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Explicating the Psychopathological Correlates of Anomalous Sleep Experiences

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The goal of this study was to explicate the nature of the associations between anomalous sleep experiences—that is, phenomena such as hypnagogic and hypnopompic hallucinations, sleep paralysis, and nightmares—and psychopathology. The participants were 406 adults, nearly half of whom (46.3%) had received—or were currently receiving—mental health treatment. We examined a more comprehensive range of psychopathology (both self-reported symptoms and interview-based diagnoses) than has been measured in previous research; the assessment battery contained multiple indicators of internalizing (including both depression and anxiety), substance use, bipolar disorder, dissociation, and psychosis/schizotypy. In addition, we examined the incremental predictive power of anomalous sleep experiences in relation to the Big Five personality traits. An Anomalous Sleep Experiences factor was defined by 4 variables: the General Sleep Experiences scale of the Iowa Sleep Experiences Survey, plus the Sleep Hallucinations, Sleep Paralysis, and Nightmares scales from the Iowa Sleep Disturbances Inventory. Anomalous Sleep Experiences was strongly and broadly related to self-rated and interview-based indicators of psychopathology, and also displayed impressive incremental predictive power vis-à-vis the Big Five. Anomalous Sleep Experiences exhibited substantial specificity in the self-report data: As predicted, it correlated more strongly with dissociation, positive schizotypy, posttraumatic stress disorder (PTSD), and panic disorder than with other symptoms. The interview-based analyses showed less specificity, although Anomalous Sleep Experiences again demonstrated relatively strong associations with psychotic disorders. Overall, our data indicate that anomalous sleep experiences are broadly related to psychopathology, with particularly strong links to dissociation and positive symptoms of psychosis/schizotypy.

Keywords: anomalous sleep experiences, factor analysis, five-factor model of personality, psychopathology

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The broad construct of *anomalous sleep experiences* (also sometimes referred to as *unusual sleep experiences* or *sleep-related experiences*) subsumes a variety of nocturnal experiences involving altered states of consciousness (Koffel & Watson, 2009; Soffer-Dudek & Shahar, 2009). Watson (2001) subjected items assessing various types of sleep experiences to factor analyses in two large student samples and established that they define a

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common factor. These structural analyses became the basis of the General Sleep Experiences Scale of the Iowa Sleep Experiences Survey (ISES; Watson, 2001). This scale includes several common symptoms of narcolepsy (e.g., cataplexy, hypnagogic and hypnopompic hallucinations, dreams of falling) and numerous items reflecting vivid and unusual dreams (e.g., nightmares, prophetic dreams, recurring dreams), as well as other anomalous nocturnal experiences (e.g., waking dreams, sensing the presence of someone who is not actually there). Items assessing lucid dreaming defined a separate factor, however, and so are not subsumed within this domain.

Sleep Experiences, Dissociation, and Schizotypy

Watson (2001)

Watson (2001) investigated the psychopathological correlates of these sleep experiences by relating them to composite measures of (a) dissociation and (b) positive symptoms of schizotypy in these same two samples. The ISES General Sleep Experiences scale correlated strongly with dissociation in both Sample 1 (r = .53) and Sample 2 (r = .54) and more moderately with schizotypy (r = .47 and .43, respectively). The ISES had a significantly stronger association with the dissociation composite than with the schizotypy composite in both samples, thereby establishing an especially strong affinity between sleep experiences and dissociation.

Subsequent Evidence

Several subsequent studies have replicated these links between anomalous sleep experiences and both dissociation and schizotypy (e.g., Fassler, Knox, & Lynn, 2006; Knox & Lynn, 2014; Koffel, 2011; Koffel & Watson, 2009; van Heugten–van der Kloet, Merckelbach, Giesbrecht, & Broers, 2014). van der Kloet, Merckelbach, Giesbrecht, and Lynn (2012) conducted a comprehensive review of the association between anomalous sleep experiences and dissociation, using data from 23 studies and more than 5,600 participants. The correlations in these studies typically ranged between .30 and .55, establishing a moderate to strong association between the constructs.

A Common Domain

Based on these types of data, Watson (2001) suggested that "measures of dissociation, schizotypy, and sleep-related experiences all define a common domain characterized by unusual cognitions and perceptions" (p. 526). Koffel and Watson (2009) subsequently presented various types of evidence that provided further support for this idea of a common domain. For example, they showed that an Unusual Sleep Experiences factor correlated more strongly with dissociation (r = .45) than with indicators of obsessive–compulsive disorder (OCD; r = .34) and general negative affectivity (r = .27). Furthermore, they subjected measures of dissociation, schizotypy, anomalous sleep experiences, and internalizing psychopathology (i.e., symptoms of depression and anxiety) to an exploratory factor analysis. Scales assessing dissociation, positive schizotypy, and anomalous sleep experiences cohered together on one factor, whereas indicators of internalizing defined the other. These results led Koffel and Watson (2009) to conclude that "unusual sleep experiences are specific to dissociation and schizotypy" (p. 551), consistent with the idea of a common underlying domain.

At the same time, however, Koffel and Watson (2009) also acknowledged the very limited amount of evidence regarding the specificity of these associations, noting that "Many of the studies we have reviewed have demonstrated these associations at a broad, general level and have not included measures of both sleep-related and non-sleep-rated symptoms thought to be outside the boundaries of the hypothesized domain" (p. 557). Thus, to establish that these constructs define a common domain, we need additional evidence demonstrating that anomalous sleep experiences correlate more strongly with dissociation and schizotypy than with other forms of psychopathology, such as indicators of internalizing and externalizing.

Broader Psychopathological Correlates

General Sleep Experiences

Anomalous sleep experiences, in fact, show significant—even substantial—associations with other types of psychopathology (Soffer-Dudek & Sadeh, 2013; Soffer-Dudek & Shahar,

2010, 2011). For example, Soffer-Dudek and Shahar (2009) and Soffer-Dudek, Shalev, Shiber, and Shahar (2011) both reported moderate associations between the ISES General Sleep Experiences scale and the Brief Symptom Inventory (Derogatis & Melisaratos, 1983), which assesses a broad range of psychological symptoms. Koffel (2011) identified an Unusual Sleep Experiences factor that was defined primarily by three scales—Nightmares, Sleep Hallucinations, and Sleep Paralysis—from the Iowa Sleep Disturbances Inventory (ISDI; Koffel, 2011; Koffel & Watson, 2010). Consistent with earlier data, this factor correlated significantly with measures of dissociation (*r*s ranged from .35 to .39) and positive symptoms of schizotypy (*r*s ranged from .18 to .31) in a sample of 200 patients. However, it correlated similarly with symptoms of posttraumatic stress disorder (PTSD), displaying particularly substantial links to traumatic intrusions ($r = .40$ with two different scales) and avoidance ($r = .34$); it also had a moderate association with panic ($r = .29$). These data suggest that the psychopathological correlates of anomalous sleep experiences may be somewhat broader and less specific than previously thought.

Nightmares

There also are extensive data linking specific types of sleep experiences with various forms of psychopathology (Roberts & Lennings, 2006). Numerous studies, for instance, have shown that individuals with borderline personality disorder experience frequent and intense nightmares (see Selby, Ribeiro, & Joiner, 2013). Moreover, Pigeon, Pinquart, and Conner (2012) reported substantial meta-analytic associations between nightmares and both suicidal ideation and suicide attempts. Nightmares also have been linked to indicators of stress, anxiety, panic, and depression (e.g., Mindell & Barrett, 2002; Ohayon, Morselli, & Guilleminault, 1997; Roberts, Lennings, & Heard, 2009).

However, nightmares are most strongly and consistently related to PTSD (e.g., Koffel, 2011). In a comprehensive review of the literature, Levin and Nielsen (2007) noted that nightmares were common in individuals experiencing a very broad range of psychopathology, including depression, anxiety disorders, substance abuse, dissociation, psychosis, and PTSD. However, they emphasized the importance of this last association, concluding "Of all psychiatric and health problems, nightmares are most closely associated with PTSD" (p. 494). Nightmares also have been shown to predict the development of PTSD symptoms prospectively (Gerhart, Hall, Russ, Canetti, & Hobfoll, 2014; van Liempt, van Zuiden, Westenberg, Super, & Vermetten, 2013).

Sleep Paralysis

Many studies have examined the psychopathological correlates of sleep paralysis. Abrams, Mulligan, Carleton, and Asmundson (2008) found that sleep paralysis was related to symptoms of depression, dissociation, and PTSD. Sleep paralysis also has been linked to bipolar disorder and to various types of anxiety (e.g., Mellman, Aigbogun, Graves, Lawson, & Alim, 2008; Paradis et al., 2009). However, the most consistent and substantial associations are seen with panic disorder, with especially strong associations observed in African Americans (see Mellman et al., 2008; Paradis et al., 2009; Ramsawh, Raffa, White, & Barlow, 2008). Sharpless and Barber (2011) report particularly interesting meta-analytic results (see their Tables 2 and 3). Collapsing across all studies, they obtained a 7.6% lifetime prevalence rate for sleep paralysis in the general population. This rate was substantially elevated in patients with panic disorder (34.6%) and was even higher in African Americans with panic disorder (40.2%).

Sleep Hallucinations

The data for sleep-related hallucinations (such as hypnagogic and hypnopompic hallucinations) are more limited. McCarthy-Jones et al. (2011) reported that sleep hallucinations were significantly related to symptoms of both depression and anxiety. Koffel (2011) examined relations between the ISDI Sleep Hallucinations scale and a broad range of psychopathology (see her Table 7). Sleep Hallucinations scores were most strongly linked to indicators of dissociation (*r*s ranged from .29 to .38), positive schizotypy (*r*s ranged from .14 to .30), PTSD (*r*s ranged from .16 to .27), panic ($r = .22$), and certain symptoms of depression (e.g., $r = .27$ with appetite loss).

Results from the reviewed studies indicate that anomalous sleep experiences have substantial associations with a range of psychopathology. Importantly, some types of sleep experiences (e.g., sleep hallucinations) are broadly related to psychopathology, whereas others (e.g., nightmares) demonstrate specificity in their associations.

The Current Study

The primary goal of this study is to explicate the scope and specificity of these associations by relating anomalous sleep experiences to a broader, more comprehensive range of psychopathology than has been examined in previous research. On the basis of the reviewed data, we expected that these sleep experiences would correlate significantly with most forms of psychopathology. With regard to the magnitude of these relations, however, we predicted that sleep experiences would correlate strongly with (a) dissociation and (b) positive symptoms of schizotypy/psychosis and, furthermore, would display substantial links with indicators of (c) PTSD and (d) panic disorder.

This study extends the existing literature in three important ways. First, as noted, our battery contained a much broader range of psychopathology than has been examined in previous research. More specifically, we report results linking anomalous sleep experiences to various measures of internalizing (including both depression and anxiety), externalizing (including both alcohol and drug use), bipolar disorder, dissociation, and psychosis/schizotypy.

Second, we were able to assess most forms of psychopathology using both self-report measures and clinical interviews. This allows us to examine the robustness of these associations across different methods, thereby providing more compelling tests of specificity.

Third, we examined the incremental predictive power of anomalous sleep experiences beyond that attributable to basic dimensions of individual differences. In this regard, it is important to note that anomalous sleep experiences are traitlike in nature and are strongly stable over time. For example, Watson (2004) examined the temporal stability of the ISES General Sleep Experiences scale over a 2-month period in a sample of 383 undergraduates; he obtained a 2-month retest correlation of .81, which establishes a strong level of stability that is very similar to that seen with general traits of personality, such as the Big Five (Gnambs, 2014). Moreover, anomalous sleep experiences are significantly related to most of the Big Five traits. For instance, Watson (2001) examined relations with the Big Five and found that the ISES General Sleep Experiences scale correlated significantly with neuroticism (overall mean $r = .26$), openness (mean $r = .20$), agreeableness (mean $r = -.15$), and conscientiousness (mean $r = -.15$), but not with extraversion (mean $r = .06$).

Previous studies have established that the Big Five personality traits are substantially related to psychopathology; neuroticism shows particularly strong and broad associations with both symptoms and diagnoses of numerous disorders (for reviews, see Kotov, Gámez, Schmidt, & Watson, 2010; Watson & Naragon-Gainey, 2014). Consequently, observed relations between anomalous sleep experiences and psychopathology may actually be partly or entirely attributable to variance shared with traits such as neuroticism. Our study included multiple markers of the Big Five—more specifically, the higher order domain scales from the NEO Personality Inventory-3 (NEO-PI-3; McCrae, Costa, & Martin, 2005), the Faceted Inventory of the Five-Factor Model (FI-FFM; Simms, 2009; see also Watson, Stasik, Ro, & Clark, 2013), and the HEXACO Personality Inventory—Revised (HEXACO-PI-R; Lee & Ashton, 2004). We also assessed the participants on multiple markers of anomalous sleep experiences, which allowed us (a) to analyze these six individual differences dimensions as latent factors and (b) to examine the amount of incremental information provided by sleep experiences over and above these general personality traits.

Method

Participants and Procedures

The original sample consisted of 438 adults drawn from the greater South Bend metropolitan area. Individuals who had provided their contact information from previous studies conducted at the Center for Advanced Measurement of Personality and Psychopathology (CAMPP) were recruited first; other community members who inquired about the study and met

the enrollment criteria (age 18 or older, comfortable reading and writing in English) also were eligible to participate. The study was described to the participants as investigating the "relations among personality and symptoms."

Participants were seen in two 3-hr sessions conducted at CAMPP; they were paid $60 for each session. They were assessed in small group sessions that typically involved 3–10 individuals. Session 1 consisted of an extensive battery of personality measures (including the NEO-PI-R, the FI-FFM, and the HEXACO-PI-R), plus part of a clinical interview. Session 2—which was completed approximately three weeks later (mean interval = 20.3 days)—consisted of the sleep experiences scales, a lengthy battery of psychopathology measures, and the rest of the clinical interview. The large majority of the participants (n = 410, or 93.6%) completed this second session. We report results here on the 406 participants with valid data from both sessions (the sample sizes for various analyses differ slightly because of missing data).

It should be noted that participants from previous studies primarily were outpatients who were recruited from various sources, such as the local community mental health center. Consequently, although not fully clinical in nature, this sample is characterized by a relatively high level of psychopathology. In fact, nearly half of the sample (n = 188, 46.3%; we will refer to this subsequently as the "clinical subsample") answered "yes" to one or more of these three questions: *Are you currently receiving psychological counseling/therapy for mental health issues?*, *Have you received psychological counseling/therapy for mental health issues in the past?*, and *Are you currently taking medications to treat a mental illness?*

The sample (age range = 18–74, mean age = 44.9 years, SD = 13.3 years) consisted of 127 men and 276 women (three participants did not specify their gender); it was 46.1% Black, 46.1% White, and 7.9% multiracial or other. In terms of marital status, 164 participants (40.6%) were single, 119 (29.5%) were married, 103 (25.5%) were divorced or separated, and 18 (4.5%) were widowed (data were missing for two individuals). Less than half of the sample (n = 181, 44.8%) was currently employed (data were missing for two participants). Education levels varied widely—ranging from dropping out of high school (N = 53, 13.1%) to receiving a doctorate (n = 5, 1.2%)—but only 89 participants (21.9%) had completed college.

Personality Inventories

As noted, the participants completed three comprehensive personality inventories in the initial session. Internal consistency reliabilities (coefficient alphas) for all personality scales included in subsequent analyses are reported in Supplemental Table S1, which is available online.

First, the NEO-PI-3 (McCrae et al., 2005) is an updated version of the widely used Revised NEO Personality Inventory (NEO PI-R; Costa & McCrae, 1992). The only change was that 38 NEO PI-R items were revised to make the instrument more appropriate for younger examinees and adults with lower educational levels (such as many of the participants in the current sample). The instrument consists of 240 items that are answered on a 5-point scale ranging from *strongly disagree* to *strongly agree.* It includes six 8-item facet scales for each higher order Big Five domain. For example, the six facets for Neuroticism are Anxiety, Angry Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability. The five higher order domain scores are used in subsequent analyses.

Second, the FI-FFM (Simms, 2009; Watson et al., 2013) is a factor-analytically derived, 247-item self-report inventory that assesses specific lower order traits within the framework of the five-factor model. The items are sentences rated on a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. The full FI-FFM consists of 26 specific trait scales. However, only 22 scales are clear markers of the higher order Big Five traits (see Watson et al., 2013). We used these 22 scales to compute higher order measures of Neuroticism (Anxiety, Depression, Anger Proneness, Somatic Complaints, and Envy), Extraversion (Positive Temperament, Sociability, Ascendance, Venturesomeness, and Frankness), Agreeableness (Empathy, Trust, Straightforwardness, and Modesty), Conscientiousness (Self-Discipline, Dutifulness, Deliberation, Achievement Striving, and Order), and Openness (Intellectance, Novel Experience Seeking, and Nontraditionalism).

Third, the HEXACO-PI-R (Lee & Ashton, 2004) contains 100 items that are rated using a 5-point response format ranging from *strongly disagree* to *strongly agree.* The instrument consists of 25 4-item scales that are organized into six higher order domains (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness). Each domain consists of four facets; for example, Conscientiousness includes Organization, Diligence, Perfectionism, and Prudence. The final scale (Altruism) is interstitial and is not scored on any domain. We use the higher order domain scores in subsequent analyses.

Although the HEXACO-PI-R contains six higher order domains, these traits fall systematically within the five-factor model framework. Five of its domain scores can be roughly equated with the Big Five: Neuroticism with Emotionality, Extraversion with Extraversion, Openness with Openness, Agreeableness with Agreeableness, and Conscientiousness with Conscientiousness (e.g., Ashton & Lee, 2005; Miller, Gaughan, Maples, & Price, 2011; Noftle & Robins, 2007). In addition, Honesty-Humility has been found to correlate .54 (Ashton & Lee, 2005) and .67 (Miller et al., 2011) with the NEO PI-R Agreeableness domain score. Consequently, at the higher order level, the HEXACO-PI-R essentially can be viewed as a Big Five measure that contains two different markers of Agreeableness.

Anomalous Sleep Experiences Measures

Participants completed four indicators of anomalous sleep experiences in the second session. First, they were assessed using the 15-item ISES General Sleep Experiences scale (Watson, 2001). The items (e.g., *Upon awakening during the night, I am unsure whether I actually experienced something or only dreamed about it, I experience intense, dreamlike images as I begin to fall asleep, I have nightmares*) are rated using a scale ranging from 1 (*never*) to 7 (*several times a week*). This scale had a coefficient alpha of .90 in the current sample.

Unlike the ISES—which focuses primarily on anomalous sleep experiences—the ISDI was designed to provide comprehensive assessment of a broad range of sleep-related problems and experiences. The expanded version of the ISDI contains three scales that are consistent markers of an Unusual Sleep Experiences factor (Koffel, 2011): Nightmares (12 items; e.g., *I have recurring bad dreams*), Sleep Hallucinations (5 items; e.g., *I sometimes see or hear things that are not real when falling asleep or waking up*), and Sleep Paralysis (4 items; e.g., *I sometimes find that I can't move my body when I wake up*). Participants respond to these items using a dichotomous yes/no format. The ISDI scales had coefficient alphas of .89 (Nightmares), .81 (Sleep Paralysis), and .75 (Sleep Hallucinations) in this sample.

Self-Report Psychopathology Measures

Overview. The participants completed a lengthy battery of self-report psychopathology measures in the second session; this protocol (which consisted of more than 125 individual scales and subscales) is too extensive to examine in its entirety. In selecting measures to be presented here, we were guided by three basic considerations. First, to explicate fully the psychopathological correlates of anomalous sleep experiences, we selected a broad range of markers related to internalizing, externalizing, mania, dissociation, and psychotic symptoms. Second, we focused particularly on symptoms that have been linked to anomalous sleep experiences in several previous studies (e.g., dissociation, PTSD, panic). Third, we concentrated on constructs that also were assessed in the clinical interview; this enabled us to examine the robustness of observed relations across methods.

The assessment battery included many redundant, highly correlated scales. Whenever possible, we aggregated them into symptom composites; in each case, the variables were standardized before being combined so that they would be equally weighted. Coefficient alphas for all symptom scales used in these analyses—including both individual scales and aggregated composites—are reported in Supplemental Table S2, which is available online.

Internalizing symptoms. We created a composite using three indicators of panic: (a) the 8-item Panic scale from the Expanded Version of the Inventory of Depression and Anxiety Symptoms (IDAS-II; Watson et al., 2012); (b) a reduced, 9-item version of the Anxious Arousal scale of the Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995); and (c) an abbreviated, 6-item version of the Panic At-

tack Symptom Questionnaire (Watson, 2000). These scales had correlations ranging from .59 to .68 (mean $r = .64$).

We combined two measures of PTSD symptoms: (a) the five intrusions items and two avoidance items from the PTSD Checklist-Civilian Version (Weathers, Litz, Herman, Huska, & Keane, 1993); and (b) an aggregate score based on the Traumatic Intrusions (4 items) and Traumatic Avoidance (4 items) scales of the IDAS-II. These indicators correlated .74 with one another.

Next, the Generalized Anxiety Disorder Questionnaire-IV (GADQ-IV; Newman et al., 2002) provides comprehensive assessment of generalized anxiety disorder (GAD) symptoms (e.g., *Do you experience excessive worry?*). The GADQ-IV was designed originally to provide an analogue diagnosis of GAD, and it therefore closely follows the diagnostic criteria for the disorder. However, the items also can be scored dimensionally, and this scoring is used in subsequent analyses.

We created a composite collapsing across three measures of depression: (a) the 9-item Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001); (b) the 20-item General Depression Scale from the original IDAS (Watson et al., 2007); and (c) the 8-item Anhedonia scale from the Personality Inventory for *DSM-5* (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012). Correlations among these scales ranged from .72 to .83 (mean $r = .76$).

We aggregated three indicators of OCD: (a) the 18-item Obsessive-Compulsive Inventory—Revised (OCI-R; Foa et al., 2002); (b) a total score based on the Obsessive Checking (14 items), Obsessive Cleanliness (12 items), Compulsive Rituals (8 items), and Hoarding (5 items) scales from the Schedule of Compulsions, Obsessions, and Pathological Impulses (SCOPI; Watson & Wu, 2005); and (c) a combined score based on the IDAS-II Checking (3 items), Ordering (5 items), and Cleaning (7 items) scales. Correlations among these measures ranged from .66 to .77 (mean $r = .71$).

We combined four measures of social anxiety: (a) the 5-item Social Phobia scale from the Fear Questionnaire (FQ; Marks & Mathews, 1979); (b) the 10-item Social Phobia scale from the Albany Panic and Phobia Questionnaire (APPQ; Rapee, Craske, & Barlow, 1994); (c) the 6-item IDAS-II Social Anxiety scale (Watson et al., 2012); and (d) a factor-analytically derived 10-item Social Anxiety scale from the Schizotypal Personality Questionnaire (SPQ; Chmielewski & Watson, 2008). Correlations among these measures ranged from .54 to .69 (mean $r = .64$).

Finally, we created a composite using (a) the 9-item APPQ Agoraphobia scale and (b) the 5-item FQ Agoraphobia scale. These measures correlated .67 with each other.

Substance use. We report data on two indicators of substance use. First, we created an Alcohol Use composite by combining scores on the 10-item Alcohol Use Disorders Test (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) and the 10-item Short Michigan Alcoholism Screening Test (Selzer, Vinokur, & van Rooijen, 1975). These scales correlated .65 with each other.

Second, the Drug Use Survey (DUS; Clark & Watson, 1999) assesses the overall frequency of drug use. Participants rate the 10 items on a 7-point scale, ranging from 1 (*never*) to 7 (*40 times or more*), indicating how many times they have ever used marijuana, cocaine, amphetamines, diet pills, tranquilizers, psychedelics, narcotics, amyl/butyl nitrates, inhalants, and ecstasy.

Bipolar symptoms. The battery included two measures of bipolar symptoms: the 5-item Mania (e.g., *it felt like my mind was moving 'a mile a minute'*) and the 5-item Euphoria (e.g., *I felt like I was 'on top of the world'*) scales from the IDAS-II. Although these scales are moderately to strongly related ($r = .47$ in this sample), they tend to show very different correlates. Specifically, Mania is strongly associated with indicators of negative emotionality, whereas Euphoria is linked to elevated levels of positive emotionality (Watson et al., 2012). They therefore will be analyzed separately here.

Dissociation. We constructed a composite using three indicators of dissociation: (a) the 33-item Dissociative Processes Scale (Harrison & Watson, 1992); (b) a total score based on the Amnesia (5 items) and Depersonalization (8 items) scales from the Curious Experiences Survey (Goldberg, 1999), which is a revision of the Dissociative Experiences Scale (Bernstein & Putnam, 1986); and (c) a combined score based on the Depersonalization/Derealization (10 items), Disengagement (5 items), and Memory

Disturbance (5 items) scales from the Multiscale Dissociation Inventory (Briere, 2002). Correlations among these measures ranged from .61 to .82 (mean $r = .73$).

Psychosis/schizotypy. We report data on four measures broadly related to psychosis/schizotypy. First, we formed a Positive Schizotypy composite by aggregating three PID-5 scales: Eccentricity (13 items), Cognitive and Perceptual Dysregulation (12 items), and Unusual Beliefs and Experiences (8 items). These indicators had correlations ranging from .66 to .80 (mean $r = .73$).

Second, we combined two indicators into a Suspiciousness composite: (a) the 7-item PID-5 Suspiciousness scale and (b) the 7-item Paranoid Ideation scale from the Schizotypal Traits Questionnaire-Short Form (STQ; Jackson & Claridge, 1991). These scales correlated .60 with each other.

Third, we constructed a Social Aloofness composite by combining (a) the 10-item PID-5 Withdrawal scale and (b) a 9-item Social Anhedonia scale created from the SPQ (see Chmielewski & Watson, 2008). These scales correlated .70 with one another.

Finally, the 7-item PID-5 Restricted Affectivity scale assesses the coldness, detachment, and flattened affect characteristic of schizoid and schizotypal personality disorders (e.g., *When it comes to my emotions, people tell me I'm a 'cold fish'*). Along with Social Aloofness, this scale provides a second indicator of the negative symptoms of schizotypy ($r = .51$ with Social Aloofness).

Interview measures. The Mini-International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998) is a brief structured diagnostic interview that assesses symptoms of *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM–IV*; American Psychiatric Association, 2000) and *International Classification of Diseases*, tenth revision (*ICD-10*; World Health Organization, 1993) psychiatric disorders; we used an adapted version (with the authorization of the author) that incorporated diagnostic changes for *DSM-5* (American Psychiatric Association, 2013).[1] The following modules were administered in the first session: panic disorder, agoraphobia, PTSD, social anxiety disorder, OCD, alcohol use disorder, and (nonalcohol) substance use disorder. In Session 2, the modules for dysthymic disorder, major depressive disorder (MDD), GAD, mania, and psychotic disorders (which provides diagnoses of both psychotic disorder and mood disorder with psychotic features) were administered. It should be noted that the M.I.N.I. does not include a module for the dissociative disorders, so we were not able to assess them in our study. Supplemental Table S3, which is available online, provides prevalence rates for these interview ratings in the overall sample, as well as in the clinical and nonclinical subsamples.

Interviewers were graduate students and advanced undergraduate research assistants (RAs) who underwent extensive training on the M.I.N.I. Graduate students had prior training in clinical interviewing and the use of the M.I.N.I., and served as trainers for the undergraduate RAs. Training included in-depth review of *DSM* criteria for each disorder being assessed, didactics on clinical interviewing skills and administration of a semistructured interview, and a detailed overview of the administration of each item in the interview. Each RA was required to observe three administrations of the interview by a graduate student and subsequently be observed administering the interview on three separate occasions.

To assess interrater reliability, the interviews were audiotaped; a second rater independently scored 39 of the Session 1 interviews and 34 of the Session 2 interviews (because of audiotape problems, $n = 38$ and 33, respectively, for some disorders). The kappa for psychotic disorder (.65) indicated good interrater reliability (see Cicchetti, 1994); values for all other ratings were in the excellent range (Cicchetti, 1994), with kappas ranging from .77 to 1.00.[2]

Relations between self-report and interview measures. Table 1 presents polyserial correlations between the 13 M.I.N.I. interview ratings and the 16 self-report symptom measures that will be included in subsequent anal-

[1] This study was ongoing when *DSM-5* was finalized. The version we used included the proposed changes for GAD that later were rejected by the American Psychiatric Association. Thus, our version of the GAD diagnosis differs slightly from that in *DSM-5*.

[2] Kappas could not be computed for two low base-rate diagnoses—agoraphobia and mood disorder with psychotic features—because none of the rescored cases met criteria for these disorders.

Table 1
Polyserial Correlations Between Self-Reported Symptoms and Interview-Based Diagnoses

Symptom	MDD	DYS	GAD	PTSD	PAN	SOC	AGO	OCD	ALC	SUB	MAN	PSY	MDP
Depression composite	**.73**	**.63**	**.59**	.49	.43	**.52**	.44	.48	.14	.22	**.59**	.38	**.63**
GADQ-IV	**.67**	**.60**	**.67**	.48	**.50**	**.50**	**.54**	**.56**	.18	.24	.57	.35	.47
PTSD composite	**.60**	**.50**	**.52**	**.60**	.42	.36	.49	**.55**	.22	.21	**.52**	.45	.49
Panic composite	**.63**	.48	**.55**	.49	.45	.47	.49	.43	.19	.12	**.50**	.30	**.62**
Social Anxiety composite	**.52**	.46	.49	.47	.40	**.50**	.48	**.50**	.02	.11	.44	.33	**.54**
Agoraphobia composite	.38	.37	.28	.40	.37	.37	.44	.41	−.14	−.00	.30	.26	**.54**
OCD composite	.47	.35	.36	.44	.27	.27	.33	**.57**	.19	.12	.41	.37	.44
Alcohol Use composite	.30	.16	.21	.12	.08	.13	.08	.16	**.59**	.28	.26	.12	.18
Drug Use Survey	.18	.04	.22	.16	.20	.11	.10	.01	.33	.36	.18	.09	.10
IDAS-II Mania	.44	.39	.47	.49	.34	.29	.38	.46	.22	.30	**.55**	.37	.36
IDAS-II Euphoria	.11	.04	.08	.24	.06	.01	.12	.17	.19	.11	.26	.10	.14
Dissociation composite	**.51**	.41	.38	.37	.33	.36	.41	.40	.19	.21	**.52**	.38	.44
Positive Schizotypy composite	.49	.38	.36	.43	.33	.28	.47	.46	.25	.24	**.52**	.45	**.57**
Suspiciousness composite	**.54**	.49	**.56**	**.52**	.38	.33	.46	.49	.17	.30	**.62**	.39	**.55**
Social Aloofness composite	.49	**.53**	.45	**.51**	.31	.44	**.52**	.43	.15	.20	.47	.32	**.55**
PID-5 Restricted Affectivity	.22	.24	.21	.20	.04	.22	.13	.26	.19	.20	.33	.14	.23

Note. $n = 403$. Correlations $\geq |.50|$ are in bold. MDD = Major Depressive Disorder; DYS = Dysthymic Disorder; GAD = Generalized Anxiety Disorder; PTSD = Posttraumatic Stress Disorder; PAN = Panic Disorder; SOC = Social Anxiety Disorder; AGO = Agoraphobia; OCD = Obsessive-Compulsive Disorder; ALC = Alcohol Use Disorder; SUB = Substance Use Disorder; MAN = Mania; PSY = Psychotic Disorder; MDP = Mood Disorder with Psychotic Features; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; IDAS-II = Expanded Version of the Inventory of Depression and Anxiety Symptoms; PID-5 = Personality Inventory for *DSM-5*.

yses. Polyserial correlations estimate the linear association between two normally distributed latent continuous variables when one of the observed scores is ordinal and the other is continuous (Flora & Curran, 2004; Olsson, Drasgow, & Dorans, 1982). They retain the relative rank order information provided by Pearson correlations (i.e., the same symptom scales will be relatively strong—or weak—predictors of particular diagnoses), but are unaffected by differences in prevalence rates, thereby facilitating comparisons across dichotomous indicators of psychopathology. The interview variables were scored as 0 = *absent*, 1 = *present*, so that positive correlations indicate that higher scores on a symptom measure were associated with an increased likelihood of receiving that rating.

Consistent with previously reported findings (e.g., Watson et al., 2007, 2012), Table 1 shows strong and systematic associations between self-report and interview-based measures of psychopathology. These results provide support for the validity of these variables. It is noteworthy, for example, that the Table 1 data establish strong associations between (a) the Depression composite and diagnoses of MDD ($r = .73$), (b) the GADQ-IV and diagnoses of GAD ($r = .67$), (c) the PTSD composite and diagnoses of PTSD ($r = .60$), (d) the Alcohol Use composite and diagnoses of alcohol use disorder ($r = .59$), and (e) IDAS-II Mania and diagnoses of mania ($r = .55$). At the same time, however, these results again demonstrate the strong level of overlap/comorbidity between different types of psychopathology (see Watson & Naragon-Gainey, 2014). For instance, the GADQ-IV also correlated .67 with diagnoses of MDD and .60 with diagnoses of dysthymic disorder; similarly, the PTSD composite correlated .60 with diagnoses of MDD. Thus, we clearly see a substantial amount of nonspecific variance in these data.

Overview of Data Analysis

We begin by subjecting the personality domain scores and sleep experiences scales to an exploratory factor analysis, which was expected to reveal six clear factors—the Big Five, plus a dimension reflecting Anomalous Sleep Experiences. Factor scores from this structural analysis then are used in correlational and regression analyses to examine bivariate and multivariate associations with both self-report and interview-based indicators of psychopathology. In interpreting the magnitude of the effect sizes, we will use the criteria recommended by Cohen

(1992, Table 1): namely, correlations < |.30| range represent small/weak effects; coefficients in the |.30| to |.50| range reflect medium/moderate associations; and correlations > |.50| indicate large/strong effects.

Results

Structural Analyses

The personality and sleep experiences scales were subjected to a principal factor analysis, using squared multiple correlations as the initial communality estimates. As predicted, six clearly defined factors emerged in this analysis, which were rotated to oblique simple structure using promax (power = 3). Loadings from this rotated solution are presented in Table 2. As can be seen, the solution is quite clean and includes only one salient cross-loading (FI-FFM Neuroticism on Factor I). Consistent with expectation, these factors can be interpreted as Agreeableness (as hypothesized, HEXACO-PI-R Honesty-Humility and Agreeableness both were strong markers of this dimension, with loadings of .69 and .63, respectively), Conscientiousness, Extraversion, Anomalous Sleep Experiences, Openness, and Neuroticism, respectively. It is noteworthy that ISDI Sleep Hallucinations (.82), ISES General Sleep Experiences (.78), ISDI Nightmares (.77), and ISDI Sleep Paralysis (.62) all were strong, clear markers of the Anomalous Sleep Experiences factor.

We computed regression-based factor scores to model these six dimensions in subsequent analyses. Table 3 presents the correlations among these factor scores. Corroborating previous research (e.g., Watson, 2001), scores on the Anomalous Sleep Experiences factor were broadly related to the Big Five; in fact, the Table 3 correlations generally are stronger than those reported in Watson (2001). Specifically, the Anomalous Sleep Experiences factor correlated moderately with Neuroticism (r = .48), low Agreeableness (r = −.35), and low Conscientiousness (r = −.34), and was weakly related to low Extraversion (r = −.24) and Openness (r = .15).[3] These stronger associations may reflect sample-based differences (i.e., students vs. adults). Alternatively, they may be attributable to the fact that the traits are being modeled here as latent factors rather than as single scales. In any event, it seems likely that Anomalous Sleep Experiences shares at least part of its predictive power with the Big Five traits. We will examine the incremental power of Anomalous Sleep Experiences scores over and above the Big Five in subsequent multivariate analyses.

Associations With Self-Report Measures

Bivariate analyses. Table 4 presents correlations between the factor scores and the self-report psychopathology measures. Consistent with previous research (Watson & Naragon-Gainey, 2014), Neuroticism was a strong and broad predictor of psychopathology. It had particularly strong associations with anxiety and depression symptoms, with five correlations (GAD-IV, Depression, Social Anxiety, Panic, PTSD) exceeding .55; Neuroticism also was substantially related to Suspiciousness (r = .55) and more moderately linked to most other types of symptoms. Extraversion showed greater specificity, exhibiting strong inverse associations with Social Anxiety (r = −.63), Depression (r = −.59), and Social Aloofness (r = −.57). Agreeableness was most strongly related to low Suspiciousness (r = −.55), whereas Conscientiousness was associated with low Depression (r = −.56). Finally, as would be expected based on existing data (see Watson & Naragon-Gainey, 2014), Openness essentially was unrelated to psychopathology, with correlations ranging from only −.13 to .13.

The Anomalous Sleep Experiences factor closely resembled Neuroticism in that it was strongly and broadly related to psychopathology. In fact, it had correlations ≥ .40 in 12 of 16 analyses, and had correlations ≥ .50 in nine cases. Supporting our prediction, it correlated most strongly with Dissociation (r = .69), Panic (r = .67), Positive Schizotypy (r = .65), and PTSD (r = .65). Strong associations also were observed with the GADQ-IV (r = .61), Depression (r = .58), Suspiciousness (r = .54), OCD

[3] This weak correlation with Openness may be surprising to some readers, given that (a) some previous research has emphasized the link between fantasy proneness and anomalous sleep experiences (e.g., van Heugten-van der Kloet et al., 2014) and (b) fantasy proneness is a facet within Openness. One possibility is that these domain-level associations mask stronger associations that can be observed at the facet level. However, scores on the Anomalous Sleep Experiences factor correlated only .18 with NEO-PI-3 Fantasy in our data.

Table 2
Promax Factor Loadings of the Personality and Sleep Experiences Scales

Scale	I	II	III	IV	V	VI
NEO-PI-3 Agreeableness	**.97**	−.06	−.01	−.04	.04	.19
FI-FFM Agreeableness	**.87**	.10	.11	−.01	−.05	.20
HEXACO-PI-R Honesty-Humility	**.69**	.05	−.28	.08	.07	−.04
HEXACO-PI-R Agreeableness	**.63**	−.02	−.02	−.00	−.00	−.28
FI-FFM Conscientiousness	−.02	**.94**	.05	−.01	.00	.09
NEO-PI-3 Conscientiousness	−.00	**.91**	.06	.01	−.04	−.01
HEXACO-PI-R Conscientiousness	.07	**.83**	−.08	−.01	.11	.02
NEO-PI-3 Extraversion	−.03	−.02	**.94**	−.03	.09	.09
FI-FFM Extraversion	−.24	.01	**.91**	.04	.06	.03
HEXACO-PI-R Extraversion	.12	.08	**.80**	.04	−.01	−.09
ISDI Sleep Hallucinations	−.01	.01	−.05	**.82**	.01	−.12
ISES General Sleep Experiences	.12	−.04	.01	**.78**	.14	.07
ISDI Nightmares	.03	−.05	.09	**.77**	−.05	.09
ISDI Sleep Paralysis	−.13	.08	.01	**.62**	−.14	−.01
NEO-PI-3 Openness	.08	−.01	.04	−.05	**.89**	.05
HEXACO-PI-R Openness	.03	.10	−.07	.03	**.80**	−.17
FI-FFM Openness	−.06	−.03	.18	−.01	**.77**	−.02
HEXACO-PI-R Emotionality	.22	.08	.10	−.01	−.12	**.83**
NEO-PI-3 Neuroticism	−.24	−.18	−.21	.03	.09	**.57**
FI-FFM Neuroticism	**−.33**	−.04	−.19	.10	.05	**.51**

Note. $n = 406$. Loadings $\geq |.30|$ are in bold. NEO-PI-3 = NEO Personality Inventory-3; FI-FFM = Faceted Inventory of the Five-Factor Model; HEXACO-PI-R = Revised HEXACO Personality Inventory; ISDI = Iowa Sleep Disturbances Inventory; ISES = Iowa Sleep Experiences Survey.

($r = .53$), and IDAS-II Mania ($r = .50$). At the same time, however, it is noteworthy that Anomalous Sleep Experiences did show significant specificity in these data. At the other extreme, it correlated relatively weakly with Restricted Affectivity ($r = .24$), Euphoria ($r = .20$), and both indicators of substance use ($r = .24$ and .12 with Alcohol Use and the DUS, respectively).

We can assess the specificity of these relations more formally by testing whether the Anomalous Sleep Experiences factor correlated significantly more strongly with (a) the four variables that we hypothesized would be substantially linked to it (viz., Dissociation, Positive Schizotypy, Panic, and PTSD) than with (b) the other 12 psychopathology scores shown in Table 4. We tested the significance of these differences using the Williams modification of the Hotelling test for two correlations involving a common variable (Kenny, 1987). This yielded a total of 48 (4×12) statistical comparisons. Overall, 47 of these comparisons (97.9%) were significant ($p < .05$, 1-tailed). The only exception was that Anomalous Sleep Experiences did not correlate significantly more strongly with

Table 3
Correlations Among the Factor Scores

Scale	Neur	Extra	Agree	Con	Open	Sleep
Neuroticism	—					
Extraversion	**−.52**	—				
Agreeableness	**−.40**	.23	—			
Conscientiousness	**−.51**	**.54**	**.59**	—		
Openness	−.10	.33	−.00	.04	—	
Anomalous Sleep Experiences	**.48**	−.24	−.35	−.34	.15	—

Note. $n = 406$. Correlations $\geq |.40|$ are in bold. Correlations $\geq |.10|$ are significant at $p < .05$. Neur = Neuroticism; Extra = Extraversion; Agree = Agreeableness; Con = Conscientiousness; Open = Openness; Sleep = Anomalous Sleep Experiences.

Table 4
Correlations Between the Factor Scores and Self-Rated Symptoms

Scale	Neur	Extra	Agree	Con	Open	Sleep
Depression/Anxiety						
Panic composite	**.57**	**−.41**	−.35	−.37	−.01	**.67**
PTSD composite	**.57**	−.31	−.32	−.30	.00	**.65**
GADQ-IV	**.66**	**−.41**	−.26	−.37	−.01	**.61**
Depression composite	**.63**	**−.59**	**−.41**	**−.56**	−.02	**.58**
OCD composite	**.41**	−.23	−.29	−.14	−.09	**.53**
Social Anxiety composite	**.61**	**−.63**	−.25	**−.40**	−.13	**.47**
Agoraphobia composite	**.48**	−.37	−.13	−.18	−.13	**.45**
Substance Use						
Alcohol Use composite	.20	−.07	−.33	−.29	.01	.24
Drug Use Survey	.12	−.04	−.24	−.28	.13	.12
Bipolar						
IDAS-II Mania	**.47**	−.14	**−.41**	−.37	.05	**.50**
IDAS-II Euphoria	.02	.25	−.24	.02	.06	.20
Dissociation/Schizotypy						
Dissociation composite	**.45**	−.27	−.36	−.34	.09	**.69**
Positive Schizotypy composite	.38	−.22	**−.47**	−.38	.11	**.65**
Suspiciousness composite	**.55**	**−.41**	**−.55**	**−.43**	−.04	**.54**
Social Aloofness composite	**.42**	**−.57**	**−.41**	−.34	−.13	**.45**
PID-5 Restricted Affectivity	.04	−.27	−.33	−.21	.03	.24

Note. $n = 402$. Correlations $\geq |.40|$ are in bold. Neur = Neuroticism; Extra = Extraversion; Agree = Agreeableness; Con = Conscientiousness; Open = Openness; Sleep = Anomalous Sleep Experiences; PTSD = Posttraumatic Stress Disorder; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; OCD = Obsessive-Compulsive Disorder; IDAS-II = Expanded Version of the Inventory of Depression and Anxiety Symptoms; PID-5 = Personality Inventory for *DSM-5*.

Positive Schizotypy ($r = .65$) than with the GADQ-IV ($r = .61$; $z = 1.19$, *ns*). These results strongly support our predictions and indicate that Anomalous Sleep Experiences are more substantially related to some forms of psychopathology (i.e., dissociation, positive schizotypy, panic, and PTSD) than to others.

Multivariate analyses. To isolate the unique variance contributed by Anomalous Sleep Experiences, we conducted a series of multiple regression analyses in which the six factor scores were used as predictors and the psychopathology variables served as criteria. Table 5 presents the standardized β weights from these analyses. Looking first at the findings for the Big Five, Neuroticism again emerged as a broad predictor of psychopathology, contributing significantly in 10 of 16 analyses; it was a consistent predictor of internalizing, adding significantly in all seven analyses of anxiety and depression symptoms. Extraversion added incremental variance in 11 analyses, and made particularly strong contributions to Social Anxiety ($\beta = -.46$), Depression ($\beta = -.35$), Euphoria ($\beta = .37$), and the negative symptoms of schizotypy (for Social Aloofness, $\beta = -.56$; for Restricted Affectivity, $\beta = -.42$). Agreeableness made a significant contribution in nine cases, including all five analyses involving dissociation and schizotypy. Conscientiousness had a significant positive weight in five cases (including OCD) and a negative weight in four others (including both substance use scores). Finally, consistent with the Table 4 results, Openness had relatively weak associations with psychopathology, making significant but modest contributions in three analyses.

For our purposes, however, the most noteworthy aspect of Table 5 is that Anomalous Sleep Experiences emerged as the strongest overall predictor in these analyses. It added significant incremental variance in 15 of 16 regressions (the single exception being the DUS), and made particularly strong contributions to Dissociation ($\beta = .60$), Positive Schizotypy ($\beta = .54$), Panic ($\beta = .51$), PTSD ($\beta = .50$), and OCD ($\beta = .47$). Clearly, unusual sleep experiences have substantial links with psychopathology that are not simply attributable to shared variance with the Big Five.

Table 5
Regression Results: Predicting Self-Rated Symptoms From the Factor Scores

Scale	Neur	Extra	Agree	Con	Open	Sleep
Depression/Anxiety						
Panic composite	**.23**	**−.18**	−.07	.06	−.01	**.51**
PTSD composite	**.33**	−.06	−.06	**.10**	−.03	**.50**
GADQ-IV	**.46**	**−.11**	.08	.01	.01	**.39**
Depression composite	**.21**	**−.35**	−.06	**−.12**	.07	**.33**
OCD composite	**.19**	−.09	**−.19**	**.28**	**−.12**	**.47**
Social Anxiety composite	**.29**	**−.46**	.01	.07	.01	**.24**
Agoraphobia composite	**.30**	**−.20**	.06	**.16**	**−.09**	**.35**
Substance Use						
Alcohol Use composite	.03	**.13**	**−.19**	**−.19**	−.04	**.13**
Drug Use Survey	−.00	.10	−.10	**−.28**	**.11**	.00
Bipolar						
IDAS-II Mania	**.30**	**.19**	**−.15**	**−.12**	−.02	**.31**
IDAS-II Euphoria	.03	**.37**	**−.28**	.08	−.09	**.21**
Dissociation/Schizotypy						
Dissociation composite	.09	−.07	**−.09**	−.00	.03	**.60**
Positive Schizotypy composite	−.01	−.03	**−.26**	−.03	.04	**.54**
Suspiciousness composite	**.20**	**−.21**	**−.39**	**.12**	−.00	**.29**
Social Aloofness composite	−.02	**−.56**	**−.32**	**.23**	−.00	**.29**
PID-5 Restricted Affectivity	**−.35**	**−.42**	**−.37**	.11	.09	**.21**

Note. $n = 402$. Values shown are standardized β weights; significant effects ($p < .05$) are in bold. Neur = Neuroticism; Extra = Extraversion; Agree = Agreeableness; Con = Conscientiousness; Open = Openness; Sleep = Anomalous Sleep Experiences; PTSD = Posttraumatic Stress Disorder; GADQ-IV = Generalized Anxiety Disorder Questionnaire-IV; OCD = Obsessive-Compulsive Disorder; IDAS-II = Expanded Version of the Inventory of Depression and Anxiety Symptoms; PID-5 = Personality Inventory for *DSM-5*.

Associations With Interview Measures

Bivariate analyses. Table 6 displays polyserial correlations between the factor scores and interview-based diagnoses. As was discussed earlier, polyserial correlations estimate the linear association between two normally distributed latent continuous variables when one of the observed scores is ordinal and the other is continuous (Flora & Curran, 2004; Olsson et al., 1982).

Among the Big Five, Neuroticism again exhibited the strongest associations with psychopathology in these data. It had 10 coefficients ≥ .40 (the only exceptions were the two substance use diagnoses and psychotic disorder), and seven correlations ≥ .50. Its strongest relations were with GAD ($r = .62$), mania ($r = .61$), OCD ($r = .60$), PTSD ($r = .58$), and mood disorder with psychotic features ($r = .55$). In contrast, only two of 52 correlations (3.8%) for the other four Big Five traits exceeded the |.50| threshold: Conscientiousness with mania ($r = -.52$), and Extraversion with social anxiety disorder ($r = -.51$).

The data for Anomalous Sleep Experiences replicate the self-report findings in two important ways. First, scores on the factor again were broadly related to psychopathology, with six correlations ≥ .40, and 11 coefficients ≥ .30. Note, moreover, that Anomalous Sleep Experiences had moderate to strong correlations with indicators of internalizing (e.g., MDD, GAD, and PTSD), mania, and psychosis (psychotic disorder, mood disorder with psychotic features). Second, Anomalous Sleep Experiences again showed specificity and was weakly related to both indicators of substance use ($r = .18$ with alcohol use disorder; $r = .10$ with nonalcohol substance use disorder).

Clearly, however, these associations do not display the same pattern of specificity seen in the self-report data. Consistent with our prediction, Anomalous Sleep Experiences had moderate to strong links to mood disorder with psychotic features ($r = .51$), psychotic disorder ($r = .42$), and PTSD ($r = .40$). However, it had very similar correlations with MDD ($r = .48$), mania ($r = .46$), and GAD ($r = .44$). Further-

Table 6
Polyserial Correlations Between the Factor Scores and Interview-Based Diagnoses

Scale	Neur	Extra	Agree	Con	Open	Sleep
Depression/Anxiety						
Major Depressive Disorder	**.49**	−.39	−.33	**−.40**	.04	**.48**
GAD	**.62**	−.30	−.34	**−.45**	.03	**.44**
PTSD	**.58**	−.30	−.31	−.21	.12	**.40**
Dysthymic Disorder	**.46**	**−.46**	−.16	−.30	−.03	.39
Agoraphobia	**.42**	−.38	−.20	−.22	−.13	.38
OCD	**.60**	−.28	−.25	−.21	.00	.35
Panic Disorder	**.50**	−.32	−.16	−.28	.02	.33
Social Anxiety Disorder	**.50**	**−.51**	−.12	−.34	−.03	.30
Substance use						
Alcohol Use Disorder	.19	.06	−.36	−.21	.08	.18
Substance Use Disorder	.24	.03	**−.43**	−.24	.19	.10
Bipolar						
Mania	**.61**	−.22	**−.45**	**−.52**	.15	**.46**
Psychosis						
Psychotic Disorder	.22	−.23	−.16	−.19	.12	**.42**
Mood Disorder−Psychotic	**.55**	**−.44**	−.36	**−.47**	−.32	**.51**

Note. $n = 401$. Correlations $\geq |.40|$ are in bold. Neur = Neuroticism; Extra = Extraversion; Agree = Agreeableness; Con = Conscientiousness; Open = Openness; Sleep = Anomalous Sleep Experiences; GAD = Generalized Anxiety Disorder; PTSD = Posttraumatic Stress Disorder; OCD = Obsessive-Compulsive Disorder; Mood Disorder-Psychotic = Mood Disorder with Psychotic Features.

more, its association with panic disorder ($r = .33$) was not particularly strong in these data.

Multivariate analyses. Next, we conducted a series of logistic regression analyses to identify the unique, incremental ability of the individual factor scores to predict each interview rating. Table 7 presents the odds ratios (ORs) from these analyses. Neuroticism contributed significantly in seven analyses, Extraversion in four, and Conscientiousness in three; finally, Agreeableness and Openness each added significant incremental variance in two analyses.

Overall, the Anomalous Sleep Experiences factor was a strong predictor of psychopathology in the logistic regressions, contributing significantly in seven of 13 analyses. In terms of the predicted relations, it is noteworthy that Anomalous Sleep Experiences made a significant incremental contribution to the prediction of both mood disorders with psychotic features (OR = 3.53) and psychotic disorder (OR = 2.52), but not PTSD (OR = 1.52) or panic disorder (OR = 1.41). It also contributed significantly to the prediction of MDD (OR = 2.09), dysthymic disorder (OR = 1.80), GAD (OR = 1.58), agoraphobia (OR = 1.98), and mania (OR = 1.74). Consistent with other findings we have presented, scores on the factor were not significantly related to either substance use diagnosis (OR = 1.11 and 0.63 for alcohol use disorder and substance use disorder, respectively). Thus, replicating the self-report results, these data again demonstrate that anomalous sleep experiences have substantial links with psychopathology that cannot be attributed to shared variance with the Big Five.[4]

Discussion

Summary and Integration of Results

Structural analyses. We began by identifying an Anomalous Sleep Experiences dimension in an exploratory factor analysis. Four clear, strong markers defined this factor: ISDI Sleep Hallucinations, ISES General Sleep Experiences, ISDI Nightmares, and ISDI Sleep Paralysis. Replicating previous research (e.g., Watson, 2001), this factor demonstrated signif-

[4] We conducted additional analyses to examine whether the results differed substantially as a function of gender, race (White vs. Black), and clinical status (i.e., clinical vs. non-clinical subsample). We found no systematic differences as a function of these variables.

Table 7
Odds Ratios From Logistic Regression Analyses

Scale	Neur	Extra	Agree	Con	Open	Sleep
Depression/Anxiety						
Dysthymic Disorder	1.55	**0.44**	1.14	1.14	1.08	**1.80**
Major Depressive Disorder	1.39	**0.62**	0.86	0.87	1.18	**2.09**
GAD	**3.55**	1.40	1.17	**0.61**	0.92	**1.58**
PTSD	**3.84**	0.75	0.60	**2.05**	1.26	1.52
Panic Disorder	**2.82**	0.87	1.29	0.97	1.02	1.41
Agoraphobia	1.42	0.55	0.85	1.40	0.79	**1.98**
Social Anxiety Disorder	**2.08**	**0.41**	1.33	1.07	1.13	1.35
OCD	**6.20**	0.99	0.80	1.68	0.92	1.23
Substance use						
Alcohol Use Disorder	1.27	**1.57**	**0.55**	0.88	1.00	1.11
Substance Use Disorder	**1.75**	1.24	**0.37**	1.09	**1.53**	0.63
Bipolar						
Mania	**2.85**	1.54	0.87	**0.49**	1.20	**1.74**
Psychosis						
Psychotic Disorder	0.74	0.65	0.92	1.01	1.23	**2.52**
Mood Disorder-Psychotic	1.27	0.89	0.67	0.60	**0.42**	**3.53**

Note. $n = 401$. Values shown are odds ratios; significant effects ($p < .05$) are in bold. Neur = Neuroticism; Extra = Extraversion; Agree = Agreeableness; Con = Conscientiousness; Open = Openness; Sleep = Anomalous Sleep Experiences; GAD = Generalized Anxiety Disorder; PTSD = Posttraumatic Stress Disorder; OCD = Obsessive-Compulsive Disorder; Mood Disorder-Psychotic = Mood Disorder with Psychotic Features.

icant associations with the Big Five, correlating moderately with Neuroticism ($r = .48$), low Agreeableness ($r = -.35$), and low Conscientiousness ($r = -.34$), and more weakly with low Extraversion ($r = -.24$) and Openness ($r = .15$).

Self-report data. Next, we related these factors to a broad range of self-reported psychopathology, including indicators of anxiety, depression, substance use, bipolar disorder, dissociation, and psychosis/schizotypy. These data yielded several key findings. First, consistent with previous research (e.g., Soffer-Dudek & Sadeh, 2013; Soffer-Dudek & Shahar, 2009, 2010), the Anomalous Sleep Experiences factor was strongly and broadly related to self-rated psychopathology. In fact, it had correlations $\geq .40$ in 12 of 16 analyses, and had correlations $\geq .50$ in nine cases. Supporting our prediction and consistent with previous research, it correlated most strongly with indicators of dissociation, panic, positive schizotypy, and PTSD. It also correlated moderately to strongly with symptoms of GAD, depression, suspiciousness, OCD, mania, social anxiety, agoraphobia, and social aloofness. Overall, it had a mean correlation (after *r*-to-*z* transformation) of .49 in these data. This mean coefficient is somewhat higher than the corresponding value for Neuroticism (mean $r = .43$), and is much higher than the average correlations for the remaining Big Five traits (for Extraversion, $r = |.34|$; for Agreeableness, $r = |.34|$; for Conscientiousness, $r = |.32|$; for Openness, $r = |.07|$). Clearly, anomalous sleep experiences are substantially linked to a broad range of psychopathology.

Given that the Anomalous Sleep Experiences factor had the strongest overall association with self-rated psychopathology, it is not surprising that it showed impressive predictive power in subsequent regression analyses. Consistent with our hypothesis, it made particularly strong contributions to the prediction of dissociation, positive schizotypy, PTSD, and panic symptoms. More generally, however, it added significant incremental variance in 15 of 16 regressions, including all analyses of internalizing symptoms (the single exception involved the DUS). These data establish that anomalous sleep experiences have broad and important links with psychopathology that are not simply attributable to shared variance with the Big Five.

Finally, the Anomalous Sleep Experiences factor showed impressive specificity in these data. In fact, the individual coefficients in Table 4 range from a high of .69 (with Dissociation) to

a low of .12 (with the DUS). We tested this specificity formally and established that Anomalous Sleep Experiences had significantly stronger associations with its four hypothesized correlates (dissociation, positive schizotypy, PTSD, panic) than with the other 12 self-report scores in 47 of 48 comparisons. It had particularly weak associations with self-rated substance use ($r = .24$ and .12 with alcohol use and the DUS, respectively). It also is noteworthy that—consistent with previous data (Koffel & Watson, 2009)—Anomalous Sleep Experiences correlated significantly more strongly with the Positive Schizotypy composite ($r = .65$) than with indicators of negative schizotypy ($r = .45$ with the Social Aloofness composite; $r = .24$ with PID-5 Restricted Affectivity).

Interview data. The interview-based results replicate and extend the self-report findings in three key ways. First, the Anomalous Sleep Experiences factor again was substantially related to psychopathology, with six correlations ≥ .40. Overall, Anomalous Sleep Experiences had a mean polyserial correlation of .37 in these data. This coefficient was not as high as the corresponding value for Neuroticism ($r = .47$), but it was greater than the average correlations for Conscientiousness ($r = |.32|$), Extraversion ($r = |.31|$), Agreeableness ($r = |.28|$), and Openness ($r = |.10|$).

Second, Anomalous Sleep Experiences again exhibited impressive predictive power in a series of logistic regression analyses. It was a significant predictor in seven of 13 analyses, including indicators of internalizing, mania, and psychosis. Thus, replicating the self-report results, these data again demonstrate that anomalous sleep experiences have substantial links with psychopathology that cannot be attributed to variance shared with the Big Five. In fact, across the two sets of analyses, the Anomalous Sleep Experiences factor made a significant incremental contribution in 22 of 29 regressions (75.9%).

Third, Anomalous Sleep Experiences again displayed considerable specificity in these data, with polyserial correlations ranging from .10 to .51. Consistent with expectation, it had moderate to strong associations with (a) mood disorder with psychotic features ($r = .51$) and (b) psychotic disorder ($r = .42$); moreover, both of these effects remained significant in the logistic regressions. At the other extreme—and replicating the self-report results—Anomalous Sleep Experiences was most weakly related to the two substance abuse diagnoses ($r = .18$ with alcohol use disorder; $r = .10$ with nonalcohol substance use disorder).

However, the results for PTSD and panic disorder deviated significantly from the self-report findings and were not consistent with our prediction. Anomalous Sleep Experiences had a moderate correlation ($r = .40$) with PTSD diagnoses at the bivariate level, but this effect did not remain significant in the logistic regression (OR = 1.52). Furthermore, its bivariate association with panic disorder ($r = .33$) was relatively weak; this effect also was nonsignificant in the regression analysis (OR = 1.41).

Why did this discrepancy occur? A complete examination of this topic is beyond the scope of this article, but we will discuss two methodological issues that potentially may have contributed to these results. The first issue concerns the complicating effects of time. Our measures of anomalous sleep experiences all were completed in Session 2. As noted earlier, however, the interviews were conducted at both sessions, and the data for PTSD and panic disorder were collected in Session 1. Although the time interval between sessions was relatively short (mean interval = 20.3 days), it is possible that time had a significant biasing effect on the magnitude of these associations, such that Anomalous Sleep Experiences tended to correlate more strongly with the diagnoses assessed in the same session (dysthymic disorder, MDD, GAD, mania, psychotic disorder, mood disorder with psychotic features) than those collected in the earlier session (PTSD, panic disorder, agoraphobia, social anxiety disorder, OCD, alcohol use disorder, nonalcohol substance use disorder). Note that these higher Session 2 correlations could be due to a variety of factors, including transient error (Chmielewski & Watson, 2009; Gnambs, 2014) and/or context effects (Council, 1993).

Consistent with this argument, the five diagnoses that correlated most strongly with Anomalous Sleep Experiences—mood disorder with psychotic features (.51), MDD (.48), mania (.46), GAD (.44), and psychotic disorder (.42)—all were administered in Session 2. Moreover, the mean coefficient for the Session 2 diagnoses (.45) was substantially higher than for those assessed in Session 1 (.29). Having

said that, however, it must be noted that Anomalous Sleep Experiences had a similar association with agoraphobia (r = .38)—which also was assessed in Session 1—as it did with PTSD (r = .40) and panic disorder (r = .33); moreover, its association with agoraphobia remained significant in the logistic regressions, whereas those for PTSD and panic disorder did not. Consequently, although this time effect likely influenced our results, it cannot entirely explain them.

Second, our results all were based on a general Anomalous Sleep Experiences factor, whereas our predictions regarding PTSD and panic were derived primarily from data obtained with specific types of nocturnal events. As we reviewed earlier, nightmares are most closely related to PTSD (see especially Levin & Nielsen, 2007), whereas sleep paralysis has been substantially linked to panic disorder (Mellman et al., 2008; Paradis et al., 2009; Ramsawh et al., 2008; Sharpless & Barber, 2011). This raises the possibility that these general factor-based analyses masked the presence of important specific associations related to particular types of sleep experiences.

We tested this possibility by examining correlations with the ISDI scales, which tap three distinct types of anomalous sleep experiences. Consistent with the evidence reviewed earlier, ISDI Nightmares did tend to display relatively strong associations with PTSD. In the self-report data, it correlated most highly with PTSD (r = .58), Panic (r = .55), Dissociation (r = .53), and the GADQ-IV (r = .51). Similarly, its strongest associations in the interview data were with mood disorder with psychotic features (r = .49), GAD (r = .42), mania (r = .42), and PTSD (r = .40).

In contrast, ISDI Sleep Hallucinations was most consistently linked to indicators of dissociation and positive schizotypy/psychosis. Its strongest associations in the self-report data were with the Positive Schizotypy (r = .61), Dissociation (r = .57), and Panic (r = .52) composites; similarly, it correlated most highly with mood disorder with psychotic features (r = .45), mania (r = .37), and psychotic disorder (r = .36) in the interview data.

Finally, ISDI Sleep Paralysis produced more complex results. Its strongest self-report correlates were with the Dissociation (r = .49), Panic (r = .49), PTSD (r = .47), Positive Schizotypy (r = .45), and OCD (r = .45) composites. In the interview data, however, it was most strongly linked to mood disorder with psychotic features (r = .48), MDD (r = .40), and PTSD (r = .39); no other correlation exceeded .30. Moreover, Sleep Paralysis had a relatively modest association (r = .23) with diagnoses of panic disorder.

Thus, these ISDI results provide further support for a specific link between PTSD and nightmares. However, they do not provide strong evidence for a specific association between panic disorder and any particular type of nocturnal experience, including sleep paralysis. Further research is needed to explicate the psychopathological correlates of sleep paralysis more fully.

A "common domain" revisited. Watson (2001) suggested that dissociation, schizotypy, and anomalous sleep experiences "all define a common domain" (p. 526). In their review of the literature, Koffel and Watson (2009) similarly concluded that "unusual sleep experiences are specific to dissociation and schizotypy" (p. 551), which is consistent with this notion of a common underlying domain. Our examination of a relatively broad range of psychopathology produced results that are more complex. Sleep Experiences had strong and specific associations with the Dissociation and Positive Schizotypy composites in the self-report data, and had relatively strong correlations with (a) psychotic disorder and (b) mood disorder with psychotic features in the interview analyses. Overall, dissociation and positive schizotypy/psychosis appear to represent the strongest, most consistent correlates of general sleep experiences, which is consistent with this idea of a common domain.

At the same time, however, our data also reveal that unusual sleep experiences have substantial associations with a broad range of psychopathology, including multiple indicators of depression, anxiety, and bipolar disorder. For example, the Anomalous Sleep Experiences factor correlated strongly with the PTSD composite in the self-report data; moreover, ISDI Nightmares was substantially related to both self-rated and interview-based indicators of PTSD.

What processes are responsible for these broad associations between anomalous sleep experiences and psychopathology? Watson (2001) suggested that individual differences in dissociation, schizotypy, and anomalous sleep

experiences all could be linked to the common underlying trait of *transliminality*, which can be defined as a "tendency for psychological material to cross (*trans*) thresholds (*limines*) into or out of consciousness" (Thalbourne & Houran, 2000, p. 853). More specifically, Watson (2001) argued that those reporting high levels of dissociation, schizotypy, and anomalous sleep experiences "may be individuals who readily pass from (a) normal, reality-based mentation to (b) more fantasy-based states of consciousness" (p. 533), perhaps as a result of abnormalities in the transition between sleep and waking (for a more detailed development of this argument, see Koffel & Watson, 2009). Subsequent research has supported this notion (e.g., Soffer-Dudek & Shahar, 2011). For example, Soffer-Dudek and Shahar (2009) found that individual differences in transliminality predicted increases in anomalous sleep experiences over a 3-month interval.

However, additional mechanisms are required to account for the broad associations with psychopathology that we—and others—have found. In this regard, elevated levels of stress and distress also have been found to predict increases in anomalous sleep experiences over time (Soffer-Dudek & Shahar, 2009, 2011). These findings suggest other potential mechanisms; for example, it may be that anomalous sleep experiences and psychopathology both are influenced by common third variables, such as stress. Common genetic factors also may be involved, although Coolidge, Segal, Coolidge, Spinath, and Gottschling (2010) found that only 4% of the genetic variance in nightmares was shared with GAD. It will be important for future research to explicate the complex causal mechanisms underlying these pervasive links between psychopathology and anomalous sleep experiences.

Limitations and Future Directions

This study has several notable strengths. First, we examined a much broader range of psychopathology than has been assessed in previous studies of anomalous sleep experiences; moreover, we were able to assess most forms of psychopathology using both self-reports and clinical interviews, which enabled us to determine the replicability of these associations across methods. In addition, the participants completed multiple personality measures in Session 1—including the NEO-PI-3, the FI-FFM, and the HEXACO-PI-R—which allowed us to establish the incremental predictive power of anomalous sleep experiences beyond the Big Five. Finally, our results are based on a relatively large and racially diverse sample.

At the same time, however, our study has some important limitations that need to be acknowledged. First, although our assessment of psychopathology was reasonably comprehensive, we used a clinical interview that did not include a module for dissociative disorders. Consequently, we were not able to determine whether the strong association we observed between Anomalous Sleep Experiences and self-rated dissociation replicated in the interview data. It therefore is important that future research clarify the nature of the association between anomalous sleep experiences and interview-based indicators of dissociation.

Second, the composition of our sample was unusual, in that it included both outpatients and nonclinical participants. Moreover, more than half of our participants (55.2%) were unemployed. Consequently, it is unclear how well our results will generalize to other types of samples, including those more fully representative of the general population.

Third, our study included only self-report measures of personality and anomalous sleep experiences. This potentially is problematic, given that our participants were asked to complete lengthy batteries of personality and psychopathology measures across two 3-hr sessions. These lengthy batteries may have led to fatigue and to careless, inattentive responding, thereby reducing the validity of our data. In the future, it will be important to supplement self-reports with informant ratings (see Connelly & Ones, 2010), interview-based measures (e.g., Koffel, 2011; Koffel & Watson, 2010; Trull, Widiger, & Burr, 2001), and polysomnographic data (e.g., van der Kloet, et al., 2013).

Fourth, although we collected data over two different sessions separated by a relatively brief time interval, our study essentially was cross-sectional in nature. Longitudinal designs will play an important role in clarifying the complex etiological bases of the relations among anomalous sleep experiences, personality, and psychopathology (e.g., Soffer-Dudek & Shahar, 2009, 2011).

Conclusion

Our data have helped to explicate the psychopathological correlates of anomalous sleep experiences. Our results have established that these experiences show strong, specific associations with dissociation and psychosis/positive schizotypy, but also have substantial associations with a broader range of psychopathology, including various indicators of depression, anxiety, and bipolar disorder. Future work can build on these findings to develop a more complete framework for understanding the complex associations between anomalous sleep experiences and psychopathology.

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