Association of Multidimensional Schizotypy with PID-5 Domains and Facets

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Abstract

The underlying vulnerability for schizophrenia-spectrum disorders is expressed across a continuum of clinical and subclinical symptoms and impairment referred to as schizotypy. Schizotypy is a multidimensional construct with positive, negative, and disorganized dimensions. Models of pathological personality provide useful frameworks for assessing the multidimensional structure of schizotypy. The present study examined the association of positive, negative, and disorganized schizotypy with pathological personality traits and facets assessed by the Personality Inventory for DSM-5 (PID-5) in 1,342 young adults. As hypothesized, positive schizotypy was largely associated with the PID-5 psychoticism domain and facets, negative schizotypy was primarily associated with the detachment domain and facets and the restricted affectivity facet, and disorganized schizotypy's strongest associations were with the distractibility and eccentricity facets and the negative affect domain. Negative schizotypy was differentiated from the other two schizotypy dimensions in its pattern of correlations with the PID-5 domains and facets. As expected, positive and disorganized schizotypy exhibited a moderate degree of similarity in their associations. Overall, the PID-5 domains accounted for approximately half of the variance in each of the schizotypy dimensions, and the PID-5 facets accounted for upwards of 2/3rds of the variance in each schizotypy dimension. The associations among the schizotypy and PID-5 measures did not appear to reflect highly redundant items across the measures. We conclude by providing regression-based algorithms for computing positive, negative, and disorganized schizotypy scores based on the PID-5 facets.

Keywords: schizophrenia-spectrum; schizotypy; personality; traits; personality disorders

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Schizotypy and Schizophrenia

Schizotypy refers to the expression of the underlying vulnerability for schizophrenia-spectrum disorders across a broad range of clinical and subclinical impairment (Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010). Schizotypy offers a useful construct for understanding risk for and expression of schizophrenia-spectrum psychopathology as it includes subclinical presentations, the psychosis prodrome, schizophrenia-spectrum personality disorders, and overt psychosis. Its expression includes both trait-like personality characteristics as well as clinical symptoms. Schizotypy is heterogeneous and can be best represented in a multidimensional structure that includes positive (psychotic-like), negative (deficit), and disorganized dimensions (Kwapil & Barrantes-Vidal, 2015; Mason & Claridge, 2006; Vollema & van den Bosch, 1995). Positive schizotypy involves unusual beliefs, odd perceptual experiences, and suspicious/paranoid ideation. Negative schizotypy is characterized by trait-like deficits in functioning, such as diminished affect, avolition, anhedonia, alogia, and social disinterest. Disorganized schizotypy is characterized by disruptions in the organization and expression of thought, speech, behavior, and emotion. The multidimensional model of schizotypy offers a useful and unifying framework for understanding the development and expression of these characteristics across a broad range of subclinical and clinical symptoms and impairment.

Questionnaire measures have been widely used to assess schizotypy and examine risk for developing schizophrenia-spectrum disorders (see reviews by Chapman et al., 1995; Kwapil & Chun, 2015; Mason, 2015; Mason et al. 1997). The 77-item Multidimensional Schizotypy Scale (MSS; Kwapil, Gross, Silvia et al., 2018) was developed to assess positive, negative, and disorganized schizotypy based on current conceptualizations, while addressing many of the conceptual and psychometric limitations of prior schizotypy measures. The MSS subscales have good internal consistency and test-retest reliability and replicable factor structure (e.g., Kwapil, Gross, Silvia et al., 2018; Kemp, Gross et al., 2020). Furthermore, questionnaire (e.g., Kwapil, Gross, Burgin et al., 2018; Kemp et al., 2018), interview (e.g., Kemp, Bathery et al., 2021), laboratory (e.g., Sahakyan

et al., 2020), and ambulatory assessment (e.g., Kwapil et al., 2020) studies support the construct validity of the MSS subscales.

Association of Schizotypy with Normal Personality and Personality Disorder Traits

Numerous studies have examined the association of positive, negative, and disorganized schizotypy with general personality dimensions, such as the Five-Factor Model. Using the MSS, Kwapil, Gross, Silvia et al. (2018) reported that disorganized schizotypy was associated with elevated neuroticism and inversely with conscientiousness (both medium effects). Negative schizotypy was inversely associated with extraversion (large effect), as well as inversely with openness to experience and agreeableness (small effects). Positive schizotypy was associated with neuroticism and openness, and inversely with agreeableness (all small effects). These findings have largely been replicated with other measures of schizotypy and general personality (e.g., Gross et al., 2014; Kemp, Burgin et al., 2020; Kwapil et al., 2008; Ross et al., 2002). These findings partially mirror associations for schizotypal personality disorder (which includes aspects of positive, negative, and disorganized schizotypy) with Five-Factor Model domains and facets (e.g., Saulsman & Page, 2004; Samuel & Widiger, 2008) and from expert ratings of personality disorders using Five-Factor Model facets (Lynam & Widiger 2001).

Studies have also examined the association of the schizotypy dimensions with personality disorder traits and diagnoses (e.g., Kwapil et al., in press; Barrantes-Vidal et al., 2013; Kwapil et al., 2008). Both interview and questionnaire studies indicate that positive schizotypy is consistently associated with schizotypal and paranoid personality traits, typically on the order of small to medium effect sizes. Negative schizotypy is associated with schizoid personality (often on the order of large effect sizes), and with schizotypal and paranoid traits (small to medium effects). Although less well studied, disorganized schizotypy appears to be associated with schizotypal (small effect) and borderline personality (medium effect) traits (Kwapil et al., in press). Thus, positive, negative, and disorganized schizotypy appear to have distinct patterns of associations with dimensions of normal personality and personality disorder traits. Note that other studies

have examined the association of schizotypy measures with personality traits and disorders (e.g., Blanchard et al., 2011; Bolinsky et al., 2015; Gooding et al., 2005). Although their results largely align with the aforementioned associations, these studies did not specifically examine positive, negative, and disorganized dimensions of schizotypy.

Association of Schizotypy with Pathological Personality Traits

Studies have not widely examined the associations of the schizotypy dimensions with current dimensional models of maladaptive personality such as those found embedded in the Alternative Model of Personality Disorder (AMPD) included in the fifth edition of the Diagnostic and Statistical Model of Mental Disorders (DSM-5; APA, 2013). This model is based on maladaptive trait domains and facets that are typically assessed with the Personality Inventory for DSM-5 (PID-5; Krueger et al., 2012). The AMPD and subsequent PID-5 measure include five major domains of maladaptive personality – four based on Widiger and Simonsen (2005; extraversion vs. introversion, antagonism vs. compliance, constraint vs. impulsivity, and negative affect vs. emotional stability) and a fifth “psychoticism” domain. In creating a measure that encompasses these domains, the authors sought to measure explicitly the pathological poles of these traits. This approach aligns with research indicating that personality disorders can be understood as combinations of extreme scores on the dimensions measured within the Five Factor Model (FFM) of personality (e.g., Widiger & Costa, 2013; Lynam & Widiger, 2001). The final version of the PID-5 includes five factors: negative affect, detachment, antagonism, disinhibition, and psychoticism, and 25 individual facets (e.g., depressivity, withdrawal, callousness, impulsivity, eccentricity).

Somma et al. (2019) examined the association of multiple measures of schizotypy and schizotypal traits with the PID-5. However, the measures that they employed primarily assessed positive schizotypy traits and lacked coverage of negative and disorganized schizotypy. The authors computed a general schizotypy factor (comprised predominately of positive schizotypy) and an anhedonia factor. They examined the association of the PID-5 with these two factors, but limited the analyses to the PID-5 perceptual

dysregulation, unusual beliefs and experiences, eccentricity, restricted affectivity, withdrawal, suspiciousness, anxiousness, and depressivity facets. All eight facets had statistically significant bivariate associations with the general schizotypy factor (medium to large effects) and all of the facets except perceptual dysregulation and unusual beliefs and experiences had significant bivariate associations with the anhedonia factor (small to medium effects). However, the lack of a clear multidimensional assessment of schizotypy and the small number of PID-5 facets examined limit the interpretability of the findings.

Ashton et al. (2012) examined the association of PID-5 factors with the HEXACO personality factors and a purported dissociation/schizotypy factor. The dissociation/schizotypy factor was assessed with the Curious Experience Survey (Goldberg, 1999), which predominately assesses dissociative experiences with a few items that tap positive schizotypy experiences. Not surprisingly, the dissociation/schizotypy factor had its strongest loading with the PID-5 psychoticism factor and facets. However, given the lack of a multidimensional assessment of schizotypy, the study is limited in the light it sheds on the extent to which schizotypy is captured within the PID-5.

Crego and Widiger (2017) examined the association of the PID-5 with a variety of measures including the Five-Factor Schizotypal Inventory (Edmundson et al., 2011) and the Wisconsin Schizotypy Scales, which include the Perceptual Aberration (Chapman et al., 1978), Magical Ideation (Eckblad & Chapman, 1983), Physical Anhedonia (Chapman et al., 1976), and Revised Social Anhedonia Scale (Eckblad et al., 1982). The authors did not provide all of the correlations, but indicated that the Wisconsin Schizotypy Scales that tap positive schizotypy (Perceptual Aberration and Magical Ideation) correlated with the PID-5 Psychoticism facets on the order of large effects. In two factor analyses of measures of schizotypy, fantasy, openness, and the PID-5 psychoticism factors, the authors found that PID-5 eccentricity loaded on an oddity factor, but that the PID-5 perceptual dysregulation and unusual beliefs and experiences facets uniquely loaded on a separate factor. The authors suggested that this differentiation may reflect that the "PID-5 assessment of psychoticism might indeed be going beyond schizotypal magical and aberrant thinking to include overt schizophrenic

delusions” (p. 620). For example, the PID-5 includes items that appear to tap Schneiderian First-Rank symptoms, such as “Sometimes I feel ‘controlled’ by thoughts that belong to someone else” and “Sometimes I think someone else is removing thoughts from my head.” The inclusion of such deviant items is problematic given that DSM-5 indicates that cluster A personality disorders are distinguished from psychotic disorders by the absence of persistent psychotic symptoms.

Goals and Hypotheses

Only a few studies have examined the association of schizotypy with the PID-5 factors and facets, and none of them considered the fully multidimensional structures of schizotypy or pathological personality. The present study comprehensively examined the associations of positive, negative, and disorganized schizotypy with all PID-5 factors and facets. This will allow determination about which pathological personality characteristics are shared across schizotypy dimensions and what is unique, and the extent to which the schizotypy traits can be captured by the PID-5.

The PID-5 was not designed to be a measure of multidimensional schizotypy. However, the PID-5 assesses pathological personality traits that are part of the AMPD diagnosis of schizotypal personality disorder, which includes positive, negative, and disorganized schizotypy features. Consistent with this and with previous studies examining associations of positive, negative, and disorganized schizotypy with personality dimensions (e.g., Kwapil, Gross, Burgin et al., 2018; Kemp, Burgin et al., 2020), it is hypothesized that the three schizotypy dimensions will have both overlapping and unique patterns of hypothesized associations with the PID-5 domains and facets. Specifically, it is hypothesized that all three schizotypy dimensions will be associated with the PID-5 psychoticism domain and component facets (unusual beliefs & experiences, eccentricity, perceptual dysregulation), as well as with the suspiciousness facet. Positive schizotypy is expected to have the strongest relation (medium to large effect size) as odd beliefs, perceptual experiences, and suspiciousness are core components of both psychoticism and positive schizotypy (in line with previous findings reviewed above). Associations of negative and disorganized schizotypy with

psychoticism are expected to be small to medium effects.

Consistent with Kwapil, Gross, Silvia et al. (2018) and Kemp et al. (2018), disorganized schizotypy is expected to be associated with the negative affect domain and facets (medium to large effect). Positive schizotypy is expected to be associated with the negative affect domain and facets (small to medium effect size). Negative schizotypy is characterized by diminished affect, and therefore is expected to be unassociated (or even inversely associated) with the negative affect domain and facets, and to be associated with the restricted affectivity facet. Negative schizotypy is expected to have its strongest association with the PID-5 detachment domain and component facets (withdrawal, anhedonia, intimacy avoidance) with large effect sizes, as these are core components of negative schizotypy. Disorganized schizotypy is expected to have its strongest association with the disinhibition domain and the distractibility facet.

It is expected that the patterns of correlations of the MSS subscales and the PID-5 factors and facets will demonstrate minimal similarity of negative schizotypy with positive and disorganized schizotypy ($<.40$), and moderate similarity between positive and disorganized schizotypy ($.40$ to $.70$). The study will also examine the extent to which the PID-5 domains and facets account for variance in positive, negative, and disorganized schizotypy. In terms of variance accounted for, it is expected that the PID facets will account for more variance than the PID domains. Furthermore, it is expected that the PID-5 will account for the most variance in positive schizotypy relative to negative and disorganized schizotypy, given the representation of psychoticism items. Finally, to better understand the association of the schizotypy dimensions, item-level associations and overlapping item content will be examined in an exploratory fashion. This will focus on associations of MSS negative schizotypy items with PID-5 anhedonia, intimacy avoidance, restricted affectivity, and withdrawal items; MSS positive schizotypy items with PID-5 eccentricity, perceptual dysregulation, suspiciousness, and unusual beliefs and experiences items; and MSS disorganized schizotypy items with PID-5 distractibility and eccentricity items.

Methods

Preregistration

The study goals, hypotheses, and planned analyses were preregistered on Open Science Framework at: <https://osf.io/v8fyt/>

Participants

Participants were recruited from Psychology Department undergraduate participant pools at five universities located across the United States. We did not oversample for elevated scorers on any of the measures, and the study was open to any participants 18 years or older. A total of 1,441 participants completed the study; however, 99 (7%) participants were dropped due to invalid responding. This rate is consistent with previous studies in our laboratory using comparable measures and procedures. The participating universities and their usable number of participants were: University of Illinois at Urbana-Champaign ($n=481$), Youngstown State University ($n=370$), California Polytechnic State University, San Luis Obispo ($n=298$), Tennessee Tech University ($n=162$), and University of Georgia ($n=31$). The final sample included 1,342 participants with usable data. Demographic characteristics were: M age = 19.8 years, $SD = 2.0$; 70% female; 7% Black, 14% Asian/Pacific Islander, 65% Caucasian, 10% Hispanic/Latino, <1% Native American, 4% other; 87% Native English speakers. Information regarding psychiatric diagnoses or treatment was not obtained. Supplementary Table 1 provides demographic information by institution. Note that these data were collected for the purposes of the present study and have not been used as part of any other investigations.

Measures

Multidimensional Schizotypy Scale. The MSS contains 77 true-false items that tap positive, negative, and disorganized schizotypy. As recommended by Kwapil, Gross, Silvia et al. (2018), scores were computed separately for each schizotypy subscale, instead of computing a total MSS score.

Personality Inventory for DSM-5 (PID-5). In order not to overburden participants, the 100-item Faceted Brief Form version of the PID-5 (PID-5-FBF; Maples et al., 2013) was administered, which provides scores for five domains and 25 facets. This version contains four items per facet. Note that at the request of

IRB, the Depressivity facet item, “The world would be better off if I were dead”, was excluded. Given that the focus of the study was on the association of schizotypy with the PID-5 indices, we administered the full-length versions of the PID-5 Eccentricity (13 items), Perceptual Dysregulation (12 items), and Unusual Beliefs and Experiences (8 items), which comprise the Psychoticism domain, and Suspiciousness facet (7 items). Facet and domain scores were computed following the scale guidelines.

Infrequency Questionnaire. A 13-item infrequency questionnaire (Chapman & Chapman, 1983) was included to screen out invalid protocols. Following Chapman and Chapman, participants who endorsed more than three infrequency items were excluded from the analyses.

Procedure

The project received IRB approval from each university, and participants provided informed consent before completing the surveys. Participants completed the questionnaires using Qualtrics electronic survey software. The survey began with demographic questions (age, sex, race/ethnicity, and English as first language). The MSS and the infrequency questionnaire items (all true-false response) were intermixed and divided into five blocks presented in random order, followed by the PID-5. Participants received course credit at their respective universities.

Results

Descriptive Statistics

Means, standard deviations, and reliabilities (coefficient alpha and McDonald’s Omega) for the MSS subscales and the PID-5 domains and facets are presented in Table 1. Participants scored across approximately the entire range of scores for the positive (range = 0 - 25), negative (range = 0 - 24), and disorganized (range = 0 - 25) schizotypy subscales. Intercorrelations of the MSS subscales and the PID-5 domains are presented in Table 2. Due to the large sample size and number of analyses for this study, alpha was set to .001 for all analyses to minimize Type I error. Effect sizes are noted in the table following Cohen (1992). The descriptive statistics and intercorrelations for the MSS are consistent with large normative

samples (e.g., Kwapil, Gross, Silvia et al. 2018). The intercorrelations of the PID-5 domains are higher than in the original scale derivation samples (Krueger et al., 2012), but consistent with values reported in multiple samples in Maples et al. (2015).

Associations of the MSS and PID-5

Bivariate and multivariate associations of the MSS and PID-5. Table 3 presents the bivariate correlations of the three MSS subscales with the PID-5 domain and facet scores. Steiger tests were computed to compare the correlations of the MSS subscales with each PID-5 domain and facet. In order to examine the unique associations of the MSS subscales with the PID-5 measures, we regressed each of the PID-5 domains and facets on the three MSS subscales (Table 4). Each row in the table represents a separate regression analysis in which the three MSS subscales were entered simultaneously in order to examine each MSS subscale's unique prediction over-and-above the other schizotypy subscales. The standardized regression coefficient (β), change in R^2 (or semi-partial r^2), and effect size (f^2) are reported for each predictor in the linear regressions. Following Cohen (1992), f^2 values above .15 are medium effect sizes, and above .35 are large effect sizes. Note that R^2 and f^2 were computed for each predictor by rerunning the analyses with the specific MSS predictor entered at the second step, over and above the other two MSS subscales. Variance inflation values were all below 1.6, indicating that multicollinearity did not appreciably impact the regression analyses.

As hypothesized, all three schizotypy dimensions were associated with the PID-5 psychoticism domain and component facets (unusual beliefs & experiences, eccentricity, perceptual dysregulation), as well as with the suspiciousness facet in terms of bivariate associations, generally at the level of medium to large effects. However, the Steiger tests and the simultaneous regressions indicated that, as expected, these associations were best accounted for by positive schizotypy, consistent with the model that these facets are core components of positive schizotypy, and with findings of Crego and Widiger (2017).

As hypothesized, both disorganized and positive schizotypy were associated with the negative affect domain and facets (medium effects) at the bivariate level. However, the regression analyses indicated that

the effect was generally stronger for disorganized schizotypy. As expected, negative schizotypy was unassociated with the negative affect domain and facets at the bivariate level. Furthermore, negative schizotypy was inversely associated with negative affect in the simultaneous regression analyses, consistent with the findings from Kwapil et al. (2020). As hypothesized, negative schizotypy had its strongest association with the PID-5 detachment domain and component facets (withdrawal, anhedonia, intimacy avoidance) with large effect sizes in both the bivariate and regression analyses, consistent with the model that these are core components of negative schizotypy. Following our hypotheses, disorganized schizotypy had its strongest association with the disinhibition domain and the distractibility facet at the level of a large effect in both the bivariate and regression analyses.

Similarity analyses. To examine the similarity of the positive, negative, and disorganized schizotypy subscales, we examined the similarities in the patterns of correlations of the five PID-5 domain scores and the 25 facet scores across the MSS subscales using double-entry q-correlations (r_{ICC} ; McCrae, 2008). This method assesses absolute similarity in shape and elevations of the trait profiles. As expected, the correlational profile for negative schizotypy was distinct from each of the other two dimensions at the domain ($r_{ICC} = -.27$ and $-.28$, with positive and disorganized schizotypy, respectively) and the facet ($r_{ICC} = -.01$ and $.10$) levels. Positive and disorganized schizotypy showed moderate similarity ($r_{ICC} = .58$ and $.71$) at the domain and facet levels, respectively.

We next examined the extent to which the five PID-5 domains and 25 facets captured variance in each of the three MSS schizotypy subscales by regressing the MSS subscales on the PID-5 measures. As seen in Table 5, the five PID-5 domains accounted for 56% of the variance in positive schizotypy, driven almost exclusively by the psychoticism domain. The PID-5 domains likewise accounted for 58% of the variance in negative schizotypy, largely accounted for by the detachment domain, an inverse association of the negative affect domain, and a small association with the psychoticism domain. The PID-5 domains accounted for 52% of the variance in disorganized schizotypy. As expected, the strongest association was with the disinhibition

domain, along with smaller loadings from the psychoticism, detachment, and antagonism (inversely) domains. The PID-5 facets demonstrated a comparable pattern, although as expected, they accounted for more variance than the domains in the schizotypy dimensions (Supplementary Table 2). The PID-5 facets accounted for 63% of the variance in positive schizotypy, driven by the psychoticism facets of unusual beliefs and experiences and perceptual dysregulation. The PID-5 facets accounted for 64% of the variance in negative schizotypy, driven largely by the detachment facets, and 58% of the variance in disorganized schizotypy, largely accounted for by disinhibition and psychoticism facets. We provide regression-based algorithms for computing positive, negative, and disorganized schizotypy from the PID-5 facet scores (see supplementary material).

Items associations and content. In order to better understand the association of the schizotypy and PID-5 measures, item-level associations and overlapping item content were examined in an exploratory fashion. First, we examined item-level correlations focusing on associations of MSS negative schizotypy items with PID-5 anhedonia, intimacy avoidance, restricted affectivity, and withdrawal items; MSS positive schizotypy items with PID-5 eccentricity, perceptual dysregulation, suspiciousness, and unusual beliefs and experiences items; and MSS disorganized schizotypy items with PID-5 distractibility and eccentricity items. Specifically, we identified item correlations of .5 or greater (large effect sizes). Despite the strong associations of the MSS positive schizotypy subscale with these specific PID-5 facets, none of their items met this correlation threshold. Likewise, only one MSS disorganized schizotypy subscale and distractibility facet item met this threshold. The PID-5 anhedonia item “Nothing seems to interest me very much” had elevated associations with four of the MSS negative schizotypy items, and two PID-5 interpersonal avoidance items had elevated correlations with a single MSS negative schizotypy item. Thus, overall it appears that the elevated associations of the MSS subscales and PID-5 domains and facets were not driven by psychometrically identical items.

Discussion

Schizotypy is referred to as “the latent personality organization that putatively harbors the liability for schizophrenia” (Lenzenweger, 2018, p. 25) that gives rise to schizophrenia-spectrum symptoms, disorders, and impairment (Kwapil & Barrantes-Vidal, 2015). Numerous studies have demonstrated that positive, negative, and disorganized schizotypy have differential patterns of associations with general personality domains and facets (e.g., Gross et al., 2014), and are associated with DSM personality disorder traits and disorders (e.g., Kwapil et al., in press). Although it seems appropriate that the schizotypy dimensions would have unique associations with pathological personality traits, no studies to our knowledge have comprehensively examined these associations. The present study addressed these limitations by examining the associations of positive, negative, and disorganized schizotypy with pathological personality traits assessed by the PID-5.

Positive schizotypy is characterized by odd beliefs, ranging from magical ideation to full-blown delusions, unusual perceptual experiences, ranging from brief illusions to hallucinations, and suspiciousness and paranoia. Psychotic symptoms that characterize conditions such as schizophrenia and bipolar disorder can be understood as expressions of this dimension. Likewise, milder expressions of schizotypy are characteristic of premorbid or prodromal phases, as well as residual phases, of psychotic illnesses. Furthermore, as demonstrated by Johns and van Os (2001), numerous individuals exhibit subclinical (and even transient clinical) expressions of positive schizotypy without ever transitioning into psychiatric disorders. The psychoticism domain of the PID-5, which has its roots in Harkness and McNulty (1994) and the DSM-5 AMPD (American Psychiatric Association, 2013), was designed to assess culturally incongruent odd, eccentric, and unusual behaviors and cognitions. However, as pointed out by Crego and Widiger (2017), some of the psychoticism items “refer to overt and arguably severe psychotic symptoms” (p. 620). Furthermore, the descriptions of the AMPD psychoticism facets, which provide the basis for the PID-5 subscales, at times seem inconsistent with traditional descriptions of schizotypic experiences. For example, schizotypic perceptual dysregulation or aberration usually refers to distortions in perception that can occur in all sensory modalities,

such as illusions or mild hallucinatory types of experiences, misperception of the nature of one's own body, and misperceiving the presence of other people or forces (e.g., Chapman, Edell, & Chapman, 1980; American Psychiatric Association, 2013). However, the PID-5 perceptual dysregulation facet contains items assessing passivity experiences (feeling controlled by others), difficulty controlling thoughts, and thought withdrawal. Passivity experiences and thought withdrawal seem more characteristic of unusual beliefs or ideas, whereas difficulty controlling thoughts appears more consistent with the cognitive disorganization items in the PID-5 eccentricity. Thus, the PID-5 perceptual dysregulation subscale, while mapping onto the AMPD facet, seems to include a mix of positive schizotypy experiences and psychotic-like (and psychotic) experiences that are not limited to the traditional domain of disrupted perceptual experiences.

Unusual or magical beliefs are often characterized as ideation that is outside of subcultural norms and influences behavior, although lacking delusional intensity or conviction (American Psychiatric Association, 2013). In his classic checklist, Meehl (1964) referred to magical ideation as involving "belief, quasi-belief, or semi-serious entertainment of the possibility that events which, according to the causal concepts of this culture, cannot have a causal relation with each other, might somehow nevertheless do so" (p. 54). However, the PID-5 unusual beliefs and experiences facet contains an item about hearing things that others could not hear – an item that appears to tap unusual perceptual experiences. This is consistent with the AMPD description of the facet, but not with traditional descriptions of odd ideas and delusional beliefs. Magical beliefs and unusual perceptual experiences are core components of positive schizotypy, which is supported by the finding of strong associations of these PID-5 facet with the MSS positive schizotypy subscale. However, the PID-5 provides less content coverage of these areas than the MSS (which is not surprising given the broader focus of the PID-5).

As expected, the PID-5 suspiciousness facet had its strongest association with positive schizotypy, and it accounted for a modest increment in variance in positive schizotypy over-and above the other PID-5 facets. It was notable that despite using the longer version of the suspiciousness facet, it had relatively poor internal

consistency reliability. The finding that suspiciousness only accounted for a modest proportion of variance in positive schizotypy relative to the perceptual dysregulation and unusual beliefs and experiences facets likely represents two issues. First, schizotypic suspiciousness can be conceptualized as a type of odd belief, thus much of its association with positive schizotypy may be captured by the unusual beliefs and experiences facet. In addition, the views of others as threatening tapped by PID-5 suspiciousness may be driven by factors other than positive schizotypy, such as antagonism, social anxiety, or adverse life experiences. This likely reflects the inconsistent placement of suspiciousness within models of personality pathology. The AMPD lists suspiciousness as a facet of the detachment domain and the negative affectivity domain. However, the PID-5 does not include the suspiciousness facet in the computation of any of the five domain scores. The Five-Factor Model of Personality Disorders (Widiger et al., 2012) facet of interpersonal suspiciousness falls under antagonism (Edmundson et al., 2011; Crego & Widiger, 2016), although Crego et al. (2018) found mixed support for this. This appears consistent with the contention that suspicious ideation and behaviors are driven by a diverse array of factors.

The MSS positive schizotypy subscale had its strongest associations with the PID-5 psychoticism facets of perceptual dysregulation and unusual beliefs and experiences (sharing about half of its variance in common with these facets). This is not surprising given that odd perceptual experiences and beliefs are core components of positive schizotypy. MSS positive schizotypy was less strongly associated with the PID-5 eccentricity facet that primarily taps oddities in thought and speech, and to a lesser degree overt behavior. In fact, the eccentricity facet did not account for an increment in variance in positive schizotypy over-and-above the perceptual dysregulation and unusual experiences and beliefs facets. Although some of these cognitive and behavioral eccentricities may be driven by positive schizotypy (e.g., telling others about magical beliefs or engaging in rituals driven by such ideas), many of the eccentricity facet items seem to reflect cognitive and behavioral disorganization.

As hypothesized, negative schizotypy was most strongly associated with the PID-5 detachment

domain and facets (withdrawal, anhedonia, intimacy avoidance), as well as with the restricted affectivity facet. Negative schizotypy is characterized by diminution in interests and experiences that broadly include decreased emotional experience and minimal social interest and pleasure. In fact, Christensen et al. (2019) suggested that the MSS negative schizotypy subscale includes separable facets of affective and social anhedonia. The PID-5 facets of anhedonia (tapping minimal interest and enjoyment in life) and restricted affectivity (tapping a lack of emotional experience and expression) appear to map closely onto affective anhedonia, whereas the facets of withdrawal (tapping social disinterest) and intimacy avoidance (disinterest in romantic relationships) map onto the social anhedonia aspect of negative schizotypy. As expected, MSS negative schizotypy was not associated with the PID-5 negative affect domain at the bivariate level, and was inversely associated in the regression models. This is consistent with previous studies demonstrating that MSS negative schizotypy was unassociated with neuroticism (e.g., Kwapil, Gross, Silvia et al., 2018) and with daily life measures of negative affect (e.g., Kwapil et al., 2020). Note that these findings provide support for the construct validity of the MSS negative schizotypy subscale, especially given that purported measures of negative schizotypy often correlate highly with neuroticism, negative affect, and anxiety – characteristics not considered to be part of negative schizotypy (see Barrantes-Vidal et al., 2013; Gross et al., 2014).

Negative schizotypy was moderately associated with the PID-5 depressivity facet. Note that Kemp et al. (2018) reported that MSS negative schizotypy was associated with scores on the Beck Depression Inventory; however, subsequent analyses indicated that this was driven by associations with depressive items that tapped diminished positive affect, not elevated negative affect. The PID-5 depressivity items assess a bleak or pointless (nihilistic) view of the world that seems consistent with the anhedonia and diminished anticipatory pleasure that characterize negative schizotypy. Finally, MSS negative schizotypy surprisingly had a moderate association with PID-5 callousness. These items generally assess a lack of concern if the respondent causes others suffering. These associations are unexpected given that negative schizotypy is not associated with antisocial or predatory patterns of behavior. The results may reflect a lack of social interest in

the well-being of others, rather than intention to bring harm to others.

Disorganized schizotypy is characterized by disruptions in the organization and expression of thought, speech, behavior, and emotion. Consistent with this, disorganized schizotypy had strong associations with the PID-5 distractibility and eccentricity facets. PID-5 distractibility assesses difficulty staying mentally focused, whereas the eccentricity facet taps strange thought processes, odd ideas, eccentric appearance and behavior, and odd utterances. These map on closely to the disruptions in thoughts, speech, and behavior that characterize disorganized schizotypy. Numerous studies also indicate that disorganized schizotypy is associated with elevated negative affect (Kwapil et al., 2020), neuroticism (Gross et al., 2018), and depressive disorders (Kemp, Bathery et al., 2021). Consistent with these findings, disorganized schizotypy was associated with the PID-5 negative affect domain and facets and the depressivity facet. In terms of dysregulated behavior, disorganized schizotypy was associated with PID-5 facets of impulsivity, irresponsibility, and risk taking. Note that both negative and disorganized schizotypy were associated with the PID-5 psychoticism domain, but as expected to a lesser degree than positive schizotypy was associated with psychoticism. Although correlated with positive schizotypy, disorganized schizotypy involves a distinct pattern of thought and behavior. Detecting these subtle distinctions may be critical in understanding the process of psychiatric deterioration that occurs in a subset of schizotypes.

As expected, double-entry q-correlations indicated minimal similarity of negative schizotypy with positive and disorganized schizotypy at the PID-5 domain and facet level. This is consistent with conceptualizations that negative schizotypy involves trait-like diminution of interest, sociability, emotions, and cognition, whereas positive and disorganized schizotypy involve problematic excesses in behavior such as odd beliefs and disrupted thinking. Consistent with this, positive and disorganized schizotypy exhibited moderate similarity at the PID-5 domain and facet level. Nevertheless, there is strong conceptual and empirical evidence to support the distinction between these factors. They are defined by different characteristics (e.g., Kwapil & Barrantes-Vidal, 2015), factor analytic studies support their differentiation (e.g.,

Christensen et al., 2019), and laboratory studies indicate that they are associated with distinct patterns of symptoms and impairment (e.g., Kemp, Bathery et al., 2021).

The PID-5 was developed to provide a comprehensive measure of maladaptive personality traits and facets in line with the DSM-5 AMPD. Relevant to the present study, the alternative model includes schizotypal personality disorder, which can be considered to be a pathological expression of schizotypy, but is not synonymous with multidimensional schizotypy. Relevant to the present study, the AMPD includes schizotypal personality disorder and the PID-5 includes facets that tap the six pathological personality traits comprising AMPD schizotypal personality disorder. As noted, schizotypal personality disorder is considered to be a pathological expression of the schizotypy continuum, but the two constructs are not synonymous. Schizotypy was not specifically included as part of the AMPD or assessed by the PID-5, although many of the components of multidimensional schizotypy overlap with the domains and facets assessed by the PID-5 (e.g., cognitive or perceptual distortions that are part of schizotypal personality disorder). However, the item analysis suggested that is not due to highly redundant items across the MSS and PID-5. Therefore, it is reasonable to consider the extent to which positive, negative, and disorganized schizotypy can be assessed by the PID-5. The PID-5 accounts for slightly over half of the variance in each of the three schizotypy dimensions at the domain level, and almost 2/3rds of the variance in each schizotypy domain at the facet level. In comparison, Kemp, Raulin et al. (2021) reported that short forms of the Wisconsin Schizotypy Scales and the MSS likewise share about 2/3rds of their variance in common. The association of the PID-5 with positive schizotypy is almost exclusively driven by the psychoticism domain and the perceptual dysregulation and unusual beliefs and experiences facets. These are core domains of positive schizotypy, but the content coverage of positive schizotypy by the PID-5 is rather limited in comparison to measures such as the MSS. Furthermore, as noted by Crego and Widiger (2017), the PID-5 items at times appear to tap experiences of psychotic deviancy. The prediction of negative schizotypy is largely driven by aspects of detachment, but this may fail to capture the large range of diminished experiences in negative schizotypy. Disorganized schizotypy within the PID-5 is driven by the

distractibility facet of disinhibition, but is also more distributed across facets than positive and negative schizotypy. This may reflect the challenges of assessing disorganized schizotypy. As noted by Gross et al. (2014) and Kwapil, Gross, Silvia et al. (2018), disorganized schizotypy is the least studied and most difficult-to-measure dimension of schizotypy, given that many other conditions can produce disruptions in thought, emotion, and behavior, and that increasing levels of disorganization may impair self-report of such impairments. Nevertheless, the PID-5 accounts for considerable variance in multidimensional schizotypy and the PID-5 facets appear to provide useful proxies for assessing the three schizotypy dimensions.

The present findings should be interpreted in light of the limitations of the study. First, the present study employed a non-clinically ascertained, college student sample, which could limit the generalizability of the findings. However, as noted by Kemp et al. (2021), college student samples college students are just entering the age of greatest risk for exhibiting schizophrenia-spectrum symptoms and developing schizophrenia-spectrum disorders, and they are widely used in questionnaire-based studies of schizotypy. It is worth noting that college students are not “analog” samples, but actually experience schizophrenia-spectrum psychopathology, as well as other forms of psychopathology (e.g., Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2021). More importantly for our purposes, the MSS is effective at identifying young adults enrolled in college who have schizophrenia-spectrum symptoms and impairment. Nevertheless, recruiting a non-clinically ascertained sample raises concern about restricted ranges in terms of schizotypy and personality pathology. However, as noted previously, participants reported a wide range of schizotypy and PID-5 characteristics in this study. Needless to say, future validation studies should consider employing nonstudent young adult samples, as well as samples that are more diverse in terms of age, clinical status, and racial/ethnic background. Note that the decision to use a hybrid version of the PID-5 was made in order to minimize participant burden and target specific facets of the PID-5. Two of our team members (DRL & JDM) were co-authors of the PID-5 Faceted Brief Form and our decision to use the hybrid form was made with their guidance. However, a limitation of this approach is that it meant that different facets and domains were not

comparably assessed. Nevertheless, the PID-5 Faceted Brief Form has strong psychometric properties and concordance with the full-length form. Note that all of the measures employed in the study were self-report. Future examinations may consider incorporating alternative measures such as informant reports and semi-structured interviews. Finally, the study is limited by only considering one model (and measure) of multidimensional schizotypy. Future studies may want to examine alternative models, including those based on bifactor approaches (e.g., Moussa-Tooks et al., 2021; Preti et al., 2015).

In summary, the present study is the first to our knowledge to comprehensively examine the associations of positive, negative, and disorganized schizotypy with the PID-5 domains and facets. As hypothesized, the schizotypy dimensions exhibited differential hypothesized patterns of associations with the PID-5 domains and facets. The study offers further support for the construct validity of both measures. The PID-5 provides an established measure of personality pathology based on the AMPD, whereas the MSS provides a useful measure of multidimensional schizotypy.

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Table 1. Descriptive Statistics for the Multidimensional Schizotypy Scale and Personality Disorder Inventory for DSM-5 (PID-5) (*n* = 1342)

	<u>Mean</u>	<u>S.D.</u>	<u>Coefficient Alpha</u>	<u>McDonald's Omega</u>
<u>Multidimensional Schizotypy Scale</u>				
Positive Schizotypy (26 items)	4.69	4.72	.87	.87
Negative Schizotypy (26 items)	3.11	4.03	.87	.87
Disorganized Schizotypy (25 items)	4.51	5.85	.93	.93
<u>PID-5 Domains</u>				
Negative Affect (12 items)	2.29	.65	.88	.88
Detachment (12 items)	1.55	.51	.88	.89
Antagonism (12 items)	1.67	.54	.89	.89
Disinhibition (12 items)	1.86	.53	.87	.88
Psychoticism (33 items)	1.67	.54	.95	.96
<u>PID-5 Facets</u>				
Anhedonia (4 items)	1.52	.63	.85	.85
Anxiousness (4 items)	2.55	.83	.84	.84
Attention Seeking (4 items)	2.35	.79	.87	.87
Callousness (4 items)	1.30	.48	.83	.83
Deceitfulness (4 items)	1.71	.65	.78	.79
Depressivity (3 items)	1.52	.69	.83	.84
Distractibility (4 items)	2.26	.84	.88	.88
Eccentricity (13 items)	1.85	.73	.95	.95
Emotional Lability (4 items)	1.97	.78	.84	.84
Grandiosity (4 items)	1.44	.57	.81	.81
Hostility (4 items)	1.90	.72	.82	.84
Impulsivity (4 items)	1.94	.67	.82	.82
Intimacy Avoidance (4 items)	1.46	.62	.84	.84
Irresponsibility (4 items)	1.37	.46	.64	.64
Manipulativeness (4 items)	1.88	.67	.79	.79
Perceptual Dysregulation (12 items)	1.62	.50	.84	.85
Perseveration (4 items)	2.02	.65	.77	.78
Restricted Affectivity (4 items)	1.84	.74	.81	.82
Rigid Perfectionism (4 items)	2.07	.77	.83	.84
Risk Taking (4 items)	1.81	.65	.82	.82
Separation Insecurity (4 items)	2.36	.77	.78	.78
Submissiveness (4 items)	2.45	.67	.82	.83
Suspiciousness (7 items)	1.97	.51	.66	.67
Unusual Beliefs and Experiences (8 items)	1.55	.55	.83	.83
Withdrawal (4 items)	1.66	.63	.80	.81

MSS subscale means are based on participants' raw scores

PID-5 facet means are the average item score for the facets

PID-5 dimension means are based on average score of the facet means

Table 2. Intercorrelations of the Multidimensional Schizotypy Scale Subscales and the Personality Inventory for DSM-5 Domains ($n = 1342$)

Multidimensional Schizotypy Scale:

	<u>Negative</u>	<u>Disorganized</u>
Positive Schizotypy	.23	.50
Negative Schizotypy		.37

Personality Inventory for DSM-5 Domains:

	<u>Detachment</u>	<u>Antagonism</u>	<u>Disinhibition</u>	<u>Psychoticism</u>
Negative Affect	.28	.28	.55	.52
Detachment		.29	.39	.49
Antagonism			.48	.52
Disinhibition				.64

Medium effect sizes in bold, large effect sizes in bold & italics

Correlation values > .10 are statistically significant, $p < .001$

Table 3. Bivariate Correlations of the Multidimensional Schizotypy Scale and Personality Disorder Inventory for DSM-5 (PID-5) (*n* = 1342)

<u>PID-5 Domains</u>	<u>MSS Positive Schizotypy</u>	<u>MSS Negative Schizotypy</u>	<u>MSS Disorganized Schizotypy</u>	<u>Steiger Comparison</u>
Negative Affect	.42	.04	.47	P, D > N
Detachment	.32	.74	.40	N > P,D
Antagonism	.37	.22	.28	P > N,D
Disinhibition	.45	.22	.67	D > P > N
Psychoticism	.74	.35	.60	P > D > N
<u>PID-5 Facets</u>				
Anhedonia	.30	.60	.48	N > D > P
Anxiousness	.40	.18	.43	P, D > N
Attention Seeking	.19	-.24	.13	P, D > N
Callousness	.23	.44	.20	N > P,D
Deceitfulness	.33	.23	.29	P,N,D
Depressivity	.34	.50	.50	N,D > P
Distractibility	.38	.16	.65	D > P > N
Eccentricity	.58	.35	.58	P, D > N
Emotional Lability	.40	.07	.46	P, D > N
Grandiosity	.29	.18	.19	P > N,D
Hostility	.29	.24	.31	P,N,D
Impulsivity	.36	.15	.47	D > P > N
Intimacy Avoidance	.20	.51	.17	N > P,D
Irresponsibility	.34	.27	.47	D > P,N
Manipulativeness	.32	.16	.23	P > N,D
Perceptual Dysregulation	.72	.33	.61	P > D > N
Perseveration	.40	.23	.46	P,D > N
Restricted Affectivity	.13	.52	.17	N > P,D
Rigid Perfectionism	.31	.16	.25	P > N
Risk Taking	.32	.13	.29	P,D > N
Separation Insecurity	.23	-.17	.24	P,D > N
Submissiveness	.15	-.05	.21	P,D > N
Suspiciousness	.49	.35	.45	P,D > N
Unusual Beliefs and Experiences	.74	.25	.41	P > D > N
Withdrawal	.27	.69	.32	N > P,D

Medium effect sizes in bold, large effect sizes in bold & italics

Correlation values $\geq .10$ are statistically significant, $p < .001$

Steiger test comparing the magnitude of the correlation of each PID-5 score with the MSS Positive, Negative, and Disorganized Schizotypy subscales, $p < .001$

Table 4. Linear Regressions Examining Prediction by the Multidimensional Schizotypy Scale Subscales ($n = 1342$)

	MSS Positive Schizotypy			MSS Negative Schizotypy			MSS Disorganized Schizotypy				
Criteria:	β	sr^2	f^2	β	sr^2	f^2	β	sr^2	f^2	Total R^2	Comparison
PID-5 Domains											
Negative Affect	.26*	.05	.07	-.17*	.03	.04	.40*	.11	.15	.29*	D > P > N
Detachment	.11*	.01	.02	.68*	.39	.91	.09*	.01	.01	.57*	N > P,D
Antagonism	.30*	.07	.08	.12*	.01	.01	.08	.01	.01	.16*	P > N,D
Disinhibition	.16*	.02	.04	-.04	.00	.00	.61	.25	.47	.47*	D > P > N
Psychoticism	.58*	.26	.69	.12*	.01	.03	.26*	.05	.13	.63*	P > D > N
PID-5 Facets											
Anhedonia	.06	.00	.01	.49*	.20	.36	.27*	.05	.09	.44*	N > D > P
Anxiousness	.24*	.04	.06	.01	.00	.00	.31*	.07	.09	.23*	P,D > N
Attention Seeking	.19*	.03	.03	-.34*	.10	.12	.16*	.02	.02	.14*	P,D, > N
Callousness	.14*	.02	.02	.41*	.15	.19	-.02	.00	.00	.21*	N > P > D
Deceitfulness	.24*	.05	.05	.13*	.01	.02	.12*	.01	.01	.15*	P > N,D
Depressivity	.11*	.01	.01	.36*	.11	.17	.31*	.07	.10	.37*	N,D > P
Distractibility	.08*	.01	.01	-.11*	.01	.02	.65*	.29	.51	.44*	D > P > N
Eccentricity	.38*	.11	.20	.13*	.02	.03	.34*	.08	.15	.47*	P,D > N
Emotional Lability	.23*	.04	.06	-.12*	.01	.02	.39*	.10	.14	.26*	D > P > N
Grandiosity	.26*	.05	.05	.11*	.01	.01	.02	.00	.00	.10*	P > N,D
Hostility	.18*	.02	.03	.13*	.01	.02	.18*	.02	.02	.14*	P,N,D
Impulsivity	.18*	.02	.03	-.03	.00	.00	.39*	.11	.14	.24*	D > P > N
Intimacy Avoidance	.12*	.01	.01	.51*	.22	.31	-.07	.00	.01	.27*	N > P > D
Irresponsibility	.14*	.01	.02	.11*	.01	.01	.36*	.09	.12	.24*	D > P,N
Manipulativeness	.27*	.06	.06	.07	.00	.01	.07	.00	.00	.12*	P > N,D
Perceptual Dysregulation	.55*	.23	.59	.09*	.01	.02	.30*	.06	.16	.61*	P > D > N
Perseveration	.23*	.04	.05	.05	.00	.00	.33*	.07	.10	.25*	D > P > N
Restricted Affectivity	.02	.00	.00	.53*	.24	.33	-.04	.00	.00	.27*	N > P,D
Rigid Perfectionism	.24*	.04	.05	.07	.00	.00	.10	.01	.01	.11*	P > N,D
Risk Taking	.24*	.04	.05	.01	.00	.00	.17*	.02	.02	.13*	P,D > N
Separation Insecurity	.17*	.02	.03	-.31*	.08	.10	.28*	.05	.06	.16*	P > D > N
Submissiveness	.07	.00	.00	-.15*	.02	.02	.23*	.04	.04	.07*	D > P > N
Suspiciousness	.34*	.08	.13	.19*	.03	.05	.21*	.03	.05	.33*	P > N,D

Unusual Beliefs and Experiences	.70*	.37	.83	.08*	.01	.01	.04	.00	.00	.55*	P > N, D
Withdrawal	.10*	.01	.02	.66*	.37	.72	.02	.00	.00	.49*	N > P > D

Note each row represents a separate regression analysis in which the three MSS subscales were entered as simultaneous predictors of a PID-5 domain or facet. Comparisons of beta values based on 99.9% confidence intervals.

* $p < .001$ Note: medium effect sizes (f^2) in bold; large effect sizes in bold and italics

Table 5. Linear Regressions Examining Prediction of the Multidimensional Schizotypy Scale Subscales by the PID-5 Domains ($n = 1342$)

	MSS Positive Schizotypy	MSS Negative Schizotypy	MSS Disorganized Schizotypy
<u>Predictors:</u>	β	β	β
<u>PID-5 Domains</u>			
Negative Affect	.07	-.21*	.07
Detachment	-.07	.76*	.09*
Antagonism	-.01	.02	-.15*
Disinhibition	-.05	-.02	.49*
Psychoticism	.77*	.09*	.28*
Total R ²	.56*	.58*	.52*

Note each column represents a separate regression analysis in which the five PID-5 domains were entered as simultaneous predictors of a MSS subscale.

* $p < .001$

Note: medium effect sizes (f^2) in bold; large effect sizes in bold and italics