrero et al., 2011), and one measure of ASEs, the Inventory of Psychotic-Like Anomalous Self-Experiences has been shown to be invariant across sexes (Cicero et al., 2017b). We expected to find that the identified factor structure would be invariant across race/ethnicity and between sexes.

2. Method

2.1. Participants

Participants were 744 undergraduates at a large public Pacific university who participated in exchange for partial completion of a course requirement. All students in psychology courses had the option to sign up for the study on the online system SONA. Seven hundred fifty-one participants provided informed consent, and 744 participants completed the study. Their mean age was 20.11 ($SD = 3.60$). The sample was diverse, with 30.6% East Asian, 23.9% White, 17.7% Southeast Asian, 11.6% Multiracial, 9.7% Native Hawaiian or other Pacific Islander, and 6.5% other. They were 69.7% Female and 30.3% Male. Participants completed the study online in a single session lasting approximately 60 min. Based on norms established in previous research (Raine, 1991), approximately 41 participants would be expected to meet criteria for schizotypal personality disorder.

2.2. Materials

Anomalous Self-Experiences. ASEs were measured with the Inventory of Psychotic-Like Anomalous Self-Experiences (IPASE; Cicero et al., 2017b), a 57-item scale on which participants rate items from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). It contains subscales for disturbances in Self-Awareness and Presence, Consciousness, Somatization, Cognition, and Demarcation/Transitivity. The IPASE is positively correlated with measures of PLEs, but negatively correlated with self-concept clarity in general population and schizophrenia samples (Cicero et al., 2017b; Klaunig et al., 2018). The IPASE is very strongly correlated ($r = 0.92$) with the gold standard phenomenological interview measure of ASEs, the Examination of Anomalous Self-Experiences (Nelson et al., 2019).

A second measure of anomalous self-experiences was the Self-Experience Lifetime Frequency Scale (SELF; Heering et al., 2016). The SELF is a 12-item questionnaire on which participants answer how often they have had the experiences on a scale from 0 (*Never*) to 4 (*All the time*). For each answer >0 , participants are asked how distressed they were by the experience on a scale from 0 (*Not Distressed*) to 4 (*Severely Distressed*). The SELF has two factors including disturbances in self-awareness and diminished self-affection/depersonalization.

2.3. Schizotypal personality

Schizotypal personality was measured with the Schizotypal Personality Questionnaire (SPQ; Raine, 1991). The SPQ is a 74-item yes/no scale that contains nine subscales for each of the nine symptoms of SPD in the DSM. The nine subscales include Magical Ideation (SPQ-MI), Unusual Perceptual Experiences (SPQ-UPE), Ideas of Reference (SPQ-IR), Constricted Affect (SPQ-CA), No Close Friends (SPQ-NCF), Suspiciousness (SPQ-S), Excessive Social Anxiety (SPQ-ESA), Odd Speech (SPQ-OS), and Odd or Eccentric Behavior (SPQ-OCB). Each subscale contains between seven and nine items. The SPQ is among the most commonly used measures of schizotypal personality and has impressive support the reliability and validity of its scores. Previous work has consistently shown that the best fitting factor model of the SPQ includes four factors: Cognitive-perceptual, paranoid, interpersonal, and disorganized (Cicero, 2016; Compton et al., 2009; Stefanis et al., 2004).

In addition to the SPQ, participants completed the Brief Magical Ideation Scale, Perceptual Aberration Scale, and Social Anhedonia Scale (B-MIS, B-PAS, B-RSAS, respectively; Winterstein et al., 2011). The B-MIS includes 15 true-false items derived from the full length Magical Ideation Scale through a series of IRT analyses. The B-PAS includes 15 true-false items derived from the full length Perceptual Aberration Scale which was developed to measure schizophrenic-like distortions in perception. The B-RSAS is a 15-item true-false questionnaire derived from the full-length Revised Social Anhedonia Scale, which was designed to measure lack of relationships and lack of pleasure from relationships. The B-MIS, B-PAS, and B-RSAS have been shown to be strongly correlated with the full versions of the scales, to have measurement invariance among race/ethnicities, and to be correlated with other constructs in the same pattern as the full versions of the scales (Cicero et al., 2017a; Gross et al., 2012).

3. Data analysis

All models were fit using Mplus 8.1 software (Muthen and Muthen, 1998-2019) using MLR, with standard errors that are robust to non-normality of data. The absolute fit of the models was assessed with Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Squared Residual (SRMR). Following conventional criteria, RMSEA and SRMR values <0.10 were considered acceptable and <0.05 were considered excellent. CFI and TLI values >0.90 were acceptable and >0.95 were excellent (Hu and Bentler, 1998; Marsh et al., 2004). The fit of the models was compared with Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC), and Sample Size Adjusted Bayesian Information Criterion (SABIC), and the Satorra-Bentler Chi-Square Difference test (Satorra and Bentler, 2001).

The fit of five different models were compared. As mentioned, the best fitting model for the SPQ is well established and includes four factors: Cognitive-Perceptual, Paranoid, Interpersonal, and Disorganization. In all models, the cognitive-perceptual factor included the B-MIS, B-PAS, SPQ-MI, and SPQ-UPE the paranoid factor included the SPQ-S, SPQ-IR, and SPQ-ESA, the interpersonal factor included the SPQ-S and SPQ-ESA (crossloading on paranoid), along with SPQ-NCF, SPQ-CA, and the B-RSAS and the disorganization factor included the SPQ-OCE

and SPQ-OS. The five models included the ASE variables loading on each of the four schizotypy factors (Models 1-4) or a separate factor (Model 5).

After the best fitting model was identified, the measurement invariance of the models was tested across race and between sexes. The current study had a large enough sample of White, East Asian, Southeast Asian, Native Hawaiian and Other Pacific Islander, and Multiracial participants for inclusion in these analyses. First, a configural invariance model was tested, in which the factor loadings and intercepts were free to vary across groups. If this model fits the data well, then it suggests that the factor structure is roughly the same among groups (Chen, 2008). Second, a metric invariance model was tested, in which the intercepts were allowed to vary across groups. If this model fits as well as the configural model, then it suggests that the manifest variables measure the same construct across groups. Finally, a scalar invariance model was tested in which both the factor loadings and intercepts were constrained to be equal across groups. If this model fits as well as the metric invariance model, then it suggests that the scale scores represent the same latent levels across groups and that mean comparisons are appropriate. The same models were also tested between sexes. Given the well-known limitation of chi-square difference tests (Cheung and Rensvold, 2002), we compared the fit of these models with $\Delta CFI < 0.01$ (Meade et al., 2008), McDonald's Non-Centrality Index < 0.02 (McDonald, 1989), and lower BIC (Levant et al., 2013).

4. Results

First, we examined the zero-order correlations of all of the measures. As can be seen in Supplemental Table 1, all of the anomalous self-experiences and schizotypal personality variables were positively correlated with each other.

Next, we examined the placement of ASEs on the factor models. As can be seen in Table 1, Model 5, in which ASEs form a separate, fifth factor, fit the data well according to the RMSEA, CFI, and SRMR statistics (see Fig. 1). This model also fit better, according to the AIC, BIC, and SABIC, and Satorra-Bentler Chi-Square difference test than models with ASEs loading on one of the schizotypal personality factors. This finding suggests that ASEs are distinct from other aspects of schizotypal personality.

The second goal of the current research was to examine the measurement invariance of this factor structure across race and between sexes. As can be seen in Table 2, the configural invariance model, in which the factor loadings and intercepts were free to vary across races, fit the data well. This suggests that the factor structure is roughly the same across groups. The metric invariance model, in which the factor loadings were free to vary across groups, fit the data just as well as the configural model according to ΔCFI and ΔMc and had a lower AIC and BIC than the configural model. This suggests that scales are measuring the same constructs across groups. Finally, the scalar invariance model fit just as well as the metric model according to the ΔCFI and ΔMc and had the lowest AIC and BIC of the three models tested. This suggests that the scale scores represent the same latent level of schizotypal personality/ASEs across groups and thus that mean comparisons are appropriate.

Table 1

Comparison of five-factor and four-factor models of schizotypal personality and anomalous self-experiences.

Model	AIC	BIC	SABIC	χ^2 (df)	RMSEA (90% CI)	CFI	SRMR	χ^2 diff (5)
1) 4-factor (ASE with Pos)	44499.983	44749.834	44581.526	374.135 (66)	0.075 (0.068-0.083)	0.937	0.046	43.619
2) 4-factor (ASE with neg)	44728.364	44978.215	44809.215	567.776 (66)	0.096 (0.089-0.103)	0.898	0.083	171.792
3) 4-factor (ASE with disor)	44570.528	44820.379	44652.071	436.051 (66)	0.082 (0.075-0.090)	0.924	0.054	79.013
4) 4-factor (ASE with para)	44573.078	44822.929	44654.621	435.441 (66)	0.082 (0.075-0.090)	0.925	0.050	82.617
5) 5-factor (ASE separate)	44439.342	44708.050	44527.039	313.011 (62)	0.070 (0.062-0.078)	0.949	0.042	

AIC = Akaike Information Criterion, BIC = Bayes Information Criterion, SABIC = Sample size Adjusted Bayes Information Criterion, RMSEA = Root Mean Squared Error of Approximation, CFI = Comparative Fit Index, SRMR = Standardized Root Mean Square Residual.

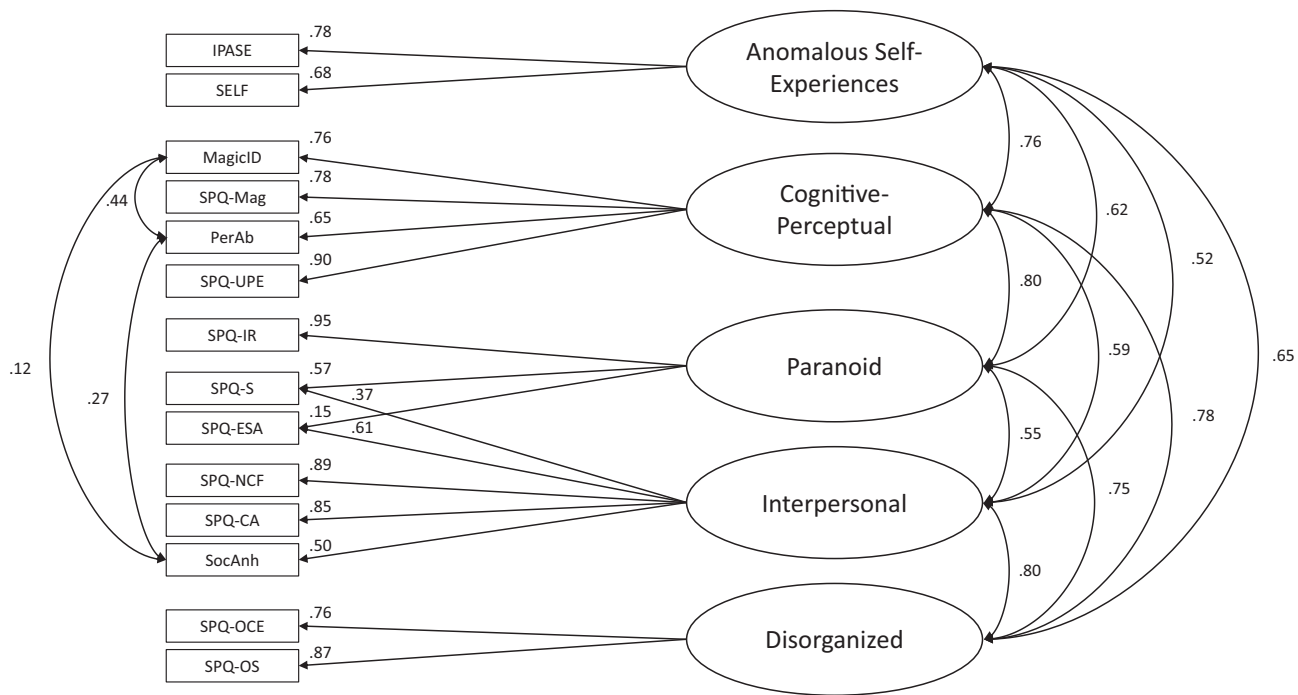


Fig. 1. The placement of anomalous self-experiences within the structure of schizotypal personality. Note: IPASE = Inventory of Psychotic-Like Anomalous Self-Experiences, SELF = Self-Experience Lifetime Frequency Scale Obliviousness Subscale, B-MIS = Brief Magical Ideation Scale, SPQ-Mag = Schizotypal Personality Questionnaire, Magical Ideation Subscale, B-PAS = Brief Perceptual Aberration Scale, SocAnh-B = Brief Social Anhedonia Scale, SPQ-IR = Schizotypal Personality Questionnaire Ideas of Reference Subscale, SPQ-S = Schizotypal Personality Questionnaire-Suspiciousness Subscale, SPQ-ESA = Schizotypal Personality Questionnaire Excessive Social Anxiety Subscale, SPQ-NCF = Schizotypal Personality Questionnaire- No Close Friends Subscale, SPQ-CA = Schizotypal Personality Questionnaire- Constricted Affect Subscale, SPQ-OEB = Schizotypal Personality Questionnaire Odd or Eccentric Behavior Subscale, SPQ-OS = Schizotypal Personality Questionnaire-Odd Speech Subscale.

Since the model had scalar invariance, we next compared the level of these scores across groups. As can be seen in Table 3, the groups did not differ in ASE scores on either the IPASE or the SELF. East Asian participants had higher scores than White participants on the SPQ subscales of Excessive Social Anxiety, No Close Friends, and Odd Speech, and they had higher scores than multiracial participants on Excessive Social Anxiety. Pacific Islanders had higher Ideas of Reference and Suspiciousness scores than White participants. Finally, Southeast Asian participants had higher Excessive Social Anxiety scores than multiracial participants and higher Odd Speech and Suspiciousness scores than White participants.

Next, we examined the measurement invariance of the structure between men and women. As can be seen in Table 4, the configural model fit the data well, and the metric model fit just as well as the configural model according to ΔCFI and ΔMc and had a lower AIC and BIC. However, the scalar model fit significantly worse than the metric model according to all four indicators. Following previous work (Byrne et al., 1989), we consulted the modification indices and found that the intercepts for Excessive Social Anxiety and Odd Speech needed to be freed to improve model fit. This modified scalar model fit the data as well as the metric model according to ΔCFI and ΔMc and had a lower BIC. This suggests that the factor structure is similar in men and women, but that the ESA and OS scale scores might represent a different underlying level of schizotypal personality, and mean comparisons for these scales should

be interpreted with caution. As can be seen in Table 5, men and women did not differ in ASE scores on either measure. Men had higher scores than women on the BMag, BPerab, SPQ-OEB, and SPQ-CA.

5. Discussion

The results of the current research suggest that ASEs are distinct from other facets of schizotypal personality. This is consistent with a long line of research into self-disturbances in schizophrenia-spectrum disorders, which suggests that ASEs are highly correlated with, but distinct from positive symptoms of schizophrenia (Henriksen and Parnas, 2012). In the current research, a factor model with separate ASE, cognitive-perceptual, paranoid, interpersonal, and disorganized schizotypal personality factors fit the data well and fit better than models in which ASEs loaded along with each of the other factors. This provides further support for the conclusion that ASEs and schizotypal facets are highly correlated yet distinct constructs.

To our knowledge, the current study is the first study to empirically examine where ASEs fit within the structure schizotypal personality using confirmatory factor analysis. This finding supports the decision of the World Health Organization to include disturbances in the experience of self among its description of schizophrenia in the beta version of the ICD-11 (World Health Organization, 2016). Moreover, the current finding may support the Criteria A and Criteria B distinction in the

Table 2
Fit statistics for configural, metric, scalar, and scalar modified invariance models by ethnicity.

Model	χ^2	df	RMSEA	90% CI	TLI	CFI	BIC	AIC	χ^2_{diff} (df)	p-value	McD	ΔCFI
1. Configural	629.735	310	0.086	0.076, 0.096	0.904	0.934	41961.182	40665.757				
2. Metric	695.073	354	0.083	0.074, 0.092	0.910	0.930	41760.303	40664.874	68.585 (44)	0.010	0.010	0.004
3. Scalar	759.006	390	0.080	0.074, 0.091	0.912	0.924	41585.659	40653.862	63.095 (36)	0.004	0.016	0.006

Model 1 = Configural model in which the factor loadings and intercepts are free to differ in all groups. Model 2 = Metric invariance model in which the intercepts are free but the factor loadings are constrained to be equal across groups. Model 3 = Scalar invariance model in which the factor loadings and intercepts are constrained to be equal across groups.

Table 3
Mean comparisons of anomalous self-experiences and schizotypal personality scores across ethnicity.

	White	East Asian	Multiracial	Pacific Islander	Southeast Asian	Total
Anomalous Self-Experiences						
Inventory of Anomalous Self-Experiences	97.67 (41.80) ^a	102.27 (43.81) ^a	100.10 (39.24) ^a	102.75 (44.83) ^a	103.94 (41.78) ^a	101.21 (42.40)
Self-Experiences Lifetime Frequency Scale	2.03 (2.60) ^a	2.06 (2.68) ^a	2.09 (2.67) ^a	1.85 (2.29) ^a	2.46 (2.46) ^a	2.11 (2.60)
Cognitive-Perceptual						
Brief Magical Ideation Scale	2.96 (3.47) ^a	3.35 (3.60) ^a	3.41 (3.20) ^a	4.11 (3.77) ^a	3.41 (3.18) ^a	3.35 (3.18)
SPQ: Magical Ideation	1.35 (1.86) ^a	1.47 (1.86) ^a	1.77 (1.86) ^a	2.00 (1.86) ^a	1.50 (1.80) ^a	1.53 (1.86)
SPQ: Unusual Perceptual Experiences	1.86 (2.19) ^a	2.01 (2.43) ^a	1.84 (1.99) ^a	2.59 (2.48) ^a	2.38 (2.31) ^a	2.08 (2.31)
Brief Perceptual Aberration Scale	1.34 (2.51) ^a	1.69 (3.45) ^a	0.86 (1.83) ^a	1.81 (3.03) ^a	1.55 (3.30) ^a	1.49 (3.01)
Paranoid						
SPQ: Ideas of Reference	3.12 (2.70) ^a	3.59 (2.78) ^{ab}	3.10 (2.64) ^{ab}	4.29 (2.79) ^b	3.98 (2.76) ^{ab}	3.56 (2.76)
SPQ: Suspiciousness	2.01 (1.99) ^a	2.61 (2.21) ^{ab}	2.60 (2.42) ^{ab}	3.38 (2.46) ^b	3.18 (2.31) ^b	2.77 (2.42)
SPQ: Excessive Social Anxiety	3.54 (2.94) ^{ab}	4.45 (2.77) ^c	3.16 (2.48) ^b	4.17 (2.54) ^{abc}	4.37 (2.74) ^{ac}	4.02 (2.79)
Interpersonal						
SPQ: No Close Friends	2.37 (2.44) ^a	3.16 (2.55) ^b	2.48 (2.16) ^{ab}	3.06 (2.25) ^{ab}	3.08 (2.50) ^{ab}	2.85 (2.46)
SPQ: Constricted Affect	2.01 (1.99) ^a	2.61 (2.21) ^a	2.66 (2.01) ^a	2.66 (2.01) ^a	2.51 (2.10) ^a	2.37 (2.10)
Brief Social Anhedonia Scale	3.24 (3.10) ^a	3.26 (2.79) ^a	2.82 (2.57) ^a	3.81 (3.32) ^a	3.55 (3.01) ^a	3.31 (3.00)
Disorganized						
SPQ: Odd Speech	2.98 (2.59) ^a	3.80 (2.93) ^b	3.04 (2.42) ^{ab}	3.80 (2.53) ^{ab}	3.99 (2.59) ^b	3.54 (2.71)
SPQ: Odd or Eccentric Behavior	1.81 (2.19) ^a	2.14 (2.30) ^a	1.72 (2.05) ^a	2.16 (2.47) ^a	1.86 (2.13) ^a	1.95 (2.23)

Note: SPQ = Schizotypal Personality Disorder. Means that share superscript letters do not significantly differ from each other.

DSM by suggesting that these constructs can be reliably discriminated from each other, at least with respect to the traits most relevant to schizotypal personality disorder. Future research may continue to examine the clinical utility of including ASEs among diagnostic criteria for schizophrenia-spectrum disorders.

Although ASEs have a long history in schizophrenia research, ASEs are typically neglected by much of mainstream psychopathology research (Park and Nasrallah, 2014). One reason ASEs have been neglected is that theorists may have assumed that ASEs could be encompassed within the positive symptoms in schizophrenia. Self-disturbances may be viewed as a “type” of positive symptom, much like grandiose delusions are viewed as type of delusion or auditory hallucinations are a type of hallucination that are encompassed by the broader symptoms of “delusions” and “hallucinations” in traditional nosologies. Moreover, researchers have suggested that ASEs may underlie negative symptoms as well (Sass and Parnas, 2003). The current research suggests that ASEs may be distinct symptoms.

One difference between ASEs and positive symptoms of schizophrenia is that ASEs have an “as if” quality in which the individual lacks conviction in their beliefs, or the hallucination-like experiences lack vividness (Parnas et al., 2005). As an individual develops psychosis, this “as if” quality fades away, the individual develops conviction in their delusions, and the hallucinations become more vivid. Interestingly, these “as if” qualities are similar to the distinctions between attenuated psychotic symptoms and full-blown psychosis, in that attenuated delusion-like beliefs tend to lack conviction, and attenuated hallucinations tend to be vague shadows or mumbled voices (Addington and Heinssen, 2012). Cognitive-perceptual schizotypy is similar to attenuated psychotic symptoms in that both are diminished forms of psychotic symptoms and represent a risk for psychosis (Barrantes-Vidal et al., 2013; Meehl, 1962). The finding that they can be discriminated from each other may explain previous findings that have found both

attenuated psychotic symptoms and ASEs independently contribute to the prediction of “conversion” to psychosis in clinical high-risk samples (Nelson et al., 2012).

One strength of the current study was that the sample was extremely diverse, with only 23.9% being of European ancestry. This represents a strength of the current research, because many previous studies on ASEs have included primarily Caucasian participants. A second major finding was that the five-factor structure of schizotypal personality and ASEs had configural, metric, and scalar invariance across race/ethnicity. To our knowledge, the current research is the first study to examine the measurement invariance of a factor structure including ASEs. This result is consistent with some previous research on the invariance of the SPQ, although previous results have been mixed (Cicero, 2016; Fonseca-Pedrero et al., 2018a; Fonseca-Pedrero et al., 2018b; Fonseca-Pedrero et al., 2011). This result suggests that the structure of schizotypal personality including ASEs is the same in the five groups included in the analysis and that scale scores can be compared across groups. The current study found no significant differences in ASE scores across race/ethnicity, and found few differences for the other factors of schizotypal personality. The factor structure also had configural invariance and metric invariance between sexes, but lacked complete scalar invariance. This suggests that the factor structure is the same between sexes, but that scale scores might indicate different latent levels of schizotypal personality. Follow-up analyses revealed that the problematic scales are the excessive social anxiety and odd speech subscales. Comparisons between men and women on these two scales should be interpreted with caution, and were not reported in the current research. Overall, men and women did not differ on ASE scores, which is consistent with previous work (Cicero et al., 2017b).

One limitation of the current research is that the participants were undergraduates. Although psychotic-like experiences have been found throughout the general population (van Os et al., 2009), including

Table 4
Fit statistics for configural, metric, scalar, and scalar modified invariance models by sex.

Model	χ^2	df	RMSEA	90% CI	TLI	CFI	BIC	AIC	χ^2_{diff} (df)	p-value	McD	Δ CFI
1. Configural	371.590	124	0.073	0.065, 0.082	0.926	0.950	44035.926	43509.542				
2. Metric	395.873	135	0.072	0.064, 0.080	0.929	0.947	43992.333	43516.741	24.676 (11)	0.010	0.008	0.003
3. Scalar	474.981	144	0.078	0.071, 0.086	0.915	0.933	44016.751	43582.715	88.559 (9)	<0.001	0.038	0.014
4. Scalar-Modified	420.157	142	0.072	0.064, 0.080	0.928	0.944	43969.620	43526.349	24.973 (7)	<0.001	0.010	0.003

Model 1 = Configural model in which the factor loadings and intercepts are free to differ between groups. Model 2 = Metric invariance model in which the intercepts are free but the factor loadings are constrained to be equal between groups. Model 3 = Scalar invariance model in which the factor loadings and intercepts are constrained to be equal between groups. Model 4 = Modified scalar invariance model in which the factor loadings and all of the intercepts except Odd Speech and Excessive Social Anxiety were constrained to be equal between groups.

Table 5
Mean comparisons of anomalous self-experiences and schizotypal personality scores between sexes.

	Male	Female
Anomalous Self-Experiences		
Inventory of Anomalous Self-Experiences	104.38 (43.83) ^a	99.39 (41.68) ^a
Self-Experiences Lifetime Frequency Scale	4.20 (6.04) ^a	4.82 (6.94) ^a
Cognitive-Perceptual		
Brief Magical Ideation Scale	3.67 (3.80) ^a	3.11 (3.16)
SPQ: Magical Ideation	1.61 (2.04) ^a	1.51 (1.72) ^a
SPQ: Unusual Perceptual Experiences	2.26 (2.56) ^a	1.96 (2.12) ^a
Brief Perceptual Aberration Scale	2.01 (3.16) ^a	1.19 (2.51)
Paranoid		
SPQ: Ideas of Reference	3.64 (2.86) ^a	3.50 (2.73) ^a
SPQ: Suspiciousness	2.87 (2.54) ^a	2.70 (2.37) ^a
SPQ: Excessive Social Anxiety	3.46 (2.73) ^a	4.20 (2.78)
Interpersonal		
SPQ: No Close Friends	2.94 (2.57) ^a	2.76 (2.41) ^a
SPQ: Constricted Affect	2.63 (2.34) ^a	2.23 (1.95)
Brief Social Anhedonia Scale	3.49 (3.02) ^a	3.24 (2.99) ^a
Disorganized		
SPQ: Odd Speech	3.46 (2.83) ^a	3.50 (2.62) ^a
SPQ: Odd or Eccentric Behavior	2.44 (2.38) ^a	1.71 (2.09)

Table note: SPQ = Schizotypal Personality Questionnaire. Means that share superscript letters do not significantly differ from each other. Mean comparisons for SPQ-Excessive Social Anxiety and SPQ-Odd Speech were not conducted due to a lack of complete scalar invariance.

undergraduates (Loewy et al., 2007), undergraduates may be psychologically healthier than the general population, have higher SES, and have more education. Moreover, the study lacks information about the existence of past or concurrent emotional problems as well as past or present treatment or hospitalization. Thus, these results may not generalize to general population or clinical samples. Recent models have suggested that psychopathology is dimensional, and the current sample represented the lower end of the schizophrenia-spectrum.

Another limitation is that we relied on self-report measures. Some theorists have suggested that ASEs cannot be measured with self-report, and must be measured with trained phenomenological interviewers (Parnas et al., 2017). However, the primary measure of ASEs, the IPASE, has been shown to be highly correlated with the gold-standard phenomenological interview for ASEs (Nelson et al., 2019). Studies have consistently found that the IPASE has high international consistency and there is growing support for the validity of IPASE scores in undergraduate, general population, clinical high risk, first-episode psychosis, and chronic schizophrenia samples (Cicero et al., 2016; Cicero et al., 2017b; Gaweda et al., 2017). Future research could test similar CFA models with phenomenological interviews of ASEs.

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Contributors

David C. Cicero designed the study, collected the data, conducted the statistical analyses, and wrote the first draft of the manuscript. Lukasz Gaweda and Barnaby Nelson edited the manuscript and contributed important conceptual input. All authors contributed to and have approved the final manuscript.

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All authors declare that they have no conflicts of interest.

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