Development of the Thought Disorder Measure for the Hierarchical Taxonomy of Psychopathology

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Abstract

The Hierarchical Taxonomy of Psychopathology consortium aims to develop a comprehensive self-report measure to assess psychopathology dimensionally. The current research describes the initial conceptualization, development, and item selection for the thought disorder spectrum and related constructs from other spectra. The thought disorder spectrum is defined primarily by the positive and disorganized traits and symptoms of schizophrenia-spectrum disorders. The Thought Disorder Sub-Workgroup identified and defined 16 relevant constructs and wrote 10 to 15 items per each construct. These items were administered, along with detachment and mania items, to undergraduates and people with serious mental illness. Three hundred and sixty-five items across 25 scales were administered. An exploratory factor analysis of the scale scores suggested a two-factor structure corresponding to positive and negative symptoms for two samples. The mania scales loaded with the positive factor, while the detachment scales loaded with the negative factor. Item-level analyses resulted in 19 preliminary scales, including 215 items that cover the range of thought disorder pathology, and will be carried forward for the next phase of data collection/analysis.

Keywords

schizophrenia, psychosis, schizotypy, schizotypal personality, exploratory factor analysis, confirmatory factor analysis

The Hierarchical Taxonomy of Psychopathology (HiTOP) is a consortium of nosologists that seeks to improve upon traditional psychiatric diagnostic systems (Kotov et al., 2017). The HiTOP system conceptualizes psychopathology dimensionally and hierarchically, which addresses several common problems with psychiatric taxonomy, including excessive comorbidity, arbitrary cut points between disorder and normality, heterogeneity of disorders, unreliable diagnoses, and the existence of subthreshold cases (Chmielewski et al., 2015; Krueger et al., 2018; Markon et al., 2011; Walton et al., 2011). HiTOP is organized into six spectra, including thought disorder, detachment, internalizing, antagonistic externalizing, disinhibited externalizing, and somatoform. Although there are self-report measures for most of the constructs included in HiTOP (see https://hitop.unt.edu/clinical-tools/hitop-friendly-measures), they are not comprehensive. HiTOP established the Measurement Development Workgroup, further divided into a subworkgroup for each spectrum, to develop a comprehensive measure that will be useful both for clinical work (Ruggero et al., 2019) and research (Conway et al.,

2019). The current research describes the Thought Disorder Sub-Workgroup's contribution to Phase 1 of this multiphase project. The primary goal of Phase 1 was to develop and refine an item pool for further refinement in Phase 2.

The thought disorder spectrum in HiTOP is part of a broader "psychosis superspectrum," a high-order

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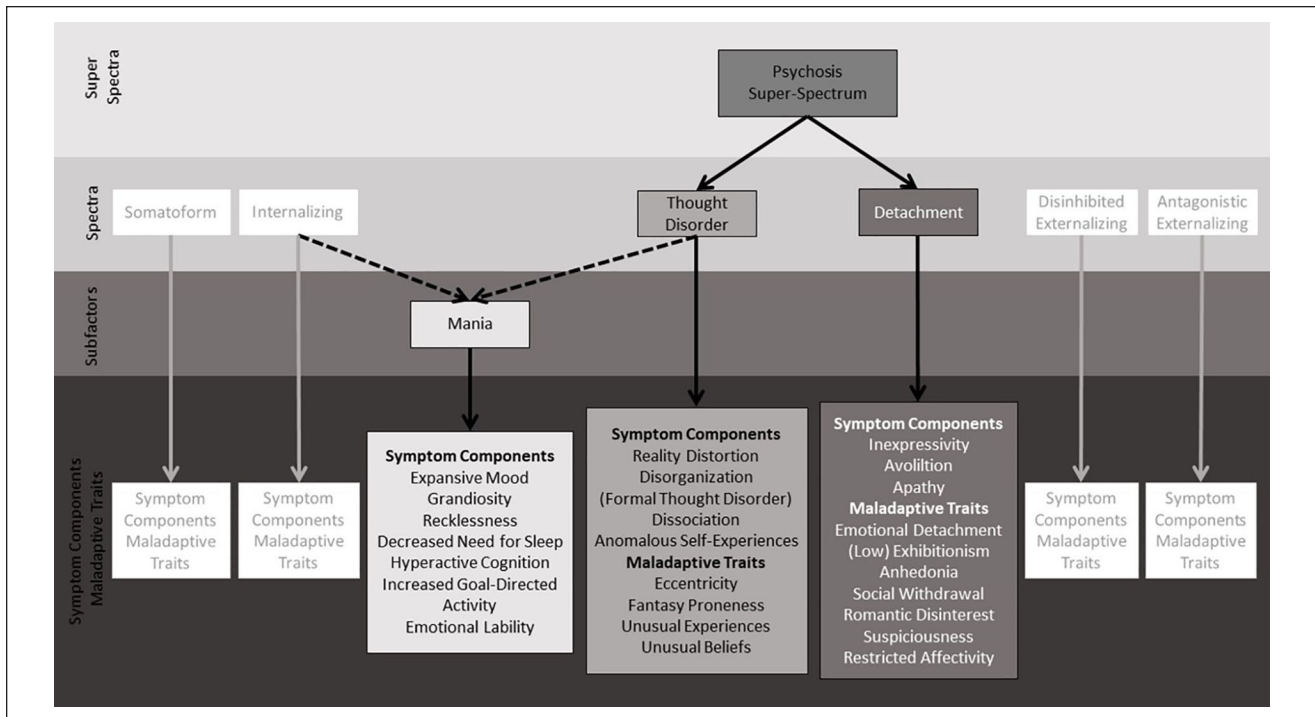[8]Duke University, Durham, NC, USA
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Figure 1. The placement of the thought disorder spectrum and psychosis superspectrum within the Hierarchical Taxonomy of Psychopathology.

construct that includes the detachment spectrum and potentially mania traits and symptoms (Kotov et al., 2020; see Figure 1). A long line of research has established that schizophrenia-spectrum disorders such as schizophrenia, schizoaffective disorder, and schizotypal personality disorder have at least three dimensions including positive, negative, and disorganized traits and symptoms (Andreasen & Olsen, 1982; Buchanan & Carpenter, 1994; J. S. Strauss et al., 1974). Within HiTOP, positive and disorganized traits and symptoms comprise the core of the thought disorder spectrum, while negative symptoms are mapped on to the detachment spectrum. All three dimensions were included in the current analyses.

Another group of symptoms that overlap with thought disorder are manic symptoms, which have been conceptualized to be a part of both the thought disorder spectrum (Caspi et al., 2014; Keyes et al., 2012; Kotov et al., 2011) and the internalizing spectrum (Wolf et al., 1988). However, empirical evidence is mixed as to whether manic symptoms are more strongly related to thought disorder or internalizing psychopathology and the HiTOP model provisionally includes mania as cross=loading on both spectra (Kotov et al., 2017). In the current project, mania items were defined and written by the Internalizing Sub-Workgroup. Although the core of the thought disorder spectrum of HiTOP only directly includes positive and disorganized traits and symptoms, the current research also includes

mania and negative traits and symptoms in order to ensure that these constructs are adequately covered in the items carried forward to the next phase of this scale development project.

Like the other HiTOP spectra, the thought disorder spectrum exists on a continuum from normal personality traits to maladaptive schizotypal traits to full-blown thought disorder symptoms such as delusions, hallucinations, and disorganization (Cicero et al., 2019; Claridge & Beech, 1995; Kendler et al., 1993; Linscott & Van Os, 2013; van Os et al., 2009). Categorical diagnoses such as schizophrenia and schizotypal personality disorder represent elevations on both the thought disorder and detachment spectra, while diagnoses such as schizoid or avoidant personality disorder may represent only elevations on the detachment spectrum (Kotov et al., 2020).

Factor analytic studies have typically defined thought disorder by positive and disorganized symptoms of schizophrenia-spectrum disorders, including reality distortion and disorganization (de Jonge et al., 2018; Wright et al., 2013; Wright & Simms, 2015). Reality distortion includes hallucinations (sensory or perceptual experiences in the absence of external stimuli), delusions (fixed false beliefs that are not consistent with an individual's culture or subculture), and cognitive distortions. Previous structural analyses have found that delusions and hallucinations tend to form a single factor (Kotov et al., 2016), and that this factor extends

into maladaptive personality traits (Boyette et al., 2013; Cicero et al., 2019; Compton et al., 2015). The construct of thought disorder can be distinguished from formal thought disorder, which is related to disorganization of thought and speech (Andreasen, 1979). Within HiTOP, formal thought disorder is specified as a symptom component (disorganization) that is included in the thought disorder spectrum (Kotov et al., 2017). Disorganization is manifested verbally by tangentiality, derailment, circumstantiality, and incoherent speech. This may reflect underlying thought processes that are illogical, circumstantial, or overly concrete.

In addition to reality distortion and disorganization, dissociation has long been linked to schizophrenia-spectrum disorders (Ashton et al., 2012; Kilcommons & Morrison, 2005; Koffel & Watson, 2009; Renard et al., 2017). Dissociation refers to a disconnection from self (depersonalization), perception (derealization), past events and memories (amnesia), and current physical surroundings (absorption). On a personality level, dissociation may be similar to fantasy proneness, in which the individual's attention is absorbed in imagination and daydreams to the point of a lack of attention to reality.

In addition to these symptoms, personality components related to positive symptoms of the schizophrenia spectrum have been described with a number of different terms, including psychoticism, positive schizotypy, and cognitive-perceptual schizotypal personality, among others (Claridge & Beech, 1995; Kwapil & Barrantes-Vidal, 2015; Lenzenweger, 2010; Meehl, 1962). Within HiTOP, these components are defined as eccentricity, unusual beliefs, and unusual experiences. Eccentricity encompasses strange behavior, appearance, speech, and thoughts, and is sometimes referred to as peculiarity or oddity. Unusual beliefs are similar to magical ideation, referring to unfounded and irrational thoughts, beliefs, and ideas about the world. Unusual experiences are similar to perceptual aberrations, and include other experiences such as aberrant salience and detachment from reality (Widiger & Crego, 2019; Wright & Simms, 2014).

Factor analytic studies have illuminated a number of subfactors within negative symptoms of the schizophrenia spectrum (Blanchard & Cohen, 2006). For example, the National Institute of Mental Health Consensus Development Conference identified five domains of negative symptoms, including blunted affect, alogia, anhedonia, avolition, and asociality (Kirkpatrick et al., 2006), and other work has verified this factor structure (G. P. Strauss et al., 2018). At the same time, studies examining the explanatory power of these constructs suggest that blunted affect and alogia might be both explained by a broader "inexpressivity factor" and anhedonia, avolition, and asociality may be similarly related to each other under the umbrella of "avolition" (Kotov et al., 2016; Marder & Galderisi, 2017; Richter et al., 2019; G. P. Strauss et al., 2013). Inexpressivity can be defined as

deficits in the expression or experience of affect or less of a reaction to stimuli that would normally cause an emotional response. Some manifestations of inexpressivity include poor eye contact, limited use of gesturing, lack of vocal intonation, and blunted facial affect. Avolition refers to a lack of activity, and may be manifested by the individual remaining physically inactive for long periods of time. This construct also includes lack of motivation, lack of interest in interpersonal relationships, and inattention to social stimuli. Individuals with high avolition may not be motivated to maintain basic hygiene.

Maladaptive personality components related to negative symptoms are represented primarily on the detachment spectrum of HiTOP. Like psychoticism, these constructs form a separate dimension, which may be consistent with introversion (Forbes et al., 2017; Markon, 2010; Wright & Simms, 2015). Within the schizophrenia-spectrum literature, this construct is also referred to as negative schizotypy or interpersonal schizotypal personality (Campellone et al., 2016; Kwapil & Barrantes-Vidal, 2015; Raine et al., 1994). These components include emotional detachment (deficits in the expression, experience, and intensity of emotions), social withdrawal (lack of involvement in social activities due to a genuine disinterest in interaction with people), and romantic disinterest (lack of interest in sex, intimate relationships, and eroticism; Crego & Widiger, 2016; Wright & Simms, 2014).

The primary goal of the current research was to develop a set of preliminary scales covering the psychosis superspectrum that can be carried forward for the second phase of scale development. As can be seen in Figure 2, this was a multistep process that included identifying relevant constructs, developing conceptual definitions, generating items for each construct, data collection, and several stages of item refinement. Ultimately, a set of preliminary scales was created that will be finalized in future phases of this scale development project.

Method

Participants

As shown in Supplemental Table 1 (available online), there were three groups of participants in this study, including 250 undergraduates from the University of Hawaii at Manoa, 432 undergraduates from the University of California, Irvine, and 188 participants recruited from the Stony Brook site of the Genomic Psychiatry Cohort (Pato et al., 2013). Inclusion criteria for the Genomic Psychiatry Cohort study included a diagnosis of schizophrenia, schizoaffective disorder, or bipolar disorder, no known medical etiology for psychosis, age 18 or older, and a capacity to provide informed consent. Undergraduates at the University of Hawaii at Manoa and the University of
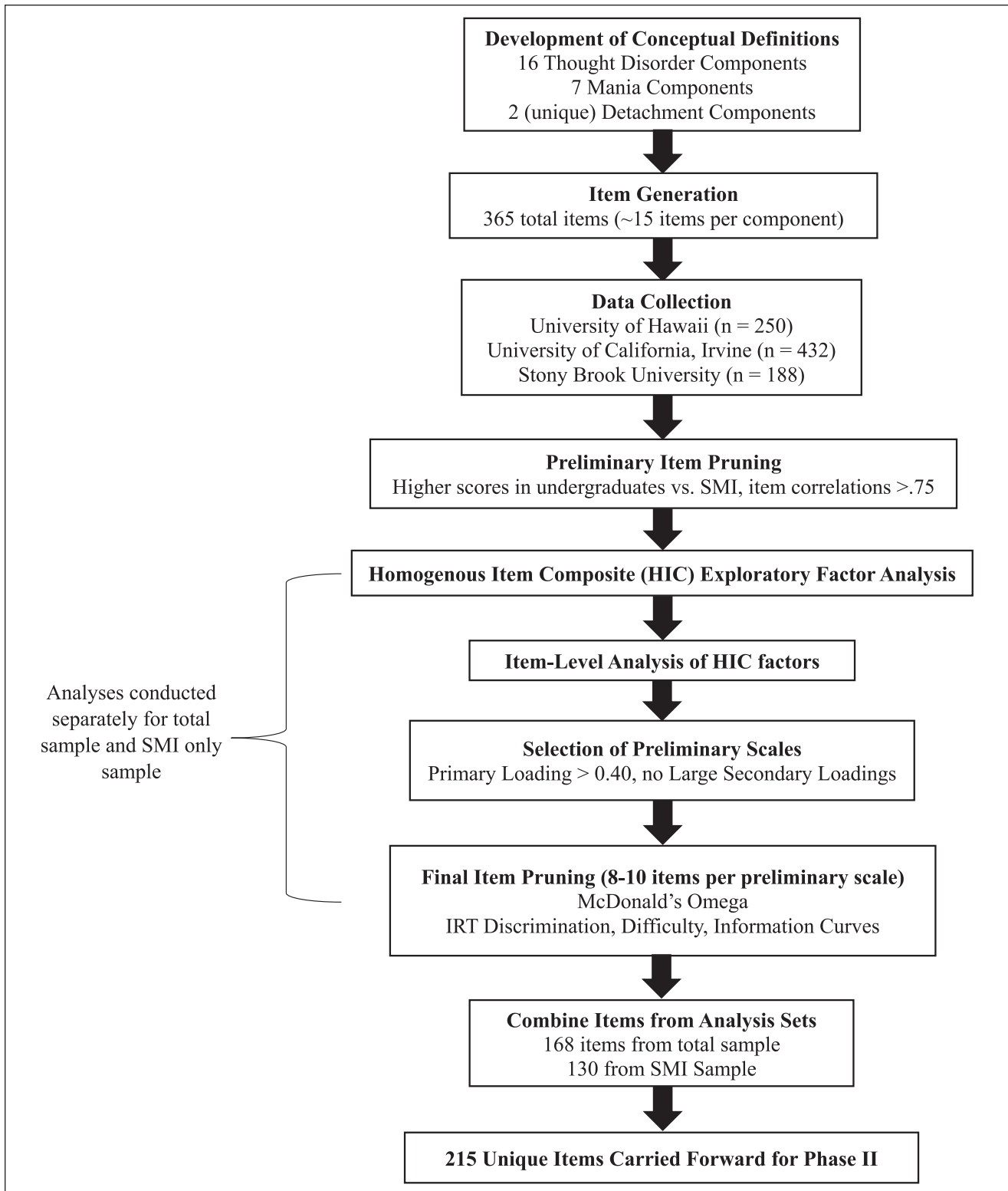
Figure 2. Flow chart of item conceptualization, development, and selection.

California, Irvine, participated in exchange for partial completion of a course requirement. All participants provided informed consent, and the study was approved by the University of Hawaii at Manoa, University of California, Irvine, and Stony Brook University institutional review boards. The total sample size of 870 was adequate for the initial data analyses, including classical test theory, exploratory factor analysis (EFA), and item-response theory analyses (Clark & Watson, 2019). The sample was a mix of patients and nonpatients to ensure that there was adequate representation of all levels of severity. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Development of Conceptual Definitions

Prior to beginning this project, the workgroup chairs developed a plan including the development of conceptual definitions, generation of items, data collection, and data analyses. As can be seen in Figure 2, the first step in developing the Thought Disorder Spectrum measure was to develop a comprehensive list of constructs for which to write items (i.e., casting a wide nomological net; Clark & Watson, 1995, 2016). The group was liberal in defining multiple, similar constructs, because adding constructs during the next phase of scale development is more difficult than removing constructs that either do not belong or are found to be redundant with other included constructs. Moreover, inclusion at this stage does not force the construct to be in the final measure, but provides the opportunity for it to be, should it be empirically justified. Workgroup members reviewed the original theoretical papers from the HiTOP consortium to identify constructs that comprise the thought disorder spectrum. Second, workgroup members put together an exhaustive list of current self-report and interview measures for thought disorder constructs. We reviewed the content of these measures to ensure that all constructs included within them were represented in our list of constructs.

Although much of this work relied on existing measures and traditional diagnostic systems such as the *Diagnostic and Statistical Manual of Mental Disorders* and International Classification of Diseases, we also included constructs not captured by either system. For example, anomalous self-experiences are subjective disturbances in the experience of the self, and have a long history in psychiatric phenomenology, despite not being included in any major nosology (Park & Nasrallah, 2014; Sass & Parnas, 2003). It is unclear from previous research if anomalous self-experiences are distinct from other psychosis components, including positive, negative, and disorganized symptoms (Sass et al., 2018). We decided to include this construct with the original conceptual definitions and determine empirically whether the

written items form their own factor or load along with other items.

Third, workgroup members suggested components for inclusion in the scale. All components nominated by workgroup members were included in Phase 1 of the data collection. Fourth, workgroup members collaboratively wrote conceptual definitions for each of the candidate components in a shared document, which was iteratively edited, with the final definitions approved by the subworkgroup chair (see Supplemental Table 2, available online, for a list of original conceptual definitions).

Item Generation

Homogeneous Item Composites (HICs) were created for each of the conceptual definitions. Each workgroup member wrote items for each of the 16 candidate constructs until there were approximately 15 items for each HIC. Items were written with a response format that was standardized across all workgroups (0 = not at all, 1 = a little, 2 = moderately, and 3 = a lot). Thought Disorder Sub-Workgroup members reported that the behavioral orientation of the format was especially useful for these constructs for several reasons. Issues of what is "true" are complicated in psychotic disorders, and people often lack insight and have ambivalence about whether their experiences are a part of them or something they experience. For example, this format enabled us to write items such as the inexpressivity item, "People told me that I do not show emotions," which participants may answer objectively regardless of whether they believe it is "true" or have insight into the symptom. The subworkgroup chair and a smaller section of the subworkgroup reviewed the items, removed redundant items, and ensured that all items were written in a similar style, which included verb tense, removal of qualifiers, and edits for clarity. Items were written to span the entire range of the construct from clinical to subclinical traits and symptoms including normal personality where appropriate. Items were written for both ends of constructs that were defined as bipolar, but no items were written with negative wording. For example, "I thought people were generally trustworthy" was a reverse-coded suspiciousness item, but "people were not out to get me" was rejected.

As mentioned, the psychosis superspectrum also includes components on the detachment spectrum of HiTOP. Members of the Detachment and Thought Disorder Sub-Workgroups have different areas of expertise and may define and operationalize these constructs in different ways. For the sake of content validity, both groups independently developed conceptual definitions and generated items for HICs. For example, the Thought Disorder Sub-Workgroup wrote items that extended into the more severe end of suspiciousness (i.e., persecutory delusions) than the

Detachment Sub-Workgroup. Prior to data collection, the chairs of both subworkgroups compared conceptual definitions and determined that both groups defined five overlapping HICs, including (low) exhibitionism, anhedonia, social withdrawal, romantic disinterest, and suspiciousness. All unique items for these five HICs, whether originally written for the detachment or thought disorders domain, were included with the thought disorders data collection. Apathy and restricted affectivity were defined by the detachment group, but not specifically by the thought disorder group, but these HICs were included in the thought disorder Sub-Workgroup's data collection. Similarly, the nine mania HICs written by the Internalizing Sub-Workgroup were also included in the thought disorder data collection. Figure 2 provides an overview of all of the steps in the current research.

Results

First, for each of the 365 items included in the item pool, we calculated Cohen's D contrasting item scores between the undergraduates (combined from both the University of Hawaii at Manoa and the University of California, Irvine) and participants with serious mental illness. Given the differences in psychopathology severity between the groups, we expected to find that all of the items would have higher mean scores in the serious mental illness group compared with undergraduates. Items with the opposite pattern (i.e., higher scores in undergraduates), were considered for removal based on item content. Overall, seven items were removed for having higher scores in the college student than the serious mental illness sample. For example, the item "I put on a costume for no particular reason" was higher in undergraduates and is likely related to relatively normative undergraduate activities and not fantasy proneness as originally intended.

Subsequent analyses were completed in the combined student and serious mental illness samples, which includes the entire range of the spectrum. We also performed a sensitivity analysis, duplicating the analyses in only the serious mental illness sample. We included this supplemental analysis to ensure that any items functioning well in the serious mental illness sample, but not in the broader sample, would be retained for Phase 2 data collection.

Total Sample

The item responses were categorical (0 = not at all, 1 = a little, 2 = moderately, and 3 = a lot). We chose a 4-point response option scale, as opposed to a dichotomous scale because 4-point scales have been shown to have higher precision and to require fewer items (Simms et al, 2019). We first calculated polychoric correlations among items in M*plus* Version 8.4 (Muthén & Muthén, 1998-2021). We

removed one item from each pair that had a correlation greater than $r = .75$. Of the item pair, we removed that item that had the most correlations $r > .75$ with other items. If the two items had the same number of high correlations with other items, we removed the item with the highest interitem correlation. This was done to ensure that high correlations among a small number of items did not unduly affect the factor structure of the data, and to ensure adequate variability in the final item set. This resulted in 14 items being removed.

In the next step of the analysis, we investigated the factor structure of the HICs. We did this by calculating HIC scores (sum of the items within each HIC) for each individual in the sample. HIC scores were used as the basis for an EFA with Maximum Likelihood Estimation with robust standard errors (MLR) with Geomin rotation in M*plus* Version 8.4 (Muthén & Muthén, 1998-2021). A parallel analysis suggested a two-factor structure, which roughly corresponded to HICs assessing "positive" and "negative" symptoms. Inexpressivity and (low) exhibitionism HICs did not load on either factor above 0.50 and were analyzed separately (see Supplemental Table 3, available online, for the factor loadings).

The goal of the next step of data analysis was to generate preliminary scales, trimming each construct to approximately 8 to 10 items. We conducted item-level EFAs for the factors identified in the previous step using weighted least squares mean and variance adjusted estimation (WLSMV) and Geomin rotation. We used WLSMV in this stage of the analysis because the items are categorical on a 0-3 scale. A parallel analysis of the "positive" factor suggested that a maximum of 10 factors could be extracted. However, no items had their primary loading on the 10th factor. Thus, a nine-factor model was extracted. In this phase of the data analysis, items were selected for each preliminary scale if they had a primary loading greater than or equal to .40 on a factor, and no cross-loadings within .20 of the primary loading.

The first factor was large, with 60 items that were mostly written for reality distortion, unusual beliefs, unusual experiences, and dissociation. This factor is consistent with previous research suggesting that delusions and hallucinations load on a single factor that is continuous with positive schizotypy/psychoticism (Cicero et al., 2019; Kotov et al., 2016). To determine if this factor could be broken down further, we conducted a parallel analysis for these items, which suggested a unidimensional structure. If two factors were extracted, all the items had their primary loading on the first factor. However, we decided to extract multiple factors because these constructs are central to HiTOP's conceptualization of thought disorder, and clinically important. For example, delusions in the absence of hallucinations (as in Capgras or Cotard's delusions) represent an important form of psychopathology. We therefore created a

preliminary scale for delusions based on reality distortion items written for delusions and unusual beliefs (19 items) and a preliminary scale for hallucinations with reality distortion items written for hallucinations and unusual experiences (19 items). The remaining items on this factor were assigned to a third preliminary scale, composed primarily of items written for dissociation and anomalous self-experiences (22 items). The second factor, "disorganization," included 13 items mostly written for disorganization and hyperactive cognition. The third factor, "eccentricity," had eight total items, including six written for eccentricity, one for disorganization, and one for unusual beliefs. The fourth factor, "suspiciousness," included 14 items, all written for the construct of suspiciousness. The fifth factor, "fantasy proneness," included 10 items all written for fantasy proneness. The sixth factor, "grandiosity," had eight items, including five written for grandiosity, two for increased goal-directed activity, and one for reality distortion. The seventh factor, "expansive mood/decreased sleep," had 10 items, including six written for decreased need for sleep and four for euphoric mood/excessive energy. The eighth factor, "recklessness," only had four items with loadings over .40. The next four highest loading items (loadings .35-.39) were retained, which resulted in eight items, all originally written for recklessness. Finally, the ninth factor "emotional lability," included seven items originally written for emotional lability.

A parallel analysis for the negative factor suggested nine factors should be retained. However, a nine-factor, eight-factor, seven-factor, six-factor, and five-factor model each produced a solution in which at least one factor had no items. Thus, we retained four factors. The first factor, "restricted affectivity," had 17 items mostly originally written for restricted affectivity and emotional detachment. The second factor included 29 items. A second EFA was run on these 29 items, and a parallel analysis suggested that two factors could be retained. These factors included "anhedonia," which comprised 20 items, mostly written for anhedonia and apathy and "avolition," which comprised six items, four written for avolition and two for apathy. The third factor, "social withdrawal," had 13 items, mostly originally written for social withdrawal. Finally, the fourth factor "romantic disinterest," had 10 items, mostly written for romantic disinterest.

In the next step, each preliminary scale identified in the EFAs was fit to a unidimensional two-parameter IRT model. For preliminary scales with more than 10 items, items were removed based on their discrimination parameters, difficulty parameters, item information curves, and McDonald's ω values. Items were selected for highest discrimination, smallest reduction in McDonald's ω, and wide range of difficulty parameters. Items were removed iteratively and parameters were reexamined after each item was removed. In some cases, additional items were selected for retention

if they were deemed to be of central importance for content validity. This resulted in 18 preliminary scales, each with between 6 and 13 items (see Supplemental Table 4, available online).

People With Serious Mental Illness

Like in the total sample, we first calculated polychoric correlations for each pair of items and removed one of each pair with a correlation $r > .75$ following the same procedure. We then conducted a parallel analysis for the scale scores which suggested a two-factor structure. Two factors were extracted using MLR with Geomin rotation, which roughly corresponded to a "positive" factor and a "negative" factor. Three scales did not meet the threshold of a .50 loading on either factor and were analyzed separately (see Supplemental Table 3, available online).

We then ran item-level factor analyses on the scales that loaded on the positive factor. A parallel analysis suggested seven factors. However, the seven-factor model resulted in no items with primary loadings on the smallest factor and only one item on the second-smallest factor. The same was true of the six-factor model. In a five-factor model, only one item had a primary loading on the fifth factor. Thus, four factors were extracted with WLSMV and Geomin rotation.

The first factor had 30 items, including most of the items written for reality distortion, unusual beliefs, unusual experiences, dissociation, and anomalous self-experiences. A parallel analysis of these 30 items suggested a one-factor solution; if more than one factor was extracted, no items had their primary loading on the second factor. Like in the total sample, we manually created a "hallucinations" preliminary scale with the unusual experiences items and reality distortion items written for hallucinations, and a "delusions" preliminary scale with the unusual beliefs items and the reality distortion items written delusions. The remaining items on this factor formed a "dissociation" preliminary scale.

The second factor, "disorganization," included 25 items related to trouble with cognition that were originally written for a number of other constructs, including disorganization, dissociation, hyperactive cognition, and anomalous self-experiences, among others. The third factor, "grandiosity," was composed of 10 items originally written for grandiosity as well as grandiose beliefs and delusions (part of unusual beliefs and reality distortion). The fourth factor included 14 items primarily written for euphoric mood/excessive energy and decreased need for sleep, which we termed "expansive mood/decreased sleep."

A parallel analysis for an item-level EFA of the negative factor suggested six factors. However, no items loaded on the smallest factor if six factors were extracted. The same was true of the five-factor model. Thus, we extracted four factors. The first factor, "anhedonia," included 28 items

written for apathy, anhedonia, and avolition. The second factor, "social withdrawal," included 25 items that were primarily written for social withdrawal. The third factor, "interpersonal avoidance," included 12 items related to interpersonal avoidance that were originally written for several constructs, including emotional detachment, romantic disinterest, social withdrawal, and restricted affectivity. Finally, the fourth factor, "romantic disinterest," included 10 items that were primarily written for romantic disinterest. The items for (low) exhibitionism, inexpressivity, and suspiciousness were carried over as separate preliminary scales for the next phase of data analysis.

Each preliminary scale was then fit to a unidimensional two-parameter IRT model and items were iteratively removed based on their discrimination parameters, difficulty parameters, item information curves, and McDonald's ω values, so that each preliminary scale had 10 or fewer items. To ensure that the preliminary scales adequately measured the higher range of the scale, the two items with the highest difficulty levels for the highest response options were retained. Items were removed based on lowest information, lowest discrimination parameters, and items that either increased McDonald's ω or decreased ω the least of all remaining items. These three strategies typically suggested the same item for removal across iterations. Items were then reviewed by workgroup members, and some items that were marked for removal were retained instead if they were deemed necessary for content validity. As a last check of Phase 1 on content validity, scales and items were reviewed by the subworkgroup chairs for each of the other spectra. This resulted in 13 preliminary scales, each including between eight and 14 items (see Supplemental Table 4, available online).

Finally, we merged the items from the two sets of analyses into a single item set to carry forward to Phase 2. Overall, 130 items were selected in the serious mental illness sample and 168 items were selected in the combined sample. Of these items, 83 were common to both samples. This results in 19 unique preliminary scales (see Table 1) and 215 unique items (see Supplemental Table 5, available online).

Discussion

The current research describes Phase I item development, data collection, and analyses for the thought disorder spectrum of HiTOP. The thought disorder spectrum is part of the broader psychosis superspectrum, which comprises positive symptoms including formal thought disorder, but also mania and elements of detachment. A list of 25 components related to the thought disorder spectrum of HiTOP was developed and conceptual definitions were written for each construct. The original overinclusive item pool, which contained 365 items, was organized into 25 HICs representing

those 25 components. An EFA of these 25 HICs suggested a two-factor structure in analyses with both the total sample and in a sensitivity analysis of only those with serious mental illnesses. Based on item-level analyses, 18 total preliminary scales were created in the total sample analyses, and 13 in the psychosis only sample, for a total of 19 unique preliminary scales. Two hundred and fifteen items comprised these preliminary scales, and are ready for Phase 2 data collection and analyses.

The ultimate goal of the current research was to create 8-to-10-item preliminary scales for all the constructs relevant to the thought disorder spectrum to be carried forward to Phase 2 of measurement development. Of the thought disorder spectrum constructs, Phase 1 data analyses ended with preliminary scales for each of the starting constructs with the exception of unusual beliefs, unusual experiences, anomalous self-experiences, and emotional detachment. The EFA of the original scales suggested a positive and negative factor in both sets of analyses. In both sets of analyses, the first item-level factor was a large group of items that included primarily reality distortion, unusual beliefs, unusual experiences, dissociation, and anomalous self-experience items. This finding is consistent with previous work finding that delusions and hallucinations load on a single factor (Kotov et al., 2016), unusual beliefs and experiences form a single factor (Fonseca-Pedrero et al., 2018; Kwapil et al., 2008; Raine et al., 1994; Stefanis et al., 2004), and dissociation can be difficult to discriminate from positive traits/symptoms (Ashton et al., 2012; Giesbrecht et al., 2007; Watson, 2001). It is also consistent with theoretical research that suggests positive symptoms and psychoticism/positive schizotypy share a common continuum (Barrantes-Vidal et al., 2015; Linscott & van Os, 2010, 2013; Thomas et al., 2018; van Os et al., 2009; van Os & Linscott, 2012). Moreover, this finding is expected within the framework of HiTOP, which conceptualizes the thought disorder spectrum dimensionally. At the same time, we created rational preliminary scales from this larger factor for delusions, hallucinations, and dissociation as a conservative strategy to ensure that enough items for these central constructs were carried over into Phase 2 data collection and analyses. Analyses in Phase 2 will ultimately determine whether these preliminary scales should remain separate or be grouped into a single scale. Future analyses will also determine whether other scales with overlapping content (e.g., disorganization and eccentricity, which formed separate preliminary scales in the undergraduate but not serious mental illness samples) form a single scale or multiple scales.

Despite not being extracted and named as a preliminary scale, anomalous self-experience items are represented in the final item pool from Phase I. In both samples, the items written for anomalous self-experiences tended to form a factor shared with dissociation, which is consistent with previous

Table I. Conceptual Definitions of Thought Disorder Constructs.

Construct	Conceptual definitions
Dissociation	Person experiences disconnection from self (depersonalization), their perception (derealization), past events and memories (amnesia), and current physical surrounding (absorption). Rich imaginary/fantasy life that at times becomes the focus rather than immediate surrounding is part of the content as well as episodes of trance states and autonomous behavior. Example item: I felt that things around me were not real.
Delusions	Tendency to hold unfounded and irrational thoughts, beliefs, and ideas about the world, including beliefs about the powers of oneself, others, and objects to control and influence others and the physical world. Extreme forms involve fixed false beliefs that are held with conviction. Example item: I felt that people were trying to poison me.
Hallucinations	Sensations and perceptions that are inconsistent with the stimuli in one's environment (in all sensory modalities). Unusual experiences, including perceptual distortions that do not correspond to reality, aberrant salience, and dissociation or detachment from reality, one's surroundings, or oneself. Example item: I heard things that no one else could hear.
Disorganization	Verbal manifestations include tangentiality and derailment, and incoherent speech. Cognitive manifestations are illogical, circumstantial, or concrete thought processes. Behavioral manifestations are bizarre or stereotyped behavior or bizarre appearance. Example item: I struggled with organizing my thoughts.
Eccentricity	Odd, unusual, or bizarre behavior, appearance, and/or speech; having strange and unpredictable thoughts; saying unusual or inappropriate things. Example item: People told me that some of my thoughts were really strange.
Suspiciousness	A tendency to question the honesty, motives, fidelity, loyalty, and believability of others, as well as a general attitude of jaded negativity, especially a general disbelief in the integrity or professed motives of others. Prone to ascribing malicious intent to the behavior of others. Example item: I thought most people had hidden motives.
Fantasy proneness	Tendency to fantasize, daydream, and become fully engrossed in one's thoughts and experiences, sometimes to the extent of becoming distracted and losing sight of reality. Example item: I was prone to daydreaming.
Grandiosity[a]	This construct involves feelings of grandiosity/delusions of grandeur in which the individual feels that he/she can do remarkable things that cannot be achieved by others. Related to this, the affected individual is overly optimistic and self-confident, and feels capable of doing things that actually are beyond his/her ability. They may also have extreme ambitions. Example item: I felt that I was someone very important or powerful.
Expansive mood/ decreased sleep[a]	This construct is a combination of two mania constructs: Euphoric Mood/Excessive Energy and Decreased Need for Sleep. Euphoric Mood/Excessive Energy includes elevated mood states in which the individual feels extremely "up," elated, euphoric, and "on top of the world." This elevated mood state also is associated with feeling "hyper" and experiencing excessive levels of energy and activation. At the behavioral level, the individual may display a level of energy and activity that others can't match. The individual may also report not feeling sleepy or tired, despite sleeping less than usual. The individual feels little need to sleep, and may in fact go for days without sleep. Example Item: I was much more talkative than usual.
Recklessness[a]	This construct concerns risky, reckless reward-seeking behavior that causes problems for the affected individual. Specific examples of risky pleasure-seeking behavior include reckless spending (e.g., shopping sprees), risky driving, and hypersexual behavior. The person may feel invincible, as if nothing can hurt them. Example item: I spent money recklessly.

(continued)

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Table 1. (continued)

Construct	Conceptual definitions
Restricted affectivity[b]	Limited emotional expression and experience, including experience and expression of joy, warmth, and/or emotional connection. Example item: I was very limited in emotionality.
Anhedonia	General deficits in positive emotions and energy levels. High scorers report difficulties experiencing joy and excitement, show little interest in things, and exhibit lethargy, lassitude, and psychomotor slowness. Example item: I found that I did not enjoy anything I did.
Avolition	Physically inert, manifest in long periods of time spent without any spontaneous activity. Individuals may lack motivation to maintain hygiene and engage in self-care. Avolition also encompasses a lack of motivation to engage in productive activities, interpersonal relationships, and inattention to socially salient stimuli. Example item: I spent a lot of time just sitting around.
Social withdrawal	Avoidance of interpersonal interactions and a preference for being alone that is guided by a genuine disinterest in interacting with others. Example item: I was happiest when I was alone.
Romantic disinterest	General lack of interest in, desire for, and enjoyment of sex, eroticism, and interpersonal intimacy. Example Item: I felt that I watned to share my life with a partner.
(Low) Exhibitionism	Those with low exhibitionism do not enjoy being the focus of attention and try to avoid being noticed. They shun the limelight and behave in ways that will not draw the attention of others Example item: I didn't like being the center of attention.
Emotional lability[a]	This construct involves sudden, rapid, dramatic mood swings. The individual's mood state may change significantly (e.g., from happy to irritable, or from happy to sad) quickly and for no apparent reason. High scorers report that their emotions are unstable and unpredictable. They are "emotional"; their emotional states tend to be intense and are easily aroused, and may be out of proportion to events and circumstances. Example item: I had sudden, intense mood swings.
Inexpressivity	Having affect that is unreactive to stimuli that would normally elicit an emotional response. This may be reflected in limited spontaneous gesturing, poor eye contact, alogia, limited vocal intonation, as well as a limited range and incidence of facial expressions. Example item: People told me that I do not show emotions.
Intimacy avoidance	General lack of interest in close social interactions, not limited to romantic relationships. Example item: I had no close relationships in my life.

[a]Definition developed by the Internalizing Workgroup. [b]Definition developed by the Detachment Workgroup

research suggesting that anomalous self-experiences and dissociation are similar constructs with overlapping content (Sass et al., 2018). Between both analyses, six unique items related to anomalous self-experiences were retained. Similarly, items written for emotional detachment are also represented in the final item pool from Phase 1. These items tended to load along with items written for romantic disinterest, social withdrawal, and restricted affectivity. Between both samples, three items originally written for emotional detachment were retained. Thus, the final item pool appears to adequately represent all of the original constructs.

One limitation of the current research is that the sample included approximately 80% undergraduates. Compared with the serious mental illness sample, these participants were younger, had a more restricted age range, and were more likely to be female. At the same time, the undergraduate samples were more diverse in terms of race and ethnicity. These two samples were included to assess a range of symptom severity, but the differences in demographic factors may also contribute to differences in scores. The analyses in Phase 2 will continue to evaluate the items in general population, clinical, and serious mental illness samples.

The observed factor structure was remarkably similar between the total sample and serious mental illness groups. Both analyses yielded a two-factor structure that roughly corresponds to positive and negative symptoms. The only difference between the two sets of analyses was that suspiciousness loaded above 0.5 on the positive factor in the full sample (loading = .51), but failed to meet this cutoff in the psychosis only sample (loading = .48). Thus, the suspiciousness items were analyzed separately in the serious mental illness sample, but along with the positive symptom items in the total sample. In both cases, the final suspiciousness preliminary scale was composed only of items written for suspiciousness. This finding may also help understand the placement of suspiciousness within the HiTOP model. The original model tentatively includes suspiciousness on the detachment spectrum, which is consistent with some previous research (Krueger et al., 2011), but other research has shown that it belongs with thought disorder (Fonseca-Pedrero et al., 2018; Kendler et al., 1991; Raine et al., 1994) or antagonism (Lynam & Widiger, 2001; Widiger et al., 2002). Future research will include the selected suspiciousness items and determine where it fits best within the broader model.

In both sets of analyses, we extracted similar romantic disinterest, social withdrawal, and anhedonia preliminary scales. However, in the serious mental illness sample, we extracted an intimacy avoidance preliminary scale (composed of emotional detachment, romantic disinterest, social withdrawal, and restricted affectivity items), while in the total sample, we extracted a restricted affectivity preliminary scale that included eight items written for restricted affectivity and two emotional detachment items. Moreover,

the anhedonia, apathy, and avolition items mostly loaded on a single preliminary scale we labelled "anhedonia" in the serious mental illness sample, but we were able to discriminate an avolition preliminary scale from the anhedonia preliminary scale in the total sample. The differences between the samples may be related to the increased variance of combining the relatively healthy college students with patients with serious mental illness.

With respect to negative components, the Thought Disorder Sub-Workgroup started with two broad negative symptoms, including inexpressivity and avolition, as well as components of emotional detachment, anhedonia, social withdrawal, romantic disinterest, and low (exhibitionism) and restricted affectivity and apathy items developed by the Detachment Sub-Workgroup. The result was preliminary scales for inexpressivity, avolition, anhedonia, social withdrawal, romantic disinterest, intimacy avoidance, (low) exhibitionism, and restricted affectivity. Like positive symptoms, the measure from Phase I appears to contain preliminary scales for all of the original constructs.

As mentioned, the placement of mania within the broader structure of psychopathology is controversial (Kotov et al., 2017), and the results for the mania items may help further understand the relation between thought disorder and manic symptoms. In the scale-level EFAs, the mania scales (i.e., grandiosity, euphoric mood/excessive energy, hyperactive cognition, emotional lability, recklessness, increased goal directed activity, and decreased need for sleep) all loaded with the positive psychosis symptom factor as opposed to comprising a separate factor or loading with the negative psychosis symptom factor. This is consistent with previous work showing that mania loads along with thought disorders in structural analyses (Caspi et al., 2014; Kilcommons & Morrison, 2005). However, other work has found that mania belongs on the internalizing spectrum, and internalizing items were not included with this data collection. Both sets of analyses resulted in a decreased need for sleep/expansive mood preliminary scale and a grandiosity preliminary scale, with similar item content. The combined sample analyses also resulted in recklessness and emotional lability preliminary scales, which were entirely composed of items written for the same constructs. Regarding the other mania items, six of the seven hyperactive cognition items were retained on the disorganization and decreased need for sleep/expansive mood preliminary scales, which may be in part explained by the overlap between pressured speech, racing thoughts, and disorganized thinking and speech. Interestingly, none of the recklessness items were retained in the serious mental illness sample, but nine were retained on a recklessness preliminary scale composed entirely of recklessness items in the total sample.

Thought disorder and detachment constructs have been measured with both self-report and clinical interviews in previous research. Most previous scales were designed

either to measure frank psychosis (e.g., interview ratings like the SAPS; Andreasen, 1982; SANS; Andreasen, 1984; and PANSS; Kay et al., 1987; etc.) or personality traits of schizotypy/psychoticism (e.g., the Multidimensional Schizotypy Scales; Kwapil et al., 2018; Schizotypal Personality Questionnaire; Raine, 1991; etc.). Interview ratings appear to be used more in clinical samples, while self-reports often are used in general population samples (Mason, 2015); research rarely combines both types of assessments. There are several reasons why self-report questionnaires may be especially difficult for thought disorder constructs. First, people with high scores on this spectrum (e.g., people with *Diagnostic and Statistical Manual of Mental Disorders* diagnoses of schizophrenia or schizoaffective disorder) may have relatively lower insight into their psychopathology compared with people with low scores or people with higher scores on other spectra (Bell et al., 2007). For example, delusions are typically implausible and unlikely, but not impossible, and are by definition believed with complete conviction by the individual (Freeman et al., 2004). Interview measures afford the ability to probe these beliefs further and allow the interviewer to determine whether the belief is "true" or delusional. At the same time, an individual experiencing a hallucination may not recognize it as such. Thus, it is challenging to write strong items to assess these constructs.

Moreover, some aspects of the psychosis superspectrum are typically rated as observations by clinicians. For example, inexpressivity encompasses a number of related constructs including alogia (i.e., limited speech), blunted affect, poor eye contact, and limited vocal intonation. In commonly used measures such as the Positive and Negative Syndrome Scale and the Scale for the Assessment of Negative Symptoms, these symptoms are assessed with observations from the interviewer, as opposed to self-reported by the individual (Andreasen, 1984; Kay et al., 1987). It will be important in future research to validate the current self-report measure against interviewer observations. Similarly, disorganized symptoms are also often observed by the experimenter. The SAPS includes interviewer ratings for circumstantiality, tangentiality, derailment, and so on (Andreasen, 1982), while the current self-report asks participants to reflect on their own thoughts and speech and report problems. Many items ask participants to remember times in which they received feedback that their speech was disordered. Future research will validate these self-report scales against interview ratings of disorganization, or against more quantitative measures of formal thought disorder, such as the communications disturbances index (Docherty & Hebert, 1997). Similarly, reports of both disorganization and eccentricity require participant insight into how the individual is viewed by others.

The current research resulted in a preliminary item pool that will be carried forward into the next phase of analyses. Phase 2 will involve new data collection with community and clinical samples and further item refinement based on similar data analyses. There are several unanswered questions that will need to be addressed in Phase 2. As mentioned, analyses in Phase 2 will determine whether all the preliminary scales from Phase 1 should be included in the final measure or some of the scales should be combined (e.g., disorganization and eccentricity). Phase 2 will also determine whether the negative trait and symptom items developed by the Thought Disorder Sub-Workgroup form the same or different scales from those developed by the Detachment Sub-Workgroup, and whether some or all mania items belong on the internalizing spectrum. Future analyses will also include differential item functioning analyses to ensure that the items are free of bias among demographic variables, such as race, ethnicity, and sex, which has been shown to be a problem with some existing scales in this domain.

Declaration of Conflicting Interests

Funding

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Supplemental Material

Supplemental material for this article is available online.

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