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Defining Dimensions In Schizotypy: Factor Structure Replication And External Validation Of The Schizotypal Personality Questionnaire – Brief Revised Updated (SPQ-BRU).

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Defining Dimensions in Schizotypy: Factor Structure Replication and External Validation of the Schizotypal Personality Questionnaire – Brief Revised Updated (SPQ-BRU).

by

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A Research Proposal

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Abstract

Background: Schizotypy is a construct that captures quantitative dimensions of the psychosis continuum from clinical to non-clinical expressions. The purpose of this study was to determine the factor structure and criterion validity of a newly revised self-report measure, the Schizotypal Personality Questionnaire–Brief Revised Updated (SPQ-BRU; Davidson, Hoffman, & Spaulding, 2016) for predicting later cognitive-perceptual experiences in college undergraduates.

Method: The data analytic sample was comprised of 2,474 undergraduate students (female = 71.9%) attending a university in the Midwest. First, we aimed to identify a model of best fit by comparing latent measurement models of schizotypy using confirmatory factor analysis (CFA). Second, we estimated a latent cognitive-perceptual factor from multiple measures collected at a second time point in a subsample of participants (n = 357). Using structural equation modeling (SEM), we tested the impact of latent schizotypy on participants' self-reported cognitive-perceptual experiences at time 2.

Results: Overall, CFA findings supported a 4-factor model of schizotypy described by Callaway and colleagues (2013), ($\chi 2$ (450) = 2814, $p < 0.001$, CFI = 0.931, TLI = 0.942, RMSEA = 0.046, CI_{RMSEA} = 0.044—0.048, SRMR = 0.052). The 4-factor model replicated in the subsample for aim 2, ($\chi 2$ (48) = 111.073, $p < 0.001$, CFI = 0.961, TLI = 0.947, RMSEA = 0.061, CI_{RMSEA} = 0.046— 0.075, SRMR = 0.041). Consistent with our hypothesis for aim 2, the latent cognitive-perceptual model had excellent fit of the data ($\chi 2$ (1) = 0.002, p = 0.963, CFI = 1.000, TLI = 1.024, RMSEA = 0.000, CI_{RMSEA} = 0.000—0.000, SRMR = 0.000). Lastly, the SEM model for aim 3 obtained good fit of the data, ($\chi 2$ (13) = 33.636, p = 0.0014, CFI = 0.952, TLI = 0.920, RMSEA = 0.067, CI_{RMSEA} = 0.039—0.095, SRMR = 0.041). This final path model explained 41.4% of variance in time 2 cognitive-perceptual experiences ($p < 0.001$).

Conclusion: This investigation bolsters a growing body of evidence for the dimensional approach to psychometrically-defined schizotypy. In addition, this study strengthens support for the predictive power of schizotypy. Psychometric and methodology issues in the context of the dimensional approach to schizotypy will be discussed.

Keywords: Schizotypy, Schizophrenia, Psychometrics, Confirmatory Factor Analysis, Structural Equation Modeling

Introduction

Converging Frameworks: Dimensional & Neurodevelopmental

Contemporary research on psychopathology is undergoing a paradigm shift in response to the questionable validity of the categorical framework for mental illness (Cuthbert & Insel, 2013; Stefanis et al., 2007). The National Institutes of Mental Health (NIMH) has released a new strategic aim to move the field towards a dimensional paradigm of psychopathology, known as the Research Domain Criteria or “RDoC.” A central purpose of this new initiative is to provide an alternative framework spanning a broader range of behavior from normative to clinically-significant variations (Cuthbert, 2014). Exploration of a broader array of phenotypes provides opportunities for early intervention and prevention of mental illness—all of which are key areas for broader public health impact (Insel, 2014; Insel et al., 2010).

Increasing interest in dimensional approaches reflects a major paradigmatic shift in schizophrenia research (Cuthbert & Insel, 2010; Morris, Vaidyanathan, & Cuthbert, 2016). In convergence with this shift is growing agreement within the schizophrenia-spectrum disorders (SSD) research community regarding the continuous population distribution of psychosis manifest phenotypes (Barch et al., 2013; Johns & van Os, 2001; van Os, Linscott, Myin-Germeys, Delespaul, & Krabbendam, 2009). In addition, there is increased recognition that SSD is a neurodevelopmental disorder with delayed onset (Fatemi & Folsom, 2009; Weinberger & Levitt, 2011). Although research evidence suggests that gene-environment interactions across the lifespan underlie the expression of psychosis (van Os, Kenis, & Rutten, 2010; van Os, Rutten, & Poulton, 2008), little is understood about developmental pathways associated with varying trajectories in SSD, and about which stages of development and pathogenesis are most responsive to intervention. Together, dimensional and neurodevelopmental frameworks provide a valuable, unifying paradigm for researchers seeking to understand the developmental and biopsychosocial complexity of psychosis.

Researchers interested in the neurodevelopmental-dimensional framework have begun to reexamine the role of schizotypy as a construct that captures the full range of the psychosis continuum (Barrantes-Vidal, Grant, & Kwapil, 2015). Schizotypy occurs in the general population at a higher frequency than full-blown schizophrenia (Johns & van Os, 2001) and interacts with other vulnerabilities to increase cumulative risk for psychosis (Debbané & Barrantes-Vidal, 2015; Debbané et al., 2015; Debbané & Mohr, 2015). Although schizotypal traits do not confer risk for psychosis in isolation from other etiological risk factors, evidence from longitudinal research supports their utility for prediction of later clinical status in adulthood (Kwapil, Gross, Silvia, & Barrantes-Vidal, 2013; Ruhrmann et al., 2010; van Os et al., 2008). Furthermore, elevations in schizotypy are well documented in clinical populations with psychosis and first degree relatives (Barrantes-Vidal et al., 2013; Tarbox & Pogue-Geile, 2011). These lines of convergent research suggest schizotypal traits may be proximal to the genes mediating conversion to psychosis.

Psychometrically-Defined Schizotypy

Sample characterization via valid and reliable assessment is critical for bridging the gap between research and practice in mental health. Reliable and valid measures that apply psychometric theory may assist in identifying the full range of phenotypes along the schizophrenia spectrum (Mason, 2015). Unlike neural, behavioral, or biological measures, psychometric measures are convenient and inexpensive to administer. Such measures may aid in stratified recruitment research for studies using larger samples or costly research approaches. Additionally, the dimensional assessment approach permits wider inclusion of behavioral problems and populations (e.g., clinical, first-degree relatives, age-matched controls, subclinical, controls, etc.). Thus, dimensional assessments are crucial for moving research toward paradigmatic changes in SSD and broader psychopathology.

Sampling from populations with psychometrically-defined dimensional schizotypy possesses several methodological advantages over clinical samples that include: (1) reduced confounds associated with SSD chronicity (e.g., antipsychotic side effects), (2) improved measurement validity of the psychosis continuum (Stefanis et al., 2004), and (3) greater scientific convergence with evolving neurodevelopmental-dimensional models of complex psychopathology as articulated in the RDoC project (Casey, Oliveri, & Insel, 2014). Psychometrically-defined schizotypy also possesses notable advantages over familial and clinical approaches that include: (1) convenient, mass screening of individuals from the general population, (2) relatively non-invasive assessment, (3) inexpensive administration, and (4) opportunities for multivariate research (Kwapil & Chun, 2015).

To summarize, there is sound justification for the study of dimensional schizotypy and further development of accompanying psychometric measures. Schizotypy provides a frontier to study the etiology of SSD as a dimensional sampling frame, and thus its application in research aligns with broader public health initiatives in schizophrenia research.

Inconsistencies in Past Research

Although several papers seek to study the dimensional nature of schizotypy, there are several inconsistent practices that occur at different stages of the research process. For instance, researchers aiming to study dimensional schizotypy select measures that have distributional assumptions inconsistent with a dimensional approach (Kwapil, Barrantes-Vidal, & Silvia, 2008). Problematic data treatment practices may include invalidating scale assumptions when the measure is already continuous (Grimshaw, Bryson, Atchley, & Humphrey, 2010) or using mathematical functions that force a continuous distribution on non-normally distributed scales. An example of the former is the application of data transformations to change the distribution of scores to meet normality assumptions (Barrantes-Vidal, Lewandowski, & Kwapil, 2010).

In the context of sampling, it is a common practice to dichotomize continuous measures by grouping participants into “high’ and ‘low’ schizotypy groups. ‘High’ schizotypy can range from the top 5% (Cohen, Callaway, Mitchell, Larsen, & Strauss, 2016) to the top 25% (Papousek et al., 2014) of scorers, while ‘low’ schizotypy may vary from the bottom 10% (Chan et al., 2011) to the bottom 50% (Cohen, Morrison, Brown, & Minor, 2012). The practice of dichotomizing continuous variables is known to increase Type I error and decrease power (Maxwell & Delaney, 1993). Differences on scores between categories are assumed to be equal within category (MacCallum, Zhang, Preacher, & Rucker, 2002).

Lastly, inconsistent use of terminology in past schizotypy research is also apparent. Specifically, there appears to be conflated use of terminology regarding psychometric factor structure (e.g., “multidimensional”) and population distribution assumptions in schizotypy ("dimensional" e.g., Fonseca-Pedrero, Paino, Lemos-Giraldez, Sierra-Baigrie, & Muniz, 2011). A ‘multidimensional’ factor structure refers to a construct that has two or more factors. Factor structure is not an assumption about the continuity of scores, as latent factors can be categorical with the appropriate estimator.

Taken together, these practices in research and discourse may explain inconsistent findings as well as problems with generalization in research on schizotypy to broader SSD. We propose that future research examining dimensional schizotypy practice unequivocally dimensional assessment, sampling, and data analytic techniques to demonstrate consistency between theoretical assumptions and methodology.

Taxometric (Discrete) vs. Dimensional (Continuous) Schizotypy

Although the dimensional model of psychopathology is relatively new, dimensional schizotypy has a rich history in schizophrenia research dating back to debates about its theoretical structure. Discrepancies primarily stem from divergent theoretical models, each with their own disciplinary traditions and assumptions (Kwapil & Chun, 2015). Taxometric models of schizotypy primarily evolved from medicine, which emphasizes diagnostic categorization of mental illness. In this perspective, schizotypy is regarded as a qualitatively-distinct group from the general population, best described as Schizotypal Personality Disorder (SPD). Dimensional models, by contrast, originate from personality psychology and theorize that clinical phenomena fall along the extreme ends of a continuum in the general population.

The quasi-dimensional theory conceived by Meehl (1962) describes schizotypy as the manifest phenotype of schizotaxia, a genetically determined sensory-neural integrative deficit, which is necessary but not sufficient for the development of schizophrenia (Lenzenweger, 2006). Meehl (1990) hypothesized that the population distribution of schizotypy is categorical in nature, with approximately 10% of the population possessing schizotypal traits and 10% of schizotypal individuals later developing schizophrenia (Lenzenweger, 2006). Meehl believed schizotypy represented subclinical manifestations of schizophrenia, and his supporters argue that schizotypy is worthy of study in its own right for this reason (Lenzenweger, 2015). Although prior research has provided some support for Meehl's taxon, its theoretical and empirical basis has been challenged by simulation research (Rawlings, Williams, Haslam, & Claridge, 2008).

Schizotypy is increasingly understood today as a fully dimensional continuum of individual differences in personality and behavior (Nelson, Seal, Pantelis, & Phillips, 2013). The dimensional model proposed by Claridge and Beech (1995) posits that schizotypal traits are represented in the general population at varying degrees. The etiological theory corresponding with this model articulates that a combination of genetic, environmental, and individual characteristics contributes to the heterogeneous expression of schizotypal traits, which range from adaptive to non-adaptive levels (Claridge et al., 1996).

Dimensional Measures of Schizotypy

Dimensional schizotypy, while heterogeneous, can be detected in the general population using valid and reliable psychometric measures that assess its multiple dimensions (Davidson et al., 2016). The *Schizotypal Personality Questionnaire* (SPQ; Raine, 1991) is the most popular psychometric method to date (Kwapil & Chun, 2015). The present study will focus on this self-report measure for three reasons: (1) it provides a continuous measure of schizotypy, (2) it is relatively brief to administer, and (3) it has strong psychometric properties that make it ideal for further development and application in treatment and research contexts.

Davidson, Hoffman, and Spaulding (2016) recently published an updated version of the 32-item short form called *The Schizotypal Personality Questionnaire-Brief Revised Updated* (SPQ-BRU; Davidson et al., 2016). This update changed the wording of some of the items to reduce potential method effects of the SPQ-Brief Revised (SPQ-BR; Cohen, Matthews, Najolia, & Brown, 2010). Much like the original SPQ developed by Raine (1991), the SPQ-BRU assesses 9 features of schizotypy: ideas of reference, social anxiety, magical thinking, unusual perceptions, eccentric behavior, no close friends, odd speech, constricted affect, and suspiciousness. Although Raine developed the SPQ based on diagnostic criteria, the measure has been revised to capture the dimensional nature of psychosis (van Os & Reininghaus, 2016)

Factor Structure of Schizotypy

Measurement models of dimensional schizotypy vary due to theoretical and sample differences, as well as divergent measurement and analytic approaches (Fonseca-Pedrero et al., 2011; Nelson et al., 2013). Although earlier investigations proposed unidimensional and 2-factor models, more contemporary research favors models with 3 or 4 factors (Barrantes-Vidal et al., 2015; Cicero, 2016; Davidson et al., 2016; Raine et al., 1994).

2- and 3-Factor Models

Raine and colleagues (1994) were among the first to test a higher-order structure of the SPQ. Out of five models tested, the three-factor solution consisting of cognitive-perceptual, interpersonal, and disorganized had the best fit of the data across undergraduate and community samples. This three-factor solution, which consists of cognitive-perceptual and interpersonal schizotypy, had better fit than a positive-negative 2-factor model proposed earlier by Kendler et al. (1991). The 3-factor solution allows the “paranoid” (suspiciousness) subscale to cross-load onto the interpersonal and cognitive-perceptual factors. This model differs from Kendler et al. (1991) in that anxiety loads distinctly onto the interpersonal factor.

4-Factor “Paranoid” Model

Stefanis et al. (2004) later compared 13 models using the SPQ. These researchers hypothesized that a 4-factor “Paranoid” model modified from Bergman et al. (1996) would yield the best fit of the data in a large, all-male military sample. The 4-factor Paranoid model of schizotypy consists of cognitive perceptual, paranoid, negative, and disorganized factors. This model allows social anxiety and paranoid ideation (suspiciousness) to cross-load onto paranoid and negative factors. Consistent with their hypotheses, the 4-factor Paranoid model yielded good fit of the data and had superior fit over competing models including the 3-factor model in random subsamples of data.

Wuthrich and Bates (2006) tested the factor structure of the SPQ in an Australian student sample with a wide age range (17 to 60 years). This includes two different 2-factor models (Kendler et al., 1991; Siever & Gunderson, 1983), three different 3-factor models (Battaglia, Cavallini, Macciardi, & Bellodi, 1997; Bergman et al., 1996; Raine et al., 1994), and the 4-factor Paranoid model. Although the 4-factor paranoid model initially provided good fit of the data, the authors re-specified Raine's 3-factor model. Compton, Goulding, Bakeman, and McClure-Tone (2009a) later replicated the superiority the 4-factor Paranoid model in a smaller undergraduate student sample. Model fit indices for this model were more robust when compared to the nine other single- and higher-order models.

4-Factor Standard Model

Callaway, Cohen, Matthews, and Dinzeo (2014) later confirmed a 4-factor structure of the SPQ-Brief Revised consisting of social anxiety, no close friends/constrained affect, cognitive-perceptual, and disorganized. Although the 3- and 4-factor solutions examined had nearly equivalent goodness-of-fit indices, the BIC fit statistics and deviance test statistics indicated that the 4-factor solution ultimately improved model fit of the data. This 4-factor model was recently replicated by Davidson et al. (2016), with the exception that the "no close friends/constrained affect" factor was estimated as the latent factor called "interpersonal."

Neither of these more recent studies tested the fit of the 4-factor Paranoid Model identified by Stefanis and colleagues, which had robust goodness-of-fit indices later replicated by Compton et al. (2009a). Furthermore, although the 4-factor Paranoid model has robust global fit indices, its substandard local (component) fit has not been addressed to date.

The Present Study

Three primary aims guided this investigation. The first aim was to estimate and statistically compare competing lower- and higher-order models of latent schizotypy discussed in the prior literature. Overall, we hypothesized that 4-factor models will fit the data better over the unidimensional, 2-factor, and 3-factor models of schizotypy. Whether or not the 4-factor (Callaway et al., 2014) or Paranoid (Stefanis et al., 2004) model best reflects the latent construct of schizotypy is a question that remains to be empirically examined. Based on prior literature, we expected that the 4-factor model identified by Callaway et al. (2014) would have superior component fit in comparison to the 4-factor Paranoid model.

The second aim was to test the model fit of a hypothesized cognitive-perceptual model comprised of multiple measures collected at a second time point. Our three candidate measures for the latent cognitive-perceptual measurement model were selected *a priori* based off converging lines of evidence in the psychoses-spectrum literature. We hypothesized that this 4-factor model consisting of magical ideation, conspiracy beliefs, and maladaptive daydreaming would fit the time 2 data well. In addition, we hypothesized that the model of best fit from aim 1 would replicate in this subsample.

The third aim was to examine the criterion validity of the hypothesized multidimensional model from aim 1 in explaining time 2 cognitive-perceptual experiences using structural equation modeling (SEM). We hypothesized that our CFA derived solution would explain a significant proportion of variance in later cognitive-perceptual experiences. It was expected that all the factors of the SPQ-BRU would be associated with time 2 cognitive-perceptual experiences, but the cognitive-perceptual factor would explain most of the variance in that model compared to the other schizotypy factors.

Model Specification

Aim 1 (Latent Schizotypy CFA)

To meet the first aim of this study, we adopted a model specification approach similar to Compton et al. (2009a). First, a single factor model was fit using all nine sub-factors of the SPQ-BRU. This unidimensional model (Model 1) provided the baseline model and was compared with higher-order models. Next, we evaluated the fit of a 2-factor model (Model 2) consisting of positive and negative schizotypy (see Compton et al., 2009a). Following this, we estimated a 3-factor model (Model 3) containing positive, negative, and disorganized schizotypy (Raine et al., 1994). Then we assessed the fit of a 4-factor solution (Model 4) identified by Callaway et al. (2014), which includes positive, negative, disorganized, and social anxiety factors. Finally, we fit the "Paranoid" model (Model 5) identified by Stefanis et al. (2004). This model is a non-standard CFA solution and its complex indicators (social anxiety and paranoid/suspiciousness) cross-load onto multiple factors (paranoid and negative).

Aim 2 (Cognitive-Perceptual CFA)

To meet the second aim, we fit a latent cognitive-perceptual model with four observed indicators using candidate measures selected a-priori. Of the measures selected, the Magical Ideation Scale (MIS; Eckblad & Chapman, 1983) is the most familiar to schizotypy research. The MIS assesses personal beliefs or experiences associated with clairvoyance, telepathy, superstition, and other supernatural experiences. The MIS is commonly associated with fantastical and paranormal beliefs (Hergovich, Schott, & Arendasy, 2008). Like the MIS, the Generic Conspiracist Beliefs (GCB; Brotherton, French, & Pickering, 2013) scale measures endorsement of improbable or unsubstantiated beliefs. Specifically, the GCB measures the degree to which one holds prominent conspiracy theories across various contexts. Both the MIS and GCB conceptually overlap with the magical thinking, ideas of reference, and suspiciousness subscales of the SPQ-BRU. Only two of subscales on the GCB were selected for the time 2 cognitive-perceptual model due to their convergence with prior research literature in SSD: extraterrestrial cover-ups and government malfeasance (Swami, Pietschnig, Stieger, & Voracek, 2011). We added a covariance between the residuals of these two indicators because both were subscales on the same measure and expected to be correlated. In addition to cognitive aspects of functioning, we used a relatively new measure called the Maladaptive Daydreaming Scale (MDS; Somer, Lehrfeld, Bigelsen, & Jopp, 2016), which assesses impairment and distress associated with daydreaming. We selected this measure due to its ability to provide an indirect measure of unusual perceptions.

Aim 3 (Full Path Model)

To meet the third aim, we fit a path model loading the CFA solution of latent schizotypy onto time 2 cognitive-perceptual experiences. We first fit each measurement model individually and assessed model fit of the data. Then we fit the full path model and assessed its fit of the data.

Implications

If the hypothesized 4-factor Callaway et al. (2014) model is supported over single and lower-order models, this would first suggest that traditional "positive" domains of schizotypy generally reflect correlated, but ultimately distinct factors. If the hypothesized latent schizotypy model explains a significant proportion of variance in time 2 cognitive-perceptual experiences, then this would support the potential criterion and predictive validity of the 4-factor model.

Method

Participants

A total of 2,766 participants (female = 71.9%) from a Midwestern University participated in the present study. Participants were recruited from undergraduate psychology courses and completed the study measures as part of the Psychology Department's mass screening battery. All participants provided informed consent and completed the survey online via Qualtrics. The 2016 fall and spring cohorts were contacted by email to participate in a second time point that involved completion of additional measures. The group of participants who participated in time 2 (n = 357) provided the data analytic sample for the full model (aims 2-3). All participants received research credit for completion of the survey and no monetary incentives were offered for compensation. Approval for this study was obtained from the university-affiliated Institutional Review Board (IRB).

Demographics Survey. All participants completed a brief demographic survey at time 1 that assessed sex, sexual orientation, race, dating status, employment status, socioeconomic status (SES), employment status, academic status, and paternal and maternal education. In addition to these demographics, participants who completed time 2 also provided information on family history of autism spectrum disorder (ASD) and SSD among first- and second-degree relatives, as well as current and historical use of psychotropic medications.

***Schizotypal Personality Questionnaire-Brief Revised Updated* (SPQ-BRU; Davidson et al., 2016).** The SPQ-BRU is a 32-item self-report measure that assesses multiple dimensions of schizotypal personality in both clinical and nonclinical populations. Response options fall along a 5-point Likert rating scale ranging from 1 "Not at All True" to 5 "Very True." The SPQ-BRU contains a total of nine subscales typically organized in 3 or 4 factors: odd speech, eccentric behaviors, constrained affect, no close friends, magical thinking, unusual perceptions, suspiciousness, and ideas of reference. Higher scores indicate greater levels of dimensional schizotypy.

***Magical Ideation Scale* (MIS; Eckblad & Chapman, 1983).** The MIS is a valid and reliable self-report measure for assessing superstitious or improbable beliefs (item 8, "I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to him."). Responses are collected using a true/false response format on this 30-item measure. Total scores on the MIS were reversed so that higher scores indicate greater levels of magical ideation. This measure was formulated based on Meehl's conceptualization of schizotypy (Eckblad & Chapman, 1983; Kwapil, Miller, Zinser, Chapman, & Chapman, 1997). Cronbach's alpha coefficients range between .79 and .85 (Kwapil, Crump, & Pickup, 2002). The alpha coefficient for the MIS was .76 in the present study.

***Generic Conspiracist Beliefs Scale* (GBC; Brotherton et al., 2013).** The GCB is a well-established 15-item self-report instrument designed to gauge a broad range of relatively common conspiracies across six factors. These factors include belief in extraterrestrial cover-ups, malevolent global conspiracies, government malfeasance, personal wellbeing, and control of information. As stated previously, we selected the government malfeasance and exterterrestial cover-ups subscale as indicators of the time 2 cognitive-perceptual latent model. The extraterrestrial cover-ups subscales measures degree of endorsement for government contact with aliens (item 13, "Some UFO sightings and rumors are planned or staged in order to distract the public from real alien contact."). Government malfeasance assesses beliefs surrounding government interference with power structures in society or government operations involved in harming groups (item 1, "The government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret."). Response options on the GCB range from 1 "definitely not true" to 5 "definitely true." Higher scores on this measure indicate greater levels of conspiracy-belief endorsement. Cronbach's alpha coefficients on this measure range from .93 to .95 (Brotherton et al., 2013). The GCB alpha coefficient for the extraterrestrial cover-ups and government malfeasance subscales were .90 and .86 respectively in the present study.

***Maladaptive Daydreaming* (MDS; Somer et al., 2016).** The MDS is a 14-item self-report instrument that measures proneness to excessive time spent daydreaming and the extent to which daydreaming becomes disruptive [item 3, "How often are your current daydreams accompanied by vocal noises or facial expressions (e.g. laughing, talking or mouthing the words)?"]. The MDS possesses good discriminant validity, reliability, and test-retest reliability (Somer et al., 2016). Items on the MDS are rated on a sliding scale ranging from 1-100, similar to the Dissociative Experiences Scale-II (DES-II; Carlson & Putnam, 1993). Anchors on this measure are item-specific. Although the MDS can be scored into four scaled scores: yearning, kinesthesia, impairment, and music, we used the total scaled score to broadly assess the impact of schizotypy on excessive daydreaming. The MDS total scale has a Cronbach's alpha of .95 and test-retest reliability of .92 (Somer et al., 2016). Cronbach's alpha for the MDS was .93 in this study.

Preliminary Data Assumptions & Procedures

Assumptions and practical issues when working in a structural equation modeling (SEM) framework include: (1) large sample size with few missing data, (2) multivariate normality among indicators, (3) linearity among manifest variables, (4) absence of multicollinearity, and (5) small residuals centered around zero (Tabachnick & Fidell, 2007, pp. 688-689). Preliminary data analyses outlined below reflect measures taken to screen for these issues and demonstrate adherence to SEM reporting conventions discussed by Hoyle and Isherwood (2013).

All manually entered data were checked for data entry errors and outliers (Tabachnick & Fidell, 2007, p. 73). Descriptive analyses and summed scaled distributions were conducted to examine sample characteristics, skewness, and kurtosis. Reference values were defined by an absolute skew value larger than 3 or an absolute kurtosis value larger than 7 for determining non-normality. Due to the large sample size, we plotted histograms for each subscale and factor scale along with a normal distribution to visually screen the data. Differences in sample characteristics and mean differences across samples were assessed using Pearson's chi-square test. Bivariate correlations among the study variables were examined.

Model Estimation

CFA and path analyses were conducted with Mplus software (Version 7.4; Muthén & Muthén, 2012) using Maximum Likelihood estimation with robust standard errors (MLR). The standard errors in MLR, unlike those in regular ML, adjust for non-normality (Bentler & Dijkstra, 1985). The latent variable for each model was standardized by setting the variance of the latent variable to 1 in Mplus.

Assessment of Model Fit

The Model Chi-Square (χ^2) test statistic and four other standard goodness-of-fit indices were selected *a priori* based on recommendations from Kline (2015) and Brown (2015) for model fit evaluation: (1) the Steiger-Lind Root Mean Square Error of Approximation (RMSEA; Steiger, 1990) and its 90% confidence interval, (2) the Standardized Root Mean Square Residual (SRMR), (3) the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), and (4) the Bentler Comparative Fit Index (CFI; Bentler, 1990).

The Model χ^2 test is an absolute goodness-of-fit index that evaluates model fit. A non-significant Model χ^2 result indicates good model fit ($p > 0.05$; indicates good fit). It is important to note that the Model χ^2 is sensitive to sample size and tends toward rejecting the null in studies using large samples (Kline, 2015, pp. 271). We expect all Model χ^2 results to be significant given the large sample size in the present study. Furthermore, the Model χ^2 can be affected by non-normal data distributions, correlation magnitude, and unique variance (Kline, 2015).

The RMSEA can be thought of as a "badness-of-fit" indicator (Kline, 2015, p. 273) and it provides a correction for model parsimony (RMSEA $\leq$ 0.10 indicates good fit; MacCallum, Browne, & Sugawara, 1996). The RMSEA is reported along with its 90% confidence interval (90% CI), which is sensitive to sample size and model complexity (Brown, 2015). The SRMR is another "badness-of-fit" index that assesses the mean absolute correlation among the residuals (SRMR $\leq$ 0.05 indicates good fit; Browne, Cudeck, Bollen, & Long, 1993). Perfect model fit for RMSEA and SRMR is indicated by a value of 0, with lower scores indicating better model fit (Kline, 2015). The TLI (also known as the Bentler-Bonett Nonnormed Fit Index, BBNFI; Bentler & Bonett, 1980) is a relative fit index that tests discrepancy between the hypothesized and null χ^2 value (Brown, 2015). Lastly, the CFI analyzes goodness-of-fit and adjusts for sample size. Larger TLI and CFI values close to 1 are indicative of good model fit (TLI $\geq$ 0.95; CFI $\geq$ 0.90 indicates good fit; Bentler, 1990) and values range between 0 and 1.0 (Hu & Bentler, 1999).

In addition to the above global fit indices, the Akaike information criterion (AIC) and Bayesian information criterion (BIC) were selected *a priori* to assess which of the models tested was the most parsimonious, with the preferred model having lower AIC/BIC values. Component (local) fit was assessed by examining the standardized and unstandardized parameter estimates. Standardized factor loadings greater than or equal to .30 were interpreted as salient indicators for each measurement model (Brown, 2015, p. 27)

Results

Missing Data & Exclusions

First, we computed an accuracy score for the validity items by calculating the proportion of correct items obtained over total number of items for each individual. A total of 286 responses were excluded (percent excluded = 10%) from the 2,766 original responses due to performance on the validity items (accuracy < 80%). Then, missing data were screened using IBM SPSS DESCRIPTIVES. One case was found to have significant missing data on all demographic variables and was removed. Following exclusions, SPSS version 21.0 (IBM Corp., 2012) was used to create a new file containing the data. For each aim, the MLR estimator was used to address any missing data in Mplus (Enders, 2010). Five additional participants were missing scores on all study variables and thus excluded from the analysis in Mplus.

The final data analytic sample was a total of 2,474 participants for aim 1 and 357 participants for aims 2 and 3. The sample size and ratio of variables to cases was adequate for conducting SEM for each of the study aims (Brown, 2015).

Aim 1 Descriptive Statistics

Table 1 displays the univariate higher-order moment descriptive statistics for aim 1. As indicated, missing data across the SPQ-BRU was generally low and percentage of missing responses ranged from 0.3 to 3.7 percent.

Insert Table 1.

Insert Figure 1.

Aim 1 Normality of Sample Distribution

Normality was assessed using IBM SPSS DESCRIPTIVES and by examining the histograms. Consistent with assumptions regarding the continuity of schizotypy in the population (Johns & van Os, 2001), the plot of the SPQ-BRU total scores followed a normal distribution (Figure 1). All variables of interest fell within an acceptable range for skewness and kurtosis (Table 1). Parameter estimates are the same in ML and MLR (Enders, 2010), so MLR was used to account for undetected non-normality due to large sample size.

Insert Table 2.

Aim 1 Sample Characteristics

Table 2 provides the characteristics of the final data analytic sample, split by each semester on self-reported sex, socioeconomic status (SES), employment status, academic status, and paternal and maternal education. Overall, the sample was comprised of middle class female college freshmen. Participants did not differ between the four semesters on key demographic variables of interest, including race, [$\chi(15) = 23.165$, $p = 0.081$], SES, [$\chi(9) = 11.105$, $p = .296$], dating status, [$\chi(2) = 0.760$, $p = .684$], employment status, [$\chi(15) = 18.424$, $p = .241$], political affiliation, [$\chi(9) = 15.343$, $p = .082$], paternal education, [$\chi(15) = 17.740$, $p = .277$], and maternal education, [$\chi(15) = 18.424$, $p = .241$]. There were, however, significant differences across semesters on sex, [$\chi(3) = 19.312$, $p < .001$], and sexual orientation, [$\chi(9) = 20.042$, $p = .018$].

Insert Table 3.

Aim 1 Scale Reliability

Cronbach's alpha (α) coefficients for the SPQ-BRU factors and subscales are reported in Table 3 based off the 4-factor scoring reported by Davidson et al. (2016). Among the 4-factors and total scale score, reliability coefficients ranged from good to excellent. At the subscale level, reliability coefficients ranged from questionable to good. The only subscale that fell within the questionable range was Constrained Affect. Because this subscale is comprised of only three items, the average inter-item correlation may be more appropriate for assessing its reliability (Clark & Watson, 1995). Average inter-item correlations that fall below .15 are considered weakly interrelated and suggest that the items are not suitable for measuring a single construct. The average inter-item correlation for Constrained Affect was .392, suggesting the items are sufficiently related.

Insert Table 4.

Aim 1 Bivariate Correlations

Table 4 displays bivariate correlations obtained from Mplus among the factor scales for the SPQ-BRU using the same scoring procedures described above. Indicators of the hypothesized latent model of schizotypy were significantly correlated in the expected directions (i.e., all positive associations).

Insert Table 5.

Aim 1 Goodness-of-Fit

The CFA goodness-of-fit indices of the five models proposed are shown in Table 5. As expected, Model χ^2 test statistic was significant for all models due to large sample size. All models met *a priori* criteria the CFI and RMSEA fit indices. None of the models met *a priori* criteria for the TLI and only one model (Model 5) met criteria for the SRMR. When considering both local and global fit, the hypothesized model (Model 4) provided an improvement over the preceding model.

Insert Figure 2a.

Insert Figure 2b.

Table 6.

Figures 2a and 2b display standardized factor loadings for Model 4. As indicated, factor loading estimates were all above .30 in both the full and parceled models (all $p < 0.001$). Table 6a contains the unstandardized parameter estimates and standard errors for the full model and Table 6b contains the unstandardized parameter estimates for the parceled model.

Table 7.

Aim 2 Scale & Sample Characteristics

A total of 357 individuals (percent female = 68.0) participated in time 2. Demographic characteristics of the aim 2 sample are presented in Table 7. Like the larger sample, the majority of participants were college freshman from a middle-class background. Participants in this subsample did not differ between semesters on key demographic variables of interest, including: race, [$\chi(6) = 12.268$, $p = 0.056$], sex, [$\chi(1) = 2.836$, $p = .092$], dating status, [$\chi(1) = 0.001$, $p = .997$], paternal education, [$\chi(8) = 7.464$, $p = .488$], and maternal education, [$\chi(8) = 4.442$, $p = .815$].

In addition, participants did not differ between semesters on clinical-historical variables, including ASD history in first-degree relatives, [$\chi(2) = 2.654$, $p = .265$], ASD history in second-degree relatives, [$\chi(2) = 0.690$, $p = .966$], SSD in first degree relatives, [$\chi(2) = 4.466$, $p = .107$]

and SSD in second degree relatives, [$\chi(2) = 0.524$, $p = .770$], current use of psychotropic medication, [$\chi(1) = 0.354$, $p = .552$], and history of psychotropic medication use, [$\chi(2) = 0.901$, $p = .637$].

Table 8.

Table 8 displays the univariate higher-order moment descriptive statistics for aim 2. Percent of missing responses for each measure ranged from 0 to 2.0. Normality characteristics also fell within acceptable ranges for skewness and kurtosis for all scales.

Table 9.

Aim 2 Bivariate Correlations

Table 9 displays the bivariate correlations among the indicators for the time 2 cognitive-perceptual latent model (magical ideation, maladaptive daydreaming, and magical ideation) along with the SPQ-BRU. Indicators of the hypothesized latent cognitive-perceptual model were significantly correlated in the expected directions (i.e., all positive associations). In addition, the SPQ-BRU factor scales all correlated with time 2 cognitive-perceptual indicators in the expected direction.

Aim 2 Goodness-of-Fit

For aim 2, we first sought to replicate the 4-factor Callaway model of schizotypy in the subsample of participants. The 4-factor model replicated in the subsample for aim 2, ($\chi2$ (48) = 111.073, p < 0.001, CFI = 0.961, TLI = 0.947, RMSEA = 0.061, CI_{RMSEA} = 0.046— 0.075, SRMR = 0.041). In addition to replicating aim 1, we also tested the fit of a latent cognitive-perceptual model in this subsample. The hypothesized latent cognitive-perceptual model yielded excellent global and local fit of the data. Consistent with our hypothesis, this model met *a priori* criteria each of the global fit indices ($\chi2$ (1) = 0.002, p = 0.963, CFI = 1.000, TLI = 1.024, RMSEA = 0.000, CI_{RMSEA} = 0.000—0.000, SRMR = 0.000). Figure 4 displays the hypothesized model along with the standardized factor loadings. All standardized factor loadings exceeded .30 suggesting that they were salient measures of the latent construct. Lastly, table 10 contains the unstandardized parameter estimates and standard errors for the time 2 latent cognitive-perceptual model.

Insert Figure 4.

Insert Table 10.

Figure 5.

Aim 3 Goodness-of-Fit

After establishing fit for each measurement model, we tested the full model by regressing scores on the higher-order latent schizotypy variable on to time 2 cognitive-perceptual experiences in the aim 2 subsample (see Figure 5). Consistent with our predictions, this model yielded adequate fit of the data $\chi 2$ (13) = 33.636, p = 0.0014, CFI = 0.952, TLI = 0.920, RMSEA = 0.067, CI_{RMSEA} = 0.039—0.095, SRMR = 0.041). The only path that was significant in the model was the cognitive perceptual subscale of the SPQ-BRU. The R-square estimate indicates the full model explained 41.4% of the variance in time 2 cognitive-perceptual latent endogenous variable (p < .001).

Discussion

We tested three primary aims in the present study. Consistent with our hypothesis for the first aim, CFA and model comparisons supported a 4-factor model identified by Callaway et al. (2014). This model was previously supported by Davidson et al. (2016) in a similar sample. In addition to determining the factor structure of the SPQ-BRU, we also tested aim 2, the model fit of the time 2 latent cognitive-perceptual features. This aim provided an outcome of interest to test our third aim, which examined the impact of latent schizotypy on time 2 cognitive-perceptual features. Lastly, we found support for our full model tested in aim 3, which revealed that the cognitive perceptual factor subscale SPQ-BRU was a robust predictor of cognitive-perceptual features at time 2.

Strengths of the Present Study

The present study has several strengths. First, we empirically tested competing models and established using both local and global fit indices a model of best fit. Two of the models examined, the 4-factor Paranoid model and the 4-factor Callaway et al. (2014) model, have not been directly compared to date. Although prior studies have cited the superiority of the 4-factor Paranoid solution of dimensional schizotypy due to its global fit, its local fit may be substandard. Specifically, standardized factor loadings for the cross-loading indicators, which make this model unique from other models, fall below recommendations cited by Brown (2015, p. 27). Our present study appears to replicate a consistent pattern of excellent global, but poor component fit among complex indicators using this model (Compton et al., 2009a; Compton, Goulding, Bakeman, & McClure-Tone, 2009b; Gross, Mellin, Silvia, Barrantes-Vidal, & Kwapil, 2014; Stefanis et al., 2004; Wuthrich & Bates, 2006).

It is unclear why component fit has not been discussed in prior psychometric investigations using complex indicators in schizotypy. The practice of retaining solutions with complex indicators when there is good global but questionable local fit is evident in other investigations using different measures and theoretical approaches (Fonseca-Pedrero, Paino, Lemos-Giráldez, Sierra-Baigrie, & Muñiz, 2010). Brown argues that interpretability of a CFA solution involves evaluation of the items, the factors, and their respective conceptual and empirical relevance. Complex indicators that load onto more than one factor may possess poor discriminant validity. Furthermore, these types of indicators may yield weakly defined factors that only have a small number of salient indicators. It is imperative to establish both global and component fit prior to establishing a final measurement model because non-salient indicators are typically dropped in model respecification stages (Brown, 2015).

A second strength of the present study is the consistency between theoretical, measurement, and modeling approaches. Although dimensional models of psychosis have been discussed as impactful for shifting schizophrenia research, the adoption of dimensional assessment and sampling approaches are slow moving in practice. This investigation demonstrated that the SPQ-BRU adheres to the assumptions of a continuous model of schizotypy. Specifically, schizotypal traits are normally distributed and predictive of cognitive-perceptual phenomena in a non-clinical population, with extreme scores occurring less frequently. Importantly, these findings demonstrate convergence with larger shifts in SSD research and draw attention to the potential role of schizotypy in the future of psychosis research.

Lastly, this study demonstrated that the continuity of schizotypal traits can be reliably measured using a relatively brief scale. The importance of this strength is noteworthy when considering multi-trait investigations that will require brief screening measures. While other measures of schizotypy have been recently revised to reduce their length and administration time, the SPQ-BRU is the shortest and most comprehensive measure to date. Unlike other measures, the SPQ-BRU is one of the few to assess disorganized features of schizotypy. Disorganized speech and eccentricity are subtle but functionally-consequential aspects of schizotypy that are pertinent to the etiology of psychosis spectrum disorders.

Limitations

The present study also had several limitations. First, a large proportion of the variance in the full model (aim 3) appears to be explained by magical ideation. This suggests that the amount of variance explained by the other indicators (conspiracy beliefs, maladaptive daydreaming) is comparatively less than a more prototypical measure widely used in schizotypy research. We initially selected the novel measures because they provide more indirect measures of cognitive-perceptual abnormalities and proneness to fantasizing. We surmise that there may be a trade-off between measurement specificity and sensitivity in this context.

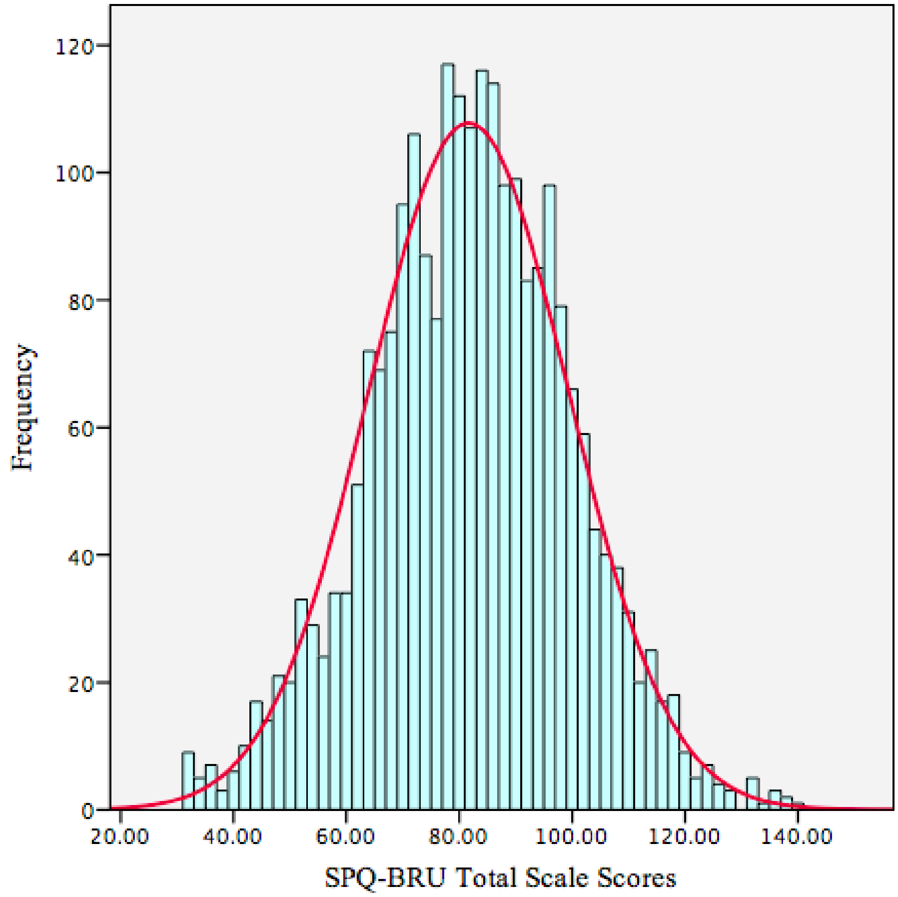
In addition, the present study focused exclusively on a convenience sample of college-age individuals from a Midwestern University. The use of this convenience sample may hinder generalization to populations with severe and persistent schizophrenia spectrum disorders (SSD). Furthermore, this study would have been strengthened by integrating additional research methods other than self-report. Finally, outcomes were assessed approximately 1-2 months after initial assessment and a long-term follow-up would have greatly enhanced the long-term impact of schizotypy on outcomes of interest.

Implications

Results from the present study dovetail with prior findings from longitudinal studies assessing schizotypal traits in childhood. These studies confirm the predictive power and accuracy of schizotypy for clinical status later in adulthood (Tyrka et al., 1995), which in turn bolsters support for the dimensional-neurodevelopmental continuum of psychosis. For example, results from the Dunedin Multidisciplinary Health and Development Study found that the positive features of schizotypy in childhood later predicted schizophreniform disorder in both adolescence and adulthood (Poulton et al., 2000). In a later investigation using the same sample, (Fisher et al., 2013) found that 23.1% of all adult cases with a psychotic disorder had childhood symptoms of schizotypy at age 11. These converging lines of evidence provide support for the role of schizotypy in predicting later psychosis psychopathology in adulthood, supporting theories positioning schizotypy as a "developmental mediator" of psychosis-risk (Debbané & Barrantes-Vidal, 2015; Debbané et al., 2015; Debbané & Mohr, 2015).

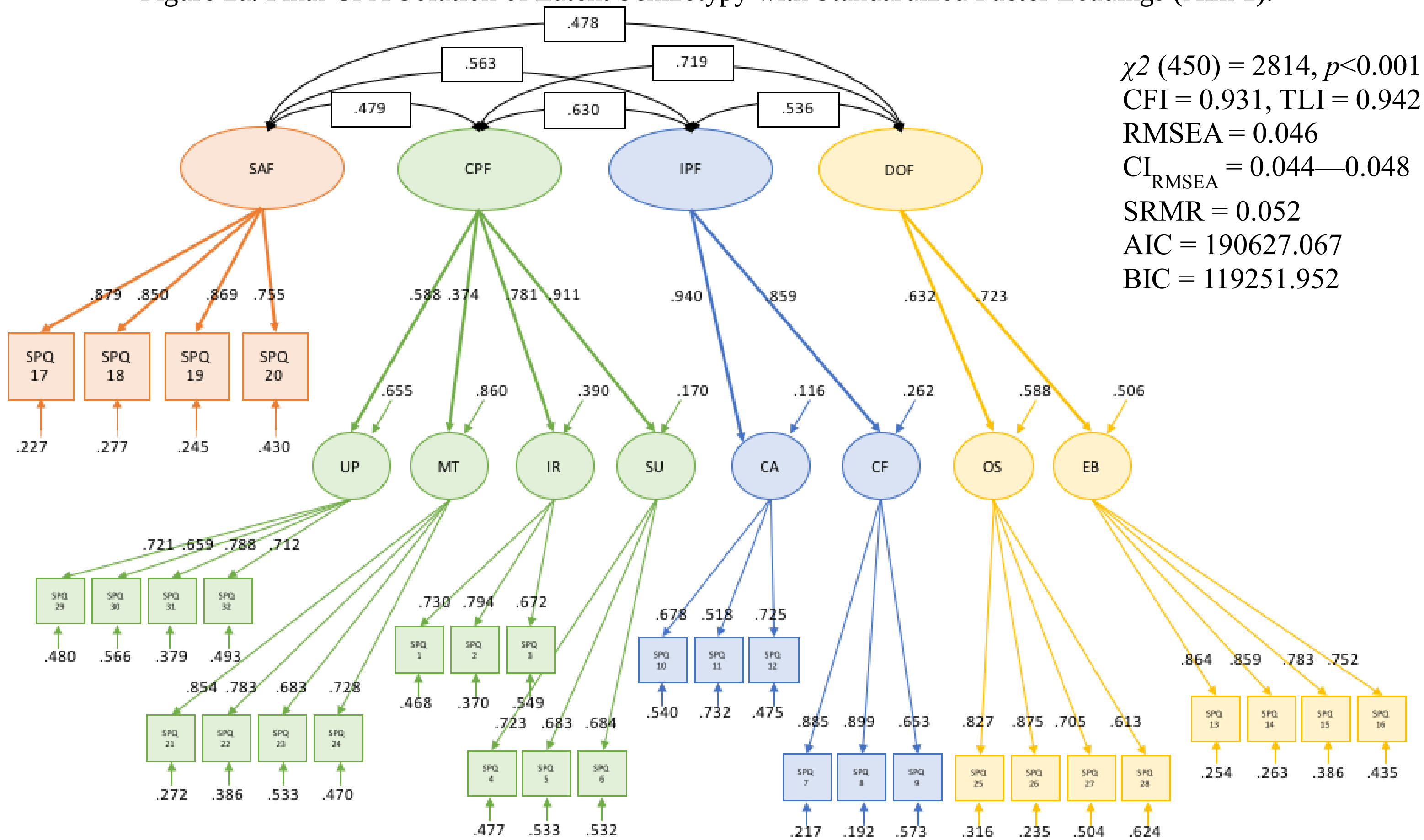
Appendices

Figure 1. Histogram and Normal Curve for Mean SPQ-BRU Total Scores.



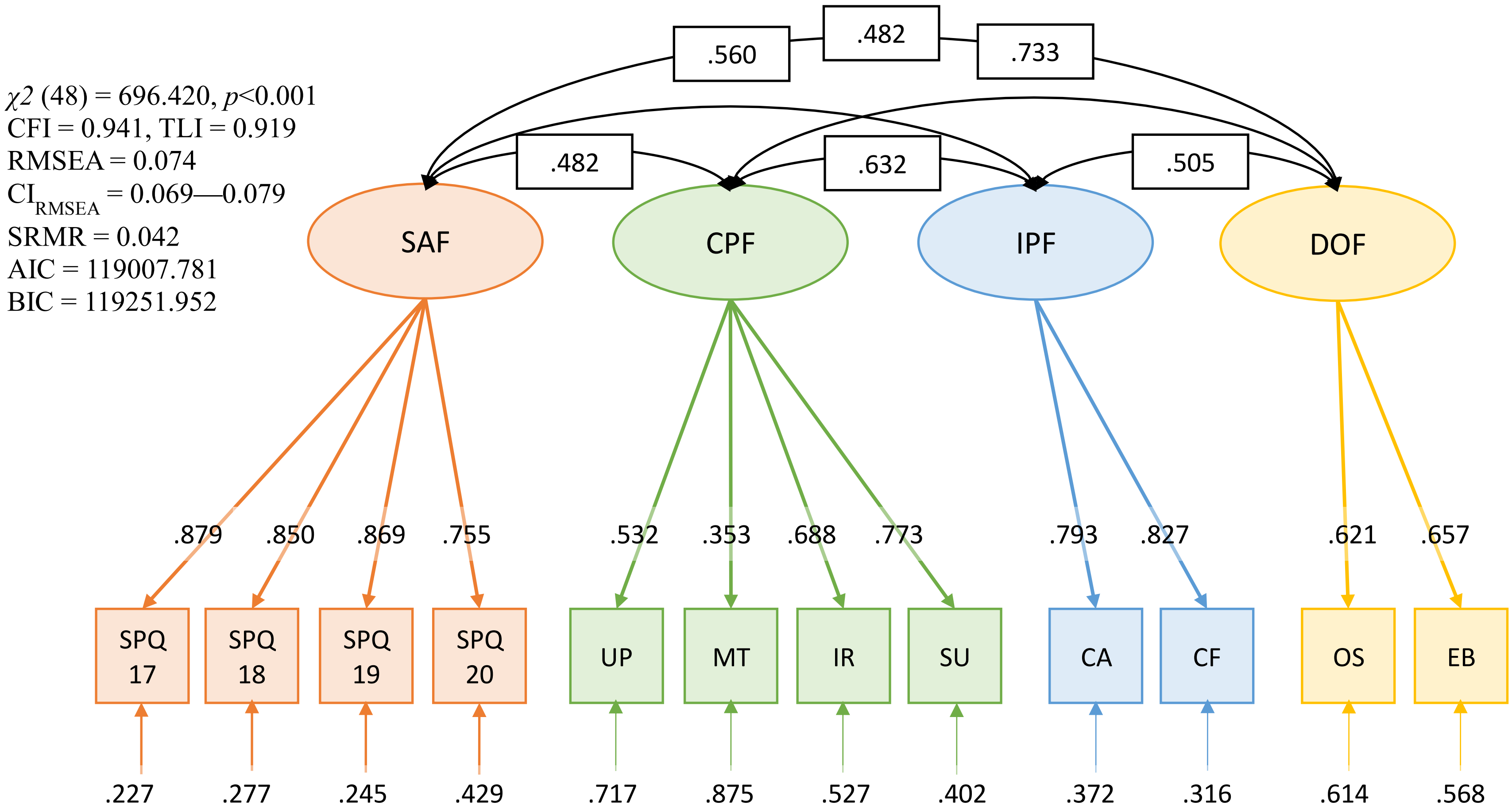
Note. Frequencies are obtained from SPSS. *N* = 2,404. The red curve depicts a Gaussian (normal) distribution. SPQ-BRU total scale scores are plotted along the *x*-axis. Listwise deletion was used.

Figure 2a. Final CFA Solution of Latent Schizotypy with Standardized Factor Loadings (Aim 1).



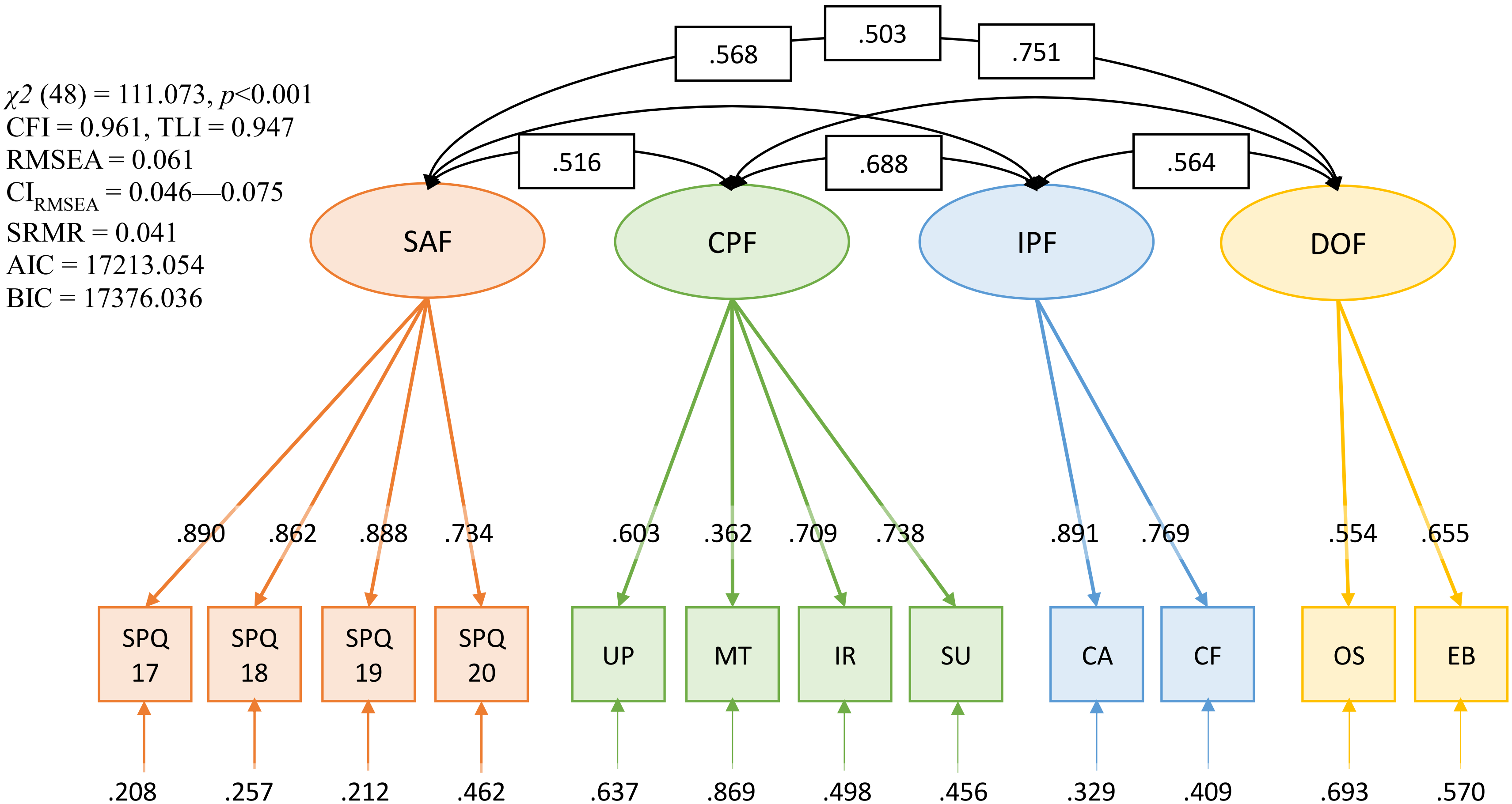
Note. N = 2,474. Standardized Factor Loadings derived from Mplus. SP, Schizotypal Personality Questionnaire-Brief Revised Updated; IR, Ideas of Reference; SU, Suspiciousness; UP, Unusual Perceptions; MT, Magical Thinking; CA, Constrained Affect; EB, Eccentric Behavior; OS, Odd Speech; SAF, Social Anxiety Factor; CPF, Cognitive Perceptual Factor; IPF, Interpersonal Factor; DOF, Disorganized Factor.

Figure 2b. Replication of Final CFA Solution of Latent Schizotypy (Parceled) with Standardized Factor Loadings (Aim 1).



Note. N = 2,474. Standardized Factor Loadings derived from Mplus. SAF, Social Anxiety Factor; CPF, Cognitive Perceptual Factor; IPF, Interpersonal Factor; DOF, Disorganized Factor; SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated, UP, Unusual Perceptions; MT, Magical Thinking; IR, Ideas of Reference; SU, Suspiciousness; CA, Constrained Affect; CF, No Close Friends; OS, Odd Speech; EB, Eccentric Behavior.

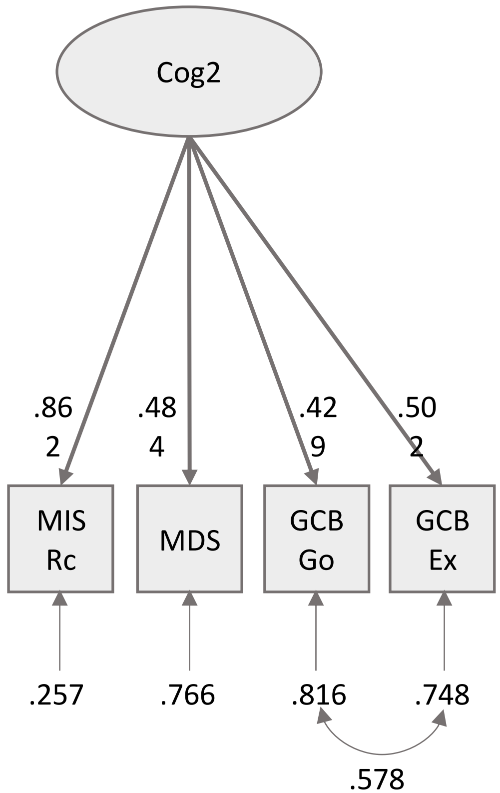
Figure 3. Replication of Final CFA Solution of Latent Schizotypy (Parceled) with Standardized Factor Loadings (Aim 2).



Note. N = 357. Standardized Factor Loadings derived from Mplus. SAF, Social Anxiety Factor; CPF, Cognitive Perceptual Factor; IPF, Interpersonal Factor; DOF, Disorganized Factor; SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated, UP, Unusual Perceptions; MT, Magical Thinking; IR, Ideas of Reference; SU, Suspiciousness; CA, Constrained Affect; CF, No Close Friends; OS, Odd Speech; EB, Eccentric Behavior.

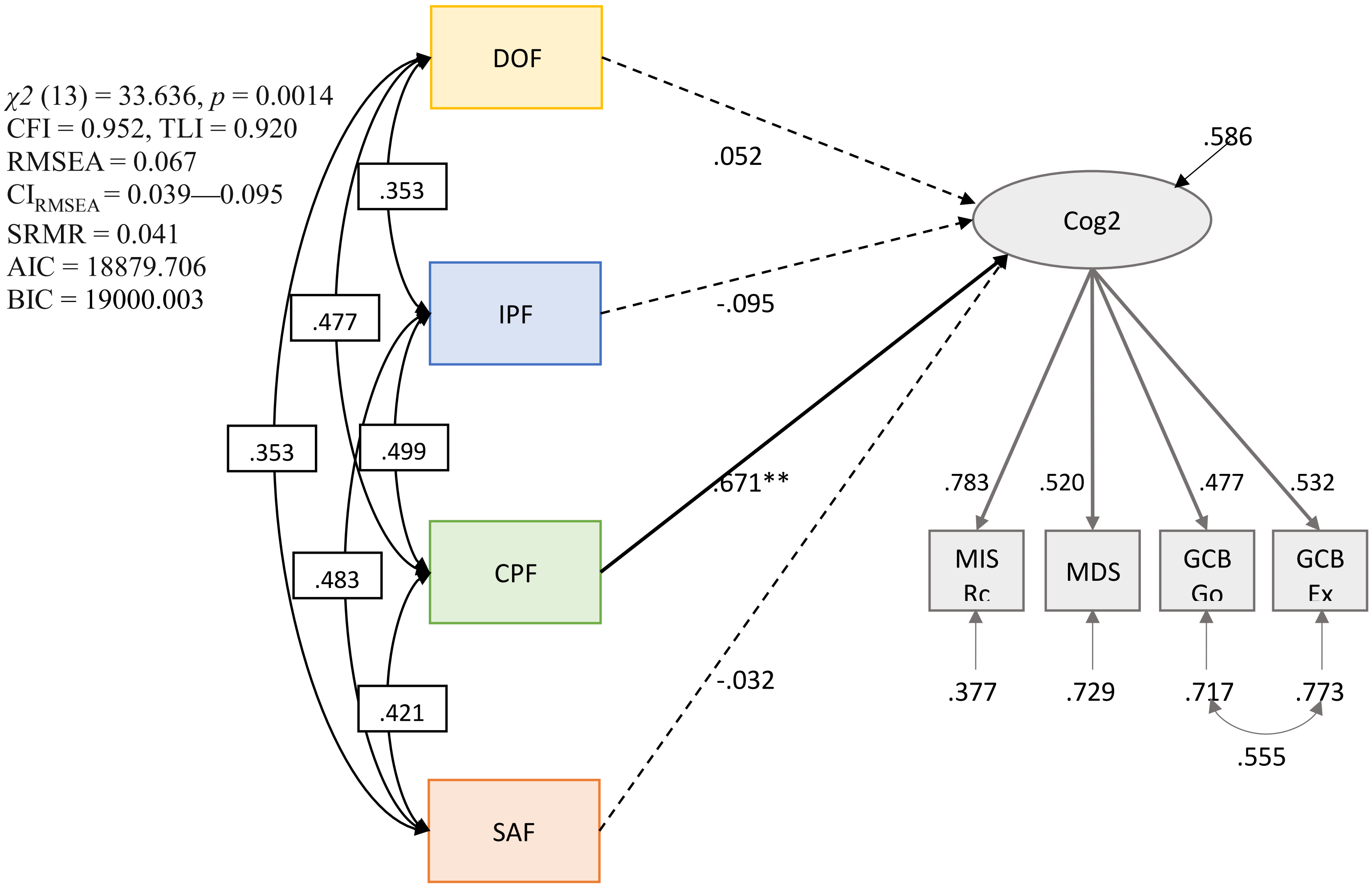
Figure 4. Final CFA Solution of Latent Time 2 Cognitive Perceptual Model with Standardized Factor Loadings (Aim 2).

$\chi 2$ (1) = 0.002, p = 0.963
CFI = 1.000, TLI = 1.024
RMSEA = 0.000
CI_{RMSEA} = 0.000—0.000
SRMR = 0.000
AIC = 10284.810
BIC = 10335.220



Note. N = 357. Standardized Factor Loadings derived from Mplus. Cog2, Latent Time 2 Cognitive Perceptual Model; MIS Rc, Magical Ideation Scale (reverse coded); MDS, Maladaptive Daydreaming Scale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale.

Figure 5. Standardized Factor Loadings: SPU-BRU Factors loading on to Latent Time 2 Cognitive-Perceptual Model (Aim 3).



Note. N = 357. Path coefficients derived from Mplus. SAF, Social Anxiety Factor; CPF, Cognitive Perceptual Factor; IPF, Interpersonal Factor; DOF, Disorganized Factor; Cog2, Latent Time 2 Cognitive-Perceptual Model; MIS Rc, Magical Ideation Scale (reverse coded); MDS, Maladaptive Daydreaming Scale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale.

Table 1. Scale Characteristics & Normality Statistics for SPQ-BRU CFA (Aim 1).

Scale	*N* (%)	Mean (Variance)	Skewness (Kurtosis)	Minimum-Maximum	Percentiles 40%-80%	Median
SPQ Ideas of Reference	2468 (99.6)	9.26 (6.75)	-0.42 (0.20)	3-15	9-12	10
SPQ Suspiciousness	2469 (99.6)	7.61 (6.70)	-0.54 (0.54)	3-15	7-10	8
SPQ No Close Friends	2464 (99.4)	7.10 (9.49)	0.54 (-0.55)	3-15	6-10	6
SPQ Constrained Affect	2465 (99.4)	7.46 (6.15)	0.10 (-0.57)	3-15	7-10	7
SPQ Eccentric Behavior	2457 (99.1)	10.62 (14.21)	-0.62 (0.87)	4-20	9-14	11
SPQ Magical Thinking	2461 (99.3)	7.10 (9.75)	0.87 (0.28)	4-20	5-10	7
SPQ Odd Speech	2462 (99.5)	12.80 (12.40)	-0.21 (-0.34)	4-20	12-16	13
SPQ Unusual Perceptions	2464 (99.4)	7.57 (9.69)	0.56 (-0.48)	4-18	6-10	8
SPQ Social Anxiety	2463 (99.4)	12.20 (17.85)	-0.09 (-0.73)	4-20	11-16	12
SPQ Cognitive Perceptual	2446 (98.7)	31.52 (66.01)	0.19 (-0.10)	14-65	29-38	31
SPQ Interpersonal	2459 (99.1)	23.41 (37.46)	0.32 (-0.53)	6-30	13-19	14
SPQ Disorganized	2446 (98.7)	23.41 (37.26)	-0.13 (-0.22)	8-40	22-29	24
SPQ Total	2404 (96.7)	81.64 (316.60)	-0.06 (0.05)	32-140	78-96	82

Note. N = 2,474. Univariate higher-order moment descriptive statistics derived from Mplus. Non-normality defined as skewness > 3, kurtosis > 7. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated.

Table 2. Sample Demographics by Semester (Percentages).

	Fall 2014	Spring 2015	Spring 2016	Fall 2016	Total
N	576	592	610	695	2,404
Sex					
Male	30.20	21.10	30.70	26.50	27.1
Female	67.40	78.80	68.50	72.90	71.9
Other	0.30	0.20	0.20	0.10	0.20
Sexual Orientation					
Bisexual	3.8	3.5	3.8	5.7	4.3
Gay/Lesbian	0.5	0.7	1.6	2.4	1.4
Heterosexual	92.0	92.4	91.2	89.4	91.2
Other	2.8	3.0	2.1	1.6	2.3
Single					
Yes	N.A.	N.A.	54.0	59.4	N.A.
No			45.2	40.0	
Race					
African American	3.3	5.1	2.8	3.4	3.6
Asian/Pacific Islander	3.8	5.1	3.6	6.0	5.2
Hispanic	7.3	6.2	7.2	7.7	6.7
Non-Hispanic White	79.7	79.8	82.2	79.2	80.2
Native American	0.3	0.0	0.2	0.3	0.2
Other	3.6	3.9	3.3	3.0	3.4
SES					
Upper class	9.20	9.10	7.50	7.20	8.20
Middle class	73.30	70.70	73.20	75.00	73.10
Working class	12.20	16.00	15.30	14.30	14.50
Lower class	4.50	3.50	2.80	2.60	3.30
Employment					
Full time	2.30	1.90	2.00	1.90	2.00
Part time	22.00	18.40	26.60	26.00	23.40
Academic Status					
Freshman		56.80	43.20	61.30	41.50
Sophomore		22.60	24.50	16.40	16.10
Junior	N.A.	11.80	18.80	10.20	10.30
Senior		5.60	11.60	9.30	6.80
Paternal Education					
Some High School	3.80	5.10	5.10	6.00	4.70
High School Degree	17.00	17.40	17.40	18.20	17.70
Some College	17.70	16.00	16.00	15.50	16.90
College Degree	34.20	39.50	39.50	36.20	37.20
Some Graduate/Prof.	4.30	4.00	4.00	3.90	3.90
Graduate/Prof. Degree	22.40	17.50	17.50	19.40	18.90
Maternal Education					
Some High School	4.30	3.70	3.30	6.00	4.30
High School Degree	15.10	13.30	13.10	18.20	14.20
Some College	13.90	18.00	14.70	15.50	15.90
College Degree	44.60	42.30	48.00	36.20	43.60
Some Graduate/Prof.	4.70	6.40	4.40	3.90	5.30
Graduate/Prof. Degree	17.00	15.90	15.80	19.40	16.30

Note. Percentages obtained from SPSS.

Table 3. Cronbach's Alpha Coefficients and Missing Data for the SPQ-BRU (Aim 1).

Scale	Alphas	No. of Items	Missing *N* (%)
SPQ Ideas of Reference	0.77	3	11 (0.4)
SPQ Suspiciousness	0.74	3	10 (0.4)
SPQ No Close Friends	0.85	3	15 (0.6)
SPQ Constrained Affect	0.66	3	14 (0.6)
SPQ Eccentric Behavior	0.89	4	22 (0.9)
SPQ Magical Thinking	0.85	4	18 (0.7)
SPQ Odd Speech	0.84	4	17 (0.7)
SPQ Unusual Perceptions	0.81	4	15 (0.6)
SPQ Social Anxiety Factor	0.90	4	16 (0.6)
SPQ Cognitive Perceptual Factor	0.85	14	33 (1.3)
SPQ Interpersonal Factor	0.85	6	20 (0.8)
SPQ Disorganized Factor	0.86	8	33 (1.3)
SPQ-BRU Total	0.91	32	75 (3.0)

Note. *N* = 2,479. Cronbach's alpha coefficients obtained from SPSS. Listwise deletion was used.

Table 5. CFA Model Fit Using Robust Maximum Likelihood (MLR) Estimation for Aim 1.

Model	# Estimated Parameters	χ2 Value†	χ2 df	CFI	TLI	SRMR	RMSEA Estimate	RMSEA Lower CI	RMSEA Higher CI	RMSEA *p*-value	AIC	BIC
Unidimensional (Baseline)	105	3495.81	455	0.911	0.903	0.064	0.052	0.050	0.054	0.02	196787.59	197398.01
2-Factor (Compton et al., 2009a)	106	2986.35	454	0.926	0.919	0.058	0.047	0.046	0.049	1.00	196214.96	196831.20
3-Factor (Raine et al., 1994)	108	2878.25	452	0.929	0.922	0.056	0.047	0.045	0.048	1.00	196094.87	196722.74
4-Factor (Callaway et al., 2014)	108	2875.21	450	0.931	0.942	0.052	0.046	0.044	0.048	1.00	196027.07	196666.56
Paranoid (Stefanis et al., 2004)	111	2523.04	449	0.939	0.933	0.042	0.043	0.042	0.045	1.00	195698.33	196343.64

Note. $N = 2{,}474$. Model fit information derived from Mplus. †All models $p<0.001$.

Table 6a. Unstandardized Parameter Estimates and Standard Errors for the Full 4-Factor Model of Latent Schizotypy (Aim 1).

Model Parameter	Unstandardized	
	Estimate	Standard Error
SPQ IR		
SPQ 1	0.460**	0.018
SPQ 2	0.535**	0.022
SPQ 3	0.439**	0.018
SPQ SU		
SPQ 4	0.275**	0.026
SPQ 5	0.315**	0.031
SPQ 6	0.321**	0.032
SPQ CF		
SPQ 7	0.522**	0.027
SPQ 8	0.566**	0.029
SPQ 9	0.377**	0.020
SPQ CA		
SPQ 10	0.282**	0.044
SPQ 11	0.134**	0.020
SPQ 12	0.291**	0.046
SPQ MT		
SPQ 21	0.749**	0.019
SPQ 22	0.754**	0.020
SPQ 23	0.610**	0.021
SPQ 24	0.552**	0.019
SPQ OS		
SPQ 25	0.689**	0.020
SPQ 26	0.729**	0.021
SPQ 27	0.586**	0.019
SPQ 28	0.479**	0.018
SPQ UP		
SPQ 29	0.612**	0.020
SPQ 30	0.416**	0.016
SPQ 31	0.714**	0.022
SPQ 32	0.537**	0.016
SPQ EB		
SPQ 13	0.656**	0.023
SPQ 14	0.663**	0.023

SPQ 15	0.618**	0.022
SPQ 16	0.586**	0.021
Disorganized Factor		
SPQ EB	0.989**	0.063
SPQ OS	0.838**	0.052
Interpersonal Factor		
SPQ CF	1.680**	0.115
SPQ CA	2.758**	0.470
Cognitive-Perceptual Factor	BY	
SPQ SU	2.210**	0.248
SPQ IR	1.250**	0.072
SPQ MT	0.404**	0.032
SPQ UP	0.726**	0.045
Social Anxiety Factor		
SPQ 17	1.057**	0.016
SPQ 18	1.004**	0.017
SPQ 19	1.038**	0.017
SPQ 20	0.924**	0.019

Note. N = 2,474. *p<0.05, **p<0.001. Estimates derived from Mplus. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated.

Table 6b. Unstandardized Parameter Estimates and Standard Errors for the Parcelled 4-Factor Model of Latent Schizotypy (Aim 1).

Model Parameter	Unstandardized	
	Estimate	Standard Error
Disorganized Factor BY		
SPQ EB	2.476**	0.088
SPQ OS	2.188**	0.089
Interpersonal Factor BY		
SPQ CF	2.546**	0.057
SPQ CA	1.964**	0.049
Cognitive-Perceptual Factor BY		
SPQ SU	2.001**	0.052
SPQ IR	1.786**	0.056
SPQ MT	1.103**	0.077
SPQ UP	1.656**	0.074
Social Anxiety Factor BY		
SPQ 17	1.057**	0.016
SPQ 18	1.004**	0.017
SPQ 19	1.038**	0.017
SPQ 20	0.924**	0.019

Note. N = 2,474. *p<0.05, **p<0.001. Estimates derived from Mplus. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated.

Table 7. Sample Demographics for Aim 2 (Percentages).

Sex	
Male	26.3
Female	73.7
Other	0.0
Sexual Orientation	
Bisexual	4.7
Gay/Lesbian	23.7
Heterosexual	70.9
Other	0.6
Single	
Yes	51.7
No	42.5
Race	
African American	2.7
Non-Hispanic White	84.8
Native American	0.8
Asian/Pacific Islander	6.7
Other	5.1
SES	
Upper class	7.0
Middle class	74.9
Working class	10.6
Lower class	2.2
Psychotropic Rx	
No, never	85.5
A few months	7.5
Many years	7.0
Employment	
Full time	1.7
Part time	23.5
Academic Status	
Freshman	59.2
Sophomore	14.5
Junior	15.1
Senior	9.8
Paternal Education	
Some High School	6.2
High School Degree	19.6
Some College/Associates	20.4
College Degree	31.1
Trade/Technical	2.7
Graduate/Prof. Degree	20.1
Maternal Education	
Some High School	4.8
High School Degree	11.8
Some College	24.7
College Degree	36.2
Trade/Technical	2.7
Graduate/Prof. Degree	19.1

Note. *N* = 376. Percentages obtained from SPSS.

Table 8. Scale Characteristics & Normality Statistics in Subsample (Aim 2).

Scale	N (%)	Mean (Variance)	Skewness (Kurtosis)	Minimum-Maximum	Percentiles 40%-80%	Median
SPQ17	358 (100)	3.52 (1.38)	-0.55 (-0.64)	1-5	3-5	4
SPQ18	358 (100)	3.49 (1.35)	-0.53 (-0.66)	1-5	3-4	4
SPQ19	358 (100)	3.27 (1.45)	-0.17 (-1.00)	1-5	3-4	3
SPQ20	358 (100)	2.82 (1.54)	0.18 (-1.13)	1-5	2-4	3
SPQ Social Anxiety	358 (100)	13.09 (17.81)	-0.239 (-0.74)	4-20	12-17	13.5
SPQ Cognitive Perceptual	358 (100)	32.15 (67.42)	0.134 (-0.36)	14-57	30-29	32
SPQ Interpersonal	358 (100)	24.53 (14.93)	0.307 (-0.40)	6 -30	13-19	14.5
SPQ Disorganized	357 (99.7)	23.96 (34.44)	-0.189 (-0.31)	8-39	23-29	24
SPQ Total	357 (99.7)	84.08 (317.52)	-0.085 (-0.03)	32-136	80-99	84
GCB Ex	351 (98.0)	6.41 (9.22)	0.523 (-0.73)	3-15	5-9	6
GCB Go	352 (98.3)	7.17 (8.95)	0.299 (-0.76)	3-15	6-10	7
MDS	352 (98.3)	265 (57200.281)	1.963 (1.291)	0-1330	150-540	210
MIS Rc	355 (98.3)	36.05 (25.53)	1.291 (1.37)	30-55	32-36	35

Note. N = 357. Univariate higher-order moment descriptive statistics derived from Mplus. Non-normality defined as skewness > 3, kurtosis > 7. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; MDS, Maladaptive Daydreaming Scale; MIS, Magical Ideation Scale.

Table 9. Bivariate Correlations and Descriptive Statistics for Aim 3.

	Scale	1	2	3	4	5	6	7	8
1	SPQ Social Anxiety	1.00							
2	SPQ Cognitive Perceptual	0.42**	1.00						
3	SPQ Interpersonal	0.48**	0.50**	1.00					
4	SPQ Disorganized	0.35**	0.48**	0.35**	1.00				
5	GCB Ex	0.12*	0.34**	0.18**	0.14**	1.00			
6	GCB Go	0.12*	0.36**	0.27**	0.17*	0.68**	1.00		
7	MDS	0.25**	0.36**	0.20**	0.27**	0.24**	0.21**	1.00	
8	MIS Rc	0.13*	0.49**	0.13*	0.23*	0.43**	0.37**	0.42**	1.00

Note. N = 357. *p<0.05, **p<0.001. Bivariate correlations derived from Mplus. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; MDS, Maladaptive Daydreaming Scale; MIS, Magical Ideation Scale.

Table 10. Unstandardized Parameter Estimates and Standard Errors for the 4-Factor Model of Latent Schizotypy (Aim 2).

Model Parameter	Unstandardized	
	Estimate	Standard Error
SPQ Social Anxiety Factor BY		
SPQ 17	1.045**	0.044
SPQ 18	1.002**	0.046
SPQ 19	1.067**	0.041
SPQ 20	0.91**	0.048
SPQ Interpersonal Factor BY		
SPQ CF	2.338**	0.144
SPQ CA	1.998**	0.126
SPQ Cognitive-Perceptual Factor BY		
SPQ SU	1.959**	0.136
SPQ IR	1.825**	0.141
SPQ MT	1.077**	0.181
SPQ UP	1.913**	0.17
SPQ Disorganized Factor BY		
SPQ EB	2.389**	0.232
SPQ OS	1.914**	0.218
COG2 BY		
GCB Ex	1.524**	0.176
GCB Go	1.282**	0.167
MDS	115.756**	18.802
MIS Rc	4.355**	0.464

Note. *N* = 357. **p*<0.05, ***p*<0.001. Estimates derived from Mplus. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; MDS, Maladaptive Daydreaming Scale; MIS, Magical Ideation Scale.

Table 11. Unstandardized Parameter Estimates and Standard Errors for Aim 3).

Model Parameter	Unstandardized	
	Estimate	Standard Error
COG2 BY		
GCB EX	1.236**	0.119
GCB GO	1.092**	0.119
MDS	95.213**	13.226
MIS RC	3.051**	0.328
COG2 ON		
SPQ Social Anxiety Factor	-0.009	0.020
SPQ Cognitive-Perceptual Factor	0.107**	0.013
SPQ Interpersonal Factor	-0.025	0.018
SPQ Disorganized Factor	0.011	0.013
Means		
SPQ Social Anxiety Factor	13.092	0.223
SPQ Cognitive-Perceptual Factor	32.154	0.434
SPQ Interpersonal Factor	14.933	0.262
SPQ Disorganized Factor	23.971	0.310

Note. $N = 357$. $^*p<0.05$, $^{**}p<0.001$. Estimates derived from Mplus. SPQ, Schizotypal Personality Questionnaire-Brief Revised Updated; GCB Ex, Generic Conspiracist Beliefs Scale, Extraterrestrial Cover-ups Subscale; GCB Go, Generic Conspiracist Beliefs Scale, Government Maleficence Subscale; MDS, Maladaptive Daydreaming Scale; MIS, Magical Ideation Scale.

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