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Comments

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Unusual Sleep Experiences, Dissociation, and Schizotypy: Evidence for a Common Domain

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Abstract

This paper reviews studies that have examined associations between unusual sleep experiences (including nightmares, vivid dreaming, narcolepsy symptoms, and complex nighttime behaviors) and dissociation and schizotypy. Using correlational studies and structural analyses, evidence is provided that unusual sleep experiences, dissociation, and schizotypy belong to a common domain. It is demonstrated that unusual sleep experiences show specificity to dissociation and schizotypy compared to other daytime symptoms (e.g., anxiety, depression, substance use) and other sleep disturbances (e.g., insomnia, lassitude/fatigue). The paper also outlines the methodological limitations of the existing evidence and makes suggestions for future research. Finally, three models for the overlap of daytime and nighttime symptoms are reviewed, including biological abnormalities, trauma, and personality traits. Although further research is needed, it is suggested that daytime and nighttime symptoms result from problems with sleep-wake state boundaries, which may be precipitated by stress or trauma. In addition, association between daytime and nighttime symptoms can be attributed to the higher order personality trait of Oddity.

Keywords: dissociation, schizotypy, sleep

Unusual Sleep Experiences, Dissociation, and Schizotypy: Evidence for a Common Domain

People have long noted the phenotypic similarities between select nighttime experiences and daytime psychological symptoms, such nightmares and hallucinations. It is possible that phenotypically similar daytime and nighttime experiences are related, although this remains an empirical question. Specifically, it has been suggested that dissociation, schizotypy, and certain sleep experiences (i.e., nightmares, narcolepsy symptoms) belong to a domain that involves unusual cognitions and perceptions (Watson, 2001). Moreover, these daytime and nighttime experiences may share common processes under different contexts (e.g., walking around during the day versus lying in bed) (Butler, 2006; Watson, 2001), although the exact nature of these processes and whether they are due to biological or environmental factors is still uncertain.

The purpose of this paper is to review evidence that certain sleep experiences, dissociation, and schizotypy represent a common domain with shared etiology. We begin by defining dissociation and schizotypy and outline the disorders and symptom dimensions that will be included in this review. We then examine sleep experiences that have been associated with dissociation and schizotypy, including nightmares, vivid dreams, narcolepsy symptoms, and complex nighttime behaviors. Throughout this review, we will describe these sleep phenomena as unusual sleep experiences to differentiate them from other sleep-related symptoms, such as insomnia and lassitude (i.e., fatigue, sleepiness, and hypersomnia). After reviewing methodological issues and the limitations of existing research, we suggest directions for future studies. Finally, we review theories that biological abnormalities, environmental stress and trauma, and personality traits contribute to the overlap of daytime and nighttime experiences.

Dissociation

Broadly defined, dissociation involves an altered state of consciousness, in which normally integrated mental processes become separated. This separation leads to disruptions in awareness, memory, and identity (American Psychiatric Association, 2000; Butler, Duran, Jasiukaitis, Koopman, & Spiegel, 1996; Kihlstrom, Glisky, & Angiulo, 1994). The category of dissociative disorders in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; American Psychiatric Association, 2000) includes dissociative amnesia (i.e., inability to recall personal information), dissociative fugue (i.e., travel away from home with identity confusion and amnesia), dissociative identity disorder (i.e., two or more distinct identities that take control of the person's behavior, along with amnesia for personal information), and depersonalization disorder (i.e., feeling detached from oneself).

Continuous measures of dissociation include items referring to amnesia, automatic behaviors, feelings of detachment, and intense imaginative involvement with internal or external experiences. Widely used measures of dissociation include the Dissociative Experiences Scale (DES; Bernstein & Putnam, 1986), the Curious Experiences Survey (CES; Goldberg, 1999), the Dissociative Processes Scale (DPS; Harrison & Watson, 1992), and the Questionnaire of Experiences of Dissociation (QED; Riley, 1988). Structural analyses of the items from these questionnaires have consistently found three symptom dimensions: (1) Obliviousness/Amnesia, which includes items about trance states and automatic behavior; (2) Depersonalization/Derealization, which includes items about feelings of unreality and disconnectedness; and (3) Imagination/Absorption, which includes items about fantasizing and internal focus (Goldberg, 1999; Harrison & Watson, 1992; Ross, Ellason, & Anderson, 1995).

Based on these studies, dissociation can be viewed as a multidimensional construct, composed of three main symptom dimensions.

This review will examine the relations between unusual sleep experiences and symptoms of dissociation. In addition, it includes studies that examine the relation between sleep and symptoms of posttraumatic stress disorder (PTSD). These studies have been included for several reasons. First, the *DSM-IV-TR* diagnostic criteria for PTSD include the dissociative symptoms of amnesia, detachment, and flashbacks (Butler et al., 1996). Second, PTSD is conceptually similar to the dissociative disorders in that trauma precedes dissociative symptoms (Kihlstrom, 2005). Third, people with PTSD tend to score higher on measures of dissociation than both non-clinical groups and people with other psychological diagnoses; moreover, multiple studies have reported strong relations between measures of PTSD and dissociation (Carlson & Putnam, 1993; Gershuny & Thayer, 1999; van Ijzendoorn & Schuengel, 1996). It is important to note that PTSD also shows substantial relations with mood disorders and other anxiety disorders (Watson, 2005, 2009), and therefore it does not clearly fall within the proposed domain. Ultimately more structural studies will be needed to determine if symptoms of PTSD show specificity to dissociation.

Schizotypy

In addition to reviewing the association of unusual sleep experiences and dissociation, this paper will examine how these sleep experiences relate to a closely related construct, schizotypy. In an early conceptualization, Meehl (1962) suggested that schizotypy is defined by four symptoms (i.e., cognitive slippage, anhedonia, ambivalence, and interpersonal aversiveness) that represent risk factors for the development of schizophrenia. The Chapmans developed a series of psychosis-proneness scales based Meehl's theory, including the Magical

Ideation scale (e.g., "I have sometimes felt that strangers were reading my mind") (Eckblad & Chapman, 1983), the Perceptual Aberration scale (e.g., "I have sometimes had the feeling that my body is decaying inside," "Sometimes I feel like everything around me is tilting") (Chapman, Chapman, & Raulin, 1978), and the Revised Social Anhedonia scale (e.g., "Having close friends is not as important as many people say") (Eckblad, Chapman, Chapman, & Mishlove, 1982). There are several other widely used scales that measure symptoms of schizotypy as defined by the diagnostic criteria for schizotypal personality disorder (STPD), including the STQ Schizotypal Personality scale (STA; Claridge & Broks, 1984) and the Schizotypal Personality Questionnaire (SPQ; Raine, 1991).

Given that there are many heterogeneous symptoms grouped under the heading of schizotypy, it is helpful to turn to structural studies to see how many distinct symptom dimensions can be identified. Traditionally, symptoms of schizotypy were organized using a two-factor model of positive symptoms (e.g., unusual perceptual and cognitive experiences) and negative symptoms (e.g., impairments in social functioning) (Arndt, Alliger, & Andreasen, 1991; Raine et al., 1994). In recent years, symptoms of schizotypy have been organized using three-factor models. The first factor consists of positive symptoms, such as delusions, hallucinations, unusual perceptual experiences, ideas of reference, odd beliefs, and paranoia. The second factor consists of negative symptoms, such as affective flattening, anhedonia, avolition, and interpersonal difficulties. The third factor consists of disorganized symptoms, such as odd speech and behavior (Arndt et al., 1991; Bergman et al., 1996; Lenzenweger & Dworkin, 1996; Raine et al., 1994). However, recent evidence suggests that as many as five factors can be extracted from schizotypal symptoms (Chmielewski & Watson, 2008). In this scheme, the positive symptom dimension is divided into Unusual Beliefs/Experience and Mistrust. Negative

symptoms are divided into Social Anhedonia and Social Anxiety. Disorganized symptoms remain an independent factor, labeled Eccentricity/Oddity.

Overlap of Dissociation and Schizotypy

Studies have found consistently that measures of dissociation correlate substantially with the positive and disorganized symptoms of schizotypy (Chmielewski & Watson, 2008; Giesbrecht, Merckelbach, Kater, & Sluis, 2007; Knox, 2008; Merckelbach & Giesbrecht, 2006; Merckelbach, Rassin, & Muris, 2000; Pope & Kwapil, 2000; Watson, 2001; Watson, Clark, & Chmielewski, 2008). In contrast to the positive and disorganized symptom dimensions, negative symptoms of schizotypy do not show substantial correlations with dissociation (Chmielewski & Watson, 2008; Knox, 2008; Watson, Clark et al., 2008). Several studies have used structural analyses with measures of dissociation and schizotypy to determine if they are essentially the same construct. Pope and Kwapil (2000) reported a three-factor solution, in which the first two factors represent dissociation and positive symptoms of schizotypy, respectively, whereas the third factor represents negative symptoms of schizotypy. However, they found that a scale measuring depersonalization/derealization loaded onto both the first and second factors. Watson (2001) analyzed measures of both dissociation and schizotypy and found that a two-factor model of dissociation and schizotypy fit the data well; however, the two factors were very strongly correlated and were weakly differentiated. When detachment and depersonalization items were removed from the dissociation factor, the differentiation was slightly improved but still weak, with correlations between dissociation and schizotypy composite scores ranging from .64 to .65. Moreover, it was found that this substantial overlap was not due to a general distress factor, given that neuroticism had low to moderate correlations with these composite scores (*r*s ranged from .25 to .40). Similarly, Chmielewski and Watson (2008) found that the positive and

disorganized symptoms of schizotypy had stronger correlations with a dissociation composite score (*r*s ranged from .39 to .59) than with neuroticism (*r*s ranged from .09 to .41).

Unusual Sleep Experiences

Iowa Sleep Experiences Survey (ISES)

Most of the research examining the overlap of sleep, dissociation, and schizotypy has been conducted using the ISES (Watson, 2001). The ISES is a factor-analytically derived instrument that measures unusual sleep experiences, including nightmares, vivid dreams, and narcolepsy symptoms. To create the instrument, multiple sleep items were submitted to factor analysis, including items referring to cataplexy (i.e., muscle weakness during strong emotions), hypnagogic and hypnopompic hallucinations (i.e., hallucinations that occur when falling asleep or waking up), nightmares, recurring dreams, dream recall, and waking dreams (i.e., a dream in which the person dreams of waking up). These items loaded onto the same factor, which became the ISES General Sleep Experiences scale, with coefficient alphas ranging from .83 to 85.

The General Sleep Experiences scale was found to have substantial relations with dissociation and schizotypy as measured by the DPS, DES, QED, STA, and the Perceptual Aberration and Magical Ideation scales (Watson, 2001). In particular, the General Sleep Experiences scale had strong correlations with the Imagination/Absorption component of dissociation (*r*s ranged from .52 to .57) and the Magical Ideation component of schizotypy (*r*s ranged from .43 to .45). The second scale on the ISES is Lucid Dreaming (i.e., being able to control the content of dreams), which had generally weaker correlations with measures of dissociation and schizotypy (*r*s ranged from .05 to .29).

Association of the ISES General Sleep Experiences scale with dissociation and schizotypy is a robust finding that has been replicated in many studies, mainly in non-clinical

populations. Several studies have found that the DES correlates significantly with the ISES General Sleep Experiences scale (*r*s ranging from .35 to .55), although not with the ISES Lucid Dreaming scale (*r*s ranging from .08 to .23) (Fassler, Knox, & Lynn, 2006; Giesbrecht, Jongen, Smulders, & Merckelbach, 2006; Giesbrecht & Merckelbach, 2004, 2006). Similarly, Knox (2008) found that the ISES General Sleep Experiences scale was significantly related to dissociation and the positive symptoms of schizotypy as measured by the DES and the Perceptual Aberration and Magical Ideation scales; however, the ISES General Sleep Experiences scale was not significantly related to the negative symptoms of schizotypy as measured by the Revised Social Anhedonia scale, and the ISES Lucid Dreaming scale was not significantly related to schizotypy and dissociation. To summarize, it appears that dissociation (especially Imagination/Absorption), the positive symptom dimension of schizotypy (especially Magical Ideation), and the unusual sleep experiences measured by the ISES General Sleep Experiences scale belong to a common domain involving unusual cognitions and perceptions.

Specificity of the ISES with Dissociation and Schizotypy

Although the research conducted with the ISES has been promising so far, it is important to move beyond general associations and demonstrate that the ISES shows specificity to measures of dissociation and schizotypy compared to other sleep experiences and other daytime symptoms. As discussed earlier, the ISES General Sleep Experiences scale shows specificity to dissociation and schizotypy compared to the Lucid Dreaming scale. In addition, the ISES General Sleep Experiences scale shows specificity to certain symptom dimensions within the constructs of dissociation (Imagination/Absorption) and schizotypy (Magical Ideation). Research has also shown that the General Sleep Experiences scale has significantly stronger correlations with dissociation and schizotypy than with neuroticism/negative emotionality,

suggesting that the association between unusual daytime and nighttime experiences is not solely attributable to general psychological distress (Watson, 2001, 2003b). Finally, Chmielewski and Watson (2007, October) submitted measures of dissociation, schizotypy, obsessive compulsive disorder (OCD), internalizing disorders (e.g., depression, anxiety), and externalizing disorders (e.g., drug and alcohol use) to principal factor analysis, along with the ISES scales. They found that a three-factor model fit the data well. In addition to an Externalizing and Internalizing factor, the third factor included measures of dissociation, schizotypy, OCD, and unusual sleep experiences as measured by the ISES. These data suggest that unusual sleep experiences measured by the ISES show stronger relations with schizotypy and dissociation compared to other psychological disorders, such as anxiety, depression, and substance use. These results support our argument that unusual sleep experiences, dissociation, and schizotypy all define a common domain involving unusual cognitions and perceptions.

We now report results from two data sets that further establish the specificity of unusual sleep experiences, dissociation, and schizotypy. The first data set was collected as part of a two-month retest study designed to examine the temporal stability of common clinical and trait measures (findings based on this data set also have been reported in Chmielewski and Watson, in press; Watson, 2003a, 2004). Participants consisted of 376 undergraduate students who completed assessment batteries at two month intervals. Neuroticism/negative emotionality was assessed using the Big Five Inventory (BFI; John & Srivastava, 1999), the trait form of the Positive and Negative Affect Schedule-Expanded Form (PANAS-X; Watson & Clark, 1994), and the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). Measures of OCD were collected using the Schedule of Obsessions, Compulsions, and Pathological Impulses (SCOPI; Watson & Wu, 2005) and the Obsessive Compulsive Inventory-

Revised (OCI-R; Foa et al., 2002). Measures of dissociation included the DES and the DPS. Finally, unusual sleep experiences were measured using the General Sleep Experiences Scale from the ISES.

Both time 1 and time 2 measures were submitted to principal factor analysis with promax rotation. Four factors emerged and clearly could be identified as Negative Affectivity, OCD, Dissociation, and Unusual Sleep Experiences (factor loadings are shown in Table 1). Table 2 shows the factor correlation matrix for these factors, using regression-based factor scores. The Unusual Sleep Experiences factor shows significantly stronger correlations with Dissociation (r = .45) compared to both Negative Affectivity (r = .27; z = 3.10) and OCD (r = .34; z = 2.26). These results again establish that unusual sleep experiences have a specific association with dissociation that is not due to nonspecific factors, such as general psychological distress.

Next, we report data from an ongoing assessment project to develop a new measure of sleep disturbances (the Iowa Sleep Disturbances Inventory or ISDI). Participants consisted of 374 undergraduate students who completed a comprehensive assessment battery. Specifically, participants completed the final ISDI scales, including a 12-item measure of Nightmares (e.g., "I frequently have frightening dreams"), an 11-item measure of Initial Insomnia (e.g., "It takes me a long time to fall asleep"), and a 10-item measure of Fatigue (e.g., "I have a hard time focusing during the day because I am tired"). These scales all had coefficients alphas of .85 or higher in this sample. Participants also completed the Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007), which has eleven basic scales: Dysphoria, Ill Temper, Traumatic Intrusions, Insomnia, Suicidality, Social Anxiety, Panic, Lassitude, Appetite Gain, Appetite Loss, and Well Being. Participants completed three dissociation measures (DPS, QED, and CES) and three measures of schizotypy (the STA, Magical Ideation, and Perceptual Aberration

scales). Finally, participants completed the ISES. These scales were submitted to principal factor analysis with promax rotation. When two factors were extracted, scales measuring symptoms of dissociation, schizotypy, and unusual sleep experiences (including the ISES scales and the ISDI Nightmares scale) cohered together as one factor, whereas scales measuring symptoms of depression and anxiety (including the IDAS Lassitude and Insomnia scales and the ISDI Fatigue and Initial Insomnia scales) formed the other factor. The inter-factor correlation was .67. Table 3 reports these factor loadings. The data suggest that unusual sleep experiences are specific to dissociation and schizotypy, whereas insomnia and lassitude are specific to depression and anxiety.

Beyond the ISES: Relations of Unusual Sleep Experiences with Dissociation and Schizotypy

It is important to show that unusual sleep experiences are specifically associated with dissociation and schizotypy (a) beyond the ISES and (b) in clinical samples. The following section reviews how individual sleep experiences included in the ISES are related to dissociation and schizotypy in clinical and non-clinical samples. In addition, we will review the association of complex behavior at night with schizotypy and dissociation. Although the limited assessment batteries utilized in many of these studies make it difficult to address the issue of specificity, several studies have found evidence that unusual sleep experiences are specific to dissociation and schizotypy compared to other daytime and nighttime symptoms. This evidence of specificity will be reviewed below.

Nightmares. The symptom criteria for nightmare disorder involve repeated awakenings from sleep with full alertness upon awakening and detailed recall of the frightening dream. The dreams normally occur in the second half of the night and there may be a delay in returning to sleep. In addition, the experience must cause distress and impairment (American Academy of

Sleep Medicine, 2005; American Psychiatric Association, 2000). Several studies have reported an association of frequent nightmares with dissociative disorders, schizophrenia, and STPD. Agargun, Kara, Ozer, Selvi, Kiran, and Ozer (2003) found that 17 out of 30 patients with dissociative disorders were also diagnosed with nightmare disorder. Conversely, a high incidence of psychiatric diagnoses (e.g., schizophrenia, STPD) has been reported in people with frequent nightmares (Hartmann, Russ, Oldfield, Sivan, & Cooper, 1987; Hartmann, Russ, van der Kolk, Falke, & Oldfield, 1981). Nightmares also are related to continuous measures of dissociation and schizotypy, including the DES and the Perceptual Aberration and Magical Ideation scales (*r*s ranging from .32 to .39, $p < .001$); importantly, they are more strongly related to these measures of dissociation and schizotypy than to the Beck Depression Inventory (BDI; Beck & Steer, 1987) and the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1983) (*r*s ranging from .20 to .24, nonsignificant) (Levin & Fireman, 2002). This suggests that nightmares show specificity to unusual perceptual experiences during the day compared to anxiety and depression. Finally, people with frequent nightmares score significantly higher than people with infrequent nightmares on measures of schizotypy (e.g., unusual perceptual experiences and magical ideation) (Levin, 1998).

A large body of evidence suggests that nightmares are related to PTSD (Harvey, Jones, & Schmidt, 2003; Levin & Nielsen, 2007; Pillar, Malhotra, & Lavie, 2000; Ross, Ball, Sullivan, & Caroff, 1989), which is perhaps not surprising considering that distressing dreams are included as part of the diagnostic criteria for PTSD in the *DSM-IV-TR*. However, studies have also shown that nightmares are associated with non-sleep-related symptoms of PTSD. For example, Neylan et al. (1998) compared combat veterans with higher versus lower scores on a self-report measure of PTSD that excluded sleep disturbances. They found that 52.4% of veterans with high PTSD

scores reported nightmares occurring sometimes or frequently, whereas only 4.8% of veterans with low scores and 3.4% of civilians with low scores reported this same level of nightmares. Most of the variance in nightmare frequency was predicted by non-sleep-related PTSD symptoms, whereas lifetime and current diagnoses of other psychological disorders (e.g., substance abuse, depression, panic) were not significant predictors of nightmares. In addition, the authors reported that non-sleep-related PTSD symptoms correlated strongly with nightmares and initial insomnia related to nightmares (e.g., problems falling asleep due to fear of nightmares) (r = .69), but had much weaker correlations with middle insomnia (e.g., waking during the night) (r = .22). Overall, this study suggests that nightmares show specificity to PTSD compared to other sleep disturbances and other psychological disorders.

Similarly, Krakow et al. (2002) found that both retrospective and prospective measures of nightmare frequency in sexual assault survivors were associated with severity ratings of PTSD (rs ranging from .46 to .49). All of the correlations among nightmare measures and PTSD reached significance, whereas only 50% of the correlations among nightmare measures and anxiety/depression reached significance (rs ranging from .28 to .39); this is further evidence that nightmares show specificity to PTSD compared to depression and other indicators of anxiety.

Dreaming. People who suffer from nightmares report a rich dream life in general. They report more dreams, describe their dreams as more vivid and detailed (i.e., involving color, taste, smell, and touch), are more likely to be affected by their dreams the next day, and report more recurring dreams than people without nightmares (Belicki, 1992; Hartmann et al., 1987; Kales et al., 1980; Levin, 1994). It is possible that beyond nightmares, other dream experiences and dream recall itself are related to dissociation and schizotypy.

Unfortunately, very few studies have examined the overlap of dreaming experiences with dissociation and schizotypy. Most of the studies that have been conducted use individual items from the ISES General Sleep Experiences scale to show that measures of dissociation and schizotypy are related to prophetic dreams, problem-solving dreams, recurring dreams, vivid dreams, waking dreams, and dream recall (Watson, 2001, 2003b). Hartmann (1991) provides more evidence for the association of various types of dream experiences with dissociation and schizotypy. In this study, items from the Boundary Questionnaire were submitted to exploratory factor analysis. The largest factor that emerged from these analyses included items referring to vivid dreams, daydreaming, and nightmares (e.g., "My dreams are so vivid that even later I can't tell them from waking reality"), items referring to unusual perceptual experiences (e.g., "Things around me seem to change their size and shape"), and items referring to vivid imagery and absorption (e.g., "When I listen to music, I get so involved that it is sometimes difficult to get back to reality"). This large first factor appears to represent a combination of vivid dreams, nightmares, dissociation (in particular the Imagination/Absorption component), and the positive symptoms of schizotypy.

Narcolepsy. According to the *DSM-IV-TR*, a diagnosis of narcolepsy includes irresistible sleep attacks that occur daily for at least 3 months, along with one of the following symptoms: cataplexy, sleep paralysis (i.e., loss of muscle tone when transitioning between wake and sleep), hypnagogic and hypnopompic hallucinations. The *International Classification of Sleep Disorders* (ICSD-2; American Academy of Sleep Medicine, 2005) symptom criteria for narcolepsy include excessive daytime sleepiness and cataplexy, with the associated features of sleep paralysis, hypnagogic hallucinations, and awakenings during the night. Automatic behavior, in which the person acts without memory or consciousness, is also associated with a

diagnosis of narcolepsy (e.g., continuing to type on a computer, but typing nonsensical information) (American Academy of Sleep Medicine, 2005).

Some studies have reported little to no overlap of narcolepsy and schizotypy (Krishnan, Volow, Miller, & Carwile, 1984; Roy, 1976); however, data from other studies suggest that people with narcolepsy are more likely to be diagnosed with a psychotic disorder (e.g., schizophrenia, schizophreniform disorder, delusional disorder) than those without narcolepsy (Sours, 1963; Vourdas et al., 2002; Wilcox, 1985). Although some of these studies attribute these findings to stimulant medications (Vourdas et al., 2002), there does appear to be a high occurrence of schizotypal symptoms in patients with narcolepsy even after controlling for medication side-effects (Sours, 1963; Wilcox, 1985).

Several studies have also been conducted at the symptom-level. Spanos, McNulty, DuBreuil, and Pires (1995) found that participants who reported having experienced sleep paralysis had a significantly higher dissociation/schizotypy composite score than people who had never experienced sleep paralysis; this composite score correlated significantly with the intensity and frequency of sleep paralysis. In an epidemiological study with community members, Ohayon, Priest, Caulet, and Guilleminault (1996) found that participants with positive symptoms of schizophrenia (i.e., visual, olfactory, gustative, or somatic hallucinations while fully awake) reported a significantly higher percentage of hypnagogic and hypnopompic hallucinations than people without these symptoms. Moreover, people with positive symptoms were more likely to report hypnagogic and hypnopompic hallucinations than those with anxiety and mood disorders, which suggests a specific association between schizotypy and sleep-related hallucinations. In a later study, Ohayon (2000) found that prevalence of hypnagogic and hypnopompic hallucinations

in people with daytime hallucinations was two to three times higher than in the rest of the sample.

Finally, symptoms of narcolepsy have shown an association with PTSD. People who are diagnosed with PTSD or who have high scores on PTSD measures are more likely to report narcolepsy symptoms (including sleep paralysis, hypnagogic and hypnopompic hallucinations) than those without PTSD or those with low PTSD scores (Mellman, Kulick-Bell, Ashlock, & Nolan, 1995; Ohayon & Shapiro, 2000). However, it is important to note that PTSD is also associated with a wide-range of sleep disturbances, including insomnia, nightmares, and violent or dangerous behaviors during the night.

Complex and Automatic Behaviors

Complex and automatic behaviors at night—which are not represented on the ISES—also are often linked to dissociation and schizotypy. Epidemiological studies have shown that people with positive symptoms of schizophrenia (e.g., daytime hallucinations) and symptoms of PTSD report a significantly higher percentage of complex and violent behaviors during sleep (e.g., punching, kicking, leaping, running from bed) than participants without these symptoms (Ohayon, Caulet, & Priest, 1997; Ohayon & Shapiro, 2000). Conversely, those who report violent behaviors during sleep (i.e., potentially harmful behaviors to self or others) had significantly higher dissociation scores than those without violent behaviors (Agargun et al., 2002) .

Several sleep disorders include complex behavior as part of the symptom criteria, including sleep related dissociative disorder and rapid eye movement (REM) sleep behavior disorder (RBD). In these sleep disorders, seemingly purposeful behavior is performed during the sleep period without conscious awareness and without deliberate control over the behavior

(American Academy of Sleep Medicine, 2005). In many cases, the behavior is violent and can cause injury to the patient or endanger others (Mahowald & Schenck, 2005b; Ohayon et al., 1997; Schenck, Milner, Hurwitz, Bundlie, & Mahowald, 1989b). The following sections review studies that have reported an association among (a) daytime dissociation and sleep related dissociative disorder and (b) PTSD and RBD.

Sleep related dissociative disorder. Sleep related dissociative disorder is a relatively new sleep disorder that appeared for the first time in the *ICSD-2* and represents the nighttime variant of daytime dissociative disorders (American Academy of Sleep Medicine, 2005). Symptom criteria include the diagnosis of a dissociative disorder based on *DSM-IV-TR* criteria, with dissociative episodes arising during the main sleep period. In addition, dissociative episodes occur when the person is technically awake, either during the transition from wake to sleep or during awakenings at night (Schenck, Milner, Hurwitz, Bundlie, & Mahowald, 1989a). A wide range of complex and potentially harmful behaviors may arise during the nighttime dissociative episodes, including walking, self-mutilation, and driving, with subsequent amnesia for these events.

In a study of 150 patients with sleep-related injury, 5.3% of the sample was identified as having sleep related dissociative disorder based on lab tests and self-report ($N = 8$) (Schenck et al., 1989a). Dissociative episodes began after sleep onset and included acting like a jungle cat, driving or flying long distances from home, self-injurious behavior, and walking outside. Most participants had amnesia for these episodes, and 7 of the 8 patients reported dissociative symptoms during the day (two fulfilled criteria for multiple personality disorder and the others were diagnosed as having dissociative disorder NOS). Alternatively, 8 out of 29 patients

diagnosed with dissociative disorders reported having experienced nocturnal dissociative episodes (Agargun et al., 2001).

For a subset of patients, daytime and nighttime symptoms of dissociation appear to go hand-in-hand. Most people diagnosed with sleep related dissociative disorder have daytime symptoms of dissociation, although the reverse does not appear to be true. There is some debate as to whether sleep related dissociative disorder should be diagnosed independently from daytime dissociative disorders. At the moment, it is unclear whether daytime dissociative symptoms also sometimes occur during the night, or whether daytime and nighttime episodes represent separate disorders (Butler et al., 1996; Mahowald & Schenck, 2001b).

RBD. The symptom criteria for RBD include presence of REM sleep without atonia (i.e., muscle weakness) as demonstrated by laboratory tests and at least one of the following: violent or injurious behaviors during sleep that are reported by the patient and abnormal REM sleep behaviors documented in laboratory tests (American Academy of Sleep Medicine, 2005). Associated features include repetitive limb movements during sleep and isomorphism, in which the observed behaviors are related to the reported dream content (American Academy of Sleep Medicine, 2005). Usually the dreams associated with RBD are nightmares that involve violence and feelings of fear and anger (Schenck & Mahowald, 2002).

Research suggests that for some people, RBD is precipitated by trauma or stress and co-occurs with PTSD (Husain, Miller, & Carwile, 2001; Mahowald & Schenck, 2005a). Husain, Miller, and Carwile (2001) identified 27 patients diagnosed with RBD at a Veterans' Affairs Medical Center. Of these 27 patients, 15 (56%) had concurrent PTSD based on unstructured psychiatric interviews. The patients with comorbid RBD and PTSD acted out their nightmares and reported that their nightmares were about traumatic events. The authors suggest that PTSD

and RBD share the same pathophysiology. Conversely, people with PTSD may show symptoms of RBD that are not present in people without PTSD, including violent body movements accompanying nightmares and physical attacks on bed-partners (Hefez, Metz, & Lavie, 1987; van der Kolk, Blitz, Burr, Sherry, & Hartmann, 1984).

Methodological Issues and Future Research

The studies reviewed above provide preliminary evidence that unusual sleep experiences are related to dissociation and schizotypy. It has also been hypothesized that these daytime and nighttime symptoms form a common domain and there is some evidence to suggest that unusual sleep experiences, dissociation, and schizotypy are, in fact, more strongly related to each other than to other daytime and nighttime symptoms. However, several methodological weaknesses and limitations are present in the existing collection of studies that limit the conclusions that can be drawn.

Disorder-Based Analyses

Many of the studies reviewed in this paper utilize dichotomous diagnoses for either sleep disorders or psychological disorders or both. These types of disorder-based analyses are subject to many problems (including changing diagnostic criteria, diagnostic inconsistency, and diagnostic unreliability; Watson, 2009). We will review several of these issues in more detail.

Low base rates. One important issue with disorder-based studies is that the daytime disorders associated with unusual sleep experiences—including dissociative disorders and schizophrenia—tend to have low base rates. In addition, the diagnoses of sleep disorders that encompass symptoms of interest also tend to be quite rare. For example, the prevalence of RBD ranges from .38-.50% in the general population (American Academy of Sleep Medicine, 2005). Narcolepsy has a prevalence of .02-.16% in the general population (American Psychiatric

Association, 2000). Low base rates make it difficult to obtain large samples, which can then lead to problems with power and precision of estimates. In contrast to diagnoses, the symptoms of many of these daytime and nighttime disorders are much more common. For example, prevalence of sleep-related hallucinations in the general population is approximately 31% (Ohayon, 2000). Use of continuous measures can address the problems associated with low base rates because these analyses include participants with subclinical symptom levels (Widiger & Samuel, 2005).

Heterogeneous symptoms. Many psychological disorders have heterogeneous symptom criteria (Watson, 2005). As a result, symptom dimensions within the same diagnosis or within a total score can show differential relations with sleep complaints. This makes it crucial for future studies to move beyond general measures/diagnoses and to examine specific symptom dimensions. Another advantage of a symptom-based perspective is that it would allow studies to explore the continuity of daytime and nighttime experiences. It may be the case that specific nighttime experiences are related to corresponding daytime experiences. For example, people who have unusual visual experiences during the daytime (e.g., visual flashbacks in PTSD, hallucinations in schizophrenia) may be more likely to have unusual visual experiences at night (e.g., nightmares, hypnagogic hallucinations). Similarly, people who experience automatic behaviors during the daytime (e.g., dissociative episodes) may be more likely to experience automatic behaviors during the night (e.g., nighttime dissociative disorder, acting out dreams). Studies that report broad associations between sleep complaints and psychological disorders cannot address the question of symptom continuity in a compelling manner.

Assessment Issues

An additional limitation of many of the reviewed studies concerns the selection of assessment batteries. In the majority of cases, the assessment battery was limited to a single daytime and nighttime symptom of interest. In future studies, comprehensive measures of daytime and nighttime symptoms hypothesized to be inside and outside the domain will be necessary to (1) to clarify the boundaries of the proposed domain and (2) support the hypothesis that unusual sleep experiences are specific to dissociation/schizotypy compared to other psychological symptoms and other sleep experiences.

Given the importance of symptom-based analyses, it is essential to have a good understanding of the number and composition of symptom dimensions within the disorders of interest. This will help ensure that each dimension is fully captured within the assessment battery. Structural analyses have been used to clarify the symptom dimensions within depression (Watson, O'Hara et al., 2008; Watson et al., 2007), PTSD (Simms, Watson, & Doebbeling, 2002), dissociative disorders (Goldberg, 1999; Harrison & Watson, 1992; C. A. Ross et al., 1995), OCD (Watson & Wu, 2005), specific phobias (Cutshall & Watson, 2004), and schizophrenia/STPD (Arndt et al., 1991; Bergman et al., 1996; Chmielewski & Watson, 2008; Lenzenweger & Dworkin, 1996; Raine et al., 1994). In some cases instruments have been created based on these structural models. However, rationally created instruments can also be analyzed/scored according to prevailing structural models.

Compared to daytime symptoms, far less research has been done to explicate the structure of sleep complaints, and most sleep instruments are not based on structural analyses. When existing sleep instruments are submitted to factor analysis, the scales often do not replicate (Bastien, Vallieres, & Morin, 2001; Cole et al., 2006; Savard, Savard, Simard, & Ivers, 2005;

Spoormaker, Verbeek, van den Bout, & Klip, 2005). In addition, many existing sleep questionnaires are limited to a narrow range of content, most commonly lassitude and insomnia. This becomes particularly problematic when trying to assess the relations between daytime symptoms and more unusual sleep complaints, such as nightmares or narcolepsy symptoms.

In our work, we have found a robust two-factor model of sleep disturbances consisting of Insomnia (e.g., problems falling asleep, awakenings during the night, poor sleep quality) and Lassitude (e.g., hypersomnia, sleepiness, fatigue) (Koffel & Watson, 2009). We are currently conducting research to determine if unusual sleep experiences (e.g., nightmares, narcolepsy symptoms) cohere as a third factor. Understanding the structure of self-reported sleep disturbances will be crucial for the development of comprehensive assessment instruments and will provide an organizing framework for examining the specificity of daytime and nighttime symptoms.

Models for the Overlap of Unusual Sleep Experiences, Dissociation, and Schizotypy

If unusual sleep experiences, dissociation, and schizotypy share a common mechanism or pathophysiology, this would provide further evidence for a common domain of daytime and nighttime symptoms. Researchers have developed three models to explain the overlap of daytime and nighttime experiences: (1) abnormalities of the sleep-wake cycle; (2) stress and trauma; and (3) underlying personality traits. We will review each of these models separately, but it is important to note that there is a degree of overlap among the models. Any comprehensive theory of daytime and nighttime symptoms will most likely need to invoke aspects of all three models.

Biological Abnormalities

Mahowald and Schenck (2001a) suggest that abnormalities of the sleep-wake cycle are responsible for unusual sleep experiences and daytime symptoms of dissociation and schizotypy. Their model involves three states: wakefulness (W), rapid eye movement sleep (REM), and non-rapid eye movement sleep (NREM). These states are physiologically complex and require a coordinated interaction of many neuronal groups. As a result of this complexity, transitions between states are gradual and can result in the temporary overlap of state markers. For example, the eye movements typical of REM sleep may persist into NREM sleep.

Beyond these normal and brief overlaps of state markers, there can be a more severe blurring of state boundaries, due to environmental (e.g., sleep deprivation, stress) or biological (e.g., degenerative disorders, neurological injury) factors (Giesbrecht, Smeets, Leppink, Jelicic, & Merckelbach, 2007; Mahowald & Schenck, 2001a). Mahowald and Schenck (2001a) describe these mixtures of states as the result of "timing or switching errors in the normal process of the dynamic reorganization of the CNS as it moves from one state of being to another. Elements of one state persist, or are recruited, erroneously into another state" (p. 273). As a result of these switching errors, the states of W, REM and NREM are not unified and coherent, but mixed. This model conceptualizes unusual sleep experiences, symptoms of dissociation, and positive symptoms of schizotypy as resulting from the overlap of sleep and wake. Waking states overlap with REM to produce narcolepsy symptoms, RBD symptoms, and hallucinations during the day. Waking states overlap with NREM to produce sleepwalking and dissociative disorders. Symptoms of PTSD, such as flashbacks, are also conceptualized as mixtures of waking and NREM or REM (Mahowald & Schenck, 1992, 2001a). This model offers an explanation for the overlap among daytime symptoms of schizotypy and dissociation and nighttime experiences

such as narcolepsy and RBD. Someone with a tendency towards switching errors may experience both daytime and nighttime symptoms.

Predictions based on this model need to be tested experimentally. For example, the model predicts that narcolepsy symptoms, RBD, and daytime hallucinations result from a mixture of REM sleep and waking. Thus, one would expect to see markers of both REM and wake present in people experiencing these symptoms. Polysomnographic (PSG) recordings of people with narcolepsy and RBD suggest that these sleep disorders do involve mixtures of wake and REM. People with RBD enter REM sleep without the characteristic muscle atonia, and thus proceed to act out their dreams (Schenck & Mahowald, 2002). Their bodies are awake while their minds are in REM sleep.

In a reverse situation, REM sleep atonia intrudes into waking states to cause cataplexy and sleep paralysis in people with narcolepsy. Hypnagogic and hypnopompic hallucinations have also been attributed to the intrusion of REM sleep into wake (American Academy of Sleep Medicine, 2005). In laboratory recordings, patients with narcolepsy show ambiguous sleep states (i.e., mixtures of stage markers) and sleep-onset REM periods (SOREMPs), during which they transition quickly from wake to REM without the intermediary steps of dozing and deep sleep. These sleep-stage abnormalities have led researchers to conclude that narcolepsy involves problems with state boundary control, given that features from one state appear in another and that patients are unable to sustain a given state of sleep or wake (Broughton et al., 1986; Howland, 1997; Overeem, Mignot, van Dijk, & Lammers, 2001; Plazzi, Serra, & Ferri, 2008).

Compared to RBD and narcolepsy, there is less evidence that daytime hallucinations result from a mixture of REM and wake. Recordings of people with schizophrenia during daytime hallucinations have failed to find intrusions of REM sleep markers, including eye

movements, atonia, and saw-tooth waves (Rechtschaffen, Schulsinger, & Mednick, 1964). However, subgroups of patients with schizophrenia have shown SOREMPs, and several studies have found associations between short REM latency and positive and negative symptoms of schizophrenia (Benson & Zarcone Jr., 2005; Howland, 1997; Reich, Weiss, Coble, McPartland, & Kupfer, 1975; Tandon et al., 1992). These studies suggest that people with positive symptoms of schizophrenia may have problems with state boundary control, similar to patients with narcolepsy.

Mahowald and Schenck's (2001a) model suggests that both sleepwalking and dissociative disorders result from an overlap of NREM and wake. These disorders involve motor activity characteristic of the waking state, but attentional and memory systems controlled by the cortex remain deactivated, leading to complex, unconscious behavior. PSG studies have shown that sleepwalking arises from NREM sleep (American Academy of Sleep Medicine, 2005). In contrast, nocturnal dissociative episodes occur during well-established wakefulness after arousals during the night (Schenck et al., 1989a). However, there is some evidence that NREM markers during wake are related to dissociation/schizotypy. Specifically, people with high scores on dissociation and people diagnosed with schizophrenia show more delta and theta activity and less alpha activity (Giesbrecht et al., 2006; Sponheim, Clementz, Iacono, & Beiser, 1994). Because alpha power decreases and theta and delta power increase in the transition from wake to sleep, this has been interpreted as evidence that sleep is very close to the surface in people with dissociation/schizotypy and easily breaks into consciousness, leading to unusual perceptual experiences during the day (Giesbrecht et al., 2006; McCreery, 1997).

Whether Mahowald and Schenck's (2001a) model of overlapping sleep and wake states is appropriate for PTSD symptoms remains to be determined. It has been suggested that an

abnormal REM sleep mechanism is responsible for both flashbacks during the day and nightmares at night (Ross et al., 1989). Many studies have been conducted to determine if various aspects of REM sleep differ in people with and without PTSD, with inconsistent results (Harvey et al., 2003; Ross et al., 1989). However, a recent review suggests that more subtle abnormalities in REM sleep parameters, such as fragmentation, are present in participants with PTSD (Spoormaker & Montgomery, 2008).

Similar to Mahowald and Schenck (2001a), Hobson (2001) defines unusual daytime and nighttime symptoms as resulting from mixed sleeping and waking states. During waking, aminergic neurons are active and blood flow shifts to the dorsolateral prefrontal cortex and hippocampus, leading to analytical thought and working memory. During REM sleep, cholinergic neurons are activated and blood flow shifts to the subcortical limbic structures, leading to more basic processing, a focus on internal stimuli, nonlinear thought, and disruption in memory. Hobson (2001) suggests that people with schizophrenia show deficient frontal cortical activation and overactivation of the limbic system when awake, which resembles brain activation during REM sleep. Hobson (2001) also hypothesizes that people prone to dissociation have an inherited or learned hypersensitivity of the cholinergic system that allows them to easily shift from waking to dreamlike states.

A recent review extends this theory to patients with PTSD (Germain, Buysee, & Nofzinger, 2008). Patients with PTSD show a brain activation pattern that resembles REM sleep when they are awake (i.e., increased activation of the amygdala and decreased activation of the medial prefrontal cortex), which is thought to be due to fear conditioning. This altered brain activation may contribute to the generation of daytime symptoms (e.g., flashbacks), amplify

nighttime symptoms (e.g., nightmares), and result in objective sleep abnormalities (e.g., impaired regulation of REM and NREM sleep).

Despite the substantial theorizing in this area, very little research has been conducted. First, it will be necessary to examine the brain activation patterns and PSG of people prone to unusual nighttime and daytime experiences to see if there is evidence of mixed states. In addition, by examining the correlation of specific symptom dimensions with biological markers, studies will be able to explicate the relations between sleeping and waking symptoms. Second, more experimental studies are needed to examine whether sleep deprivation disrupts state determination and ultimately leads to increases in dissociation, schizotypy, and unusual sleep experiences. Although Giesbrecht, Smeets et al. (2007) found that sleep deprivation increased symptoms of dissociation, it is unclear if sleep deprivation also affects nighttime experiences.

Trauma

Traumatic events have long been thought to precede both daytime dissociation and sleep disturbances (Gershuny & Thayer, 1999; Harvey et al., 2003). There also is evidence that traumatic events are related to schizotypy (Berenbaum, Thompson, Milanek, Boden, & Bredemeier, 2008). The etiology of dissociative disorders is often described using a diathesis-stress model, in which premorbid personality traits involving a capacity to dissociate (such as absorption, fantasy-proneness, or hypnotizability) combine with trauma or stress to produce pathological dissociation (Butler et al., 1996; Gershuny & Thayer, 1999; Kihlstrom, 2005; Kihlstrom et al., 1994). Similarly, in the conceptualization of PTSD, the experience of a traumatic event leads to both daytime symptoms of dissociation (e.g., flashbacks) and nighttime symptoms (e.g., nightmares) (American Psychiatric Association, 2000). In addition to nightmares, trauma and abuse may lead to a wide-range of unusual sleep experiences, including

sleep paralysis, complex behaviors during sleep, and hypnopompic and hypnagogic hallucinations (Abrams, Mulligan, Carleton, & Asmundson, 2008; Agargun et al., 2002; Agargun, Kara, Ozer, Selvi, Kiran, & Kiran, 2003; Hefez et al., 1987; Husain et al., 2001; Ohayon & Shapiro, 2000; Schenck et al., 1989a; Semiz, Basoglu, Ebrinc, & Cetin, 2008; Soffer-Dudek & Shahar, in press; van der Kolk et al., 1984).

Several authors have suggested that sleep problems both before and immediately after traumatic events predict the later development and severity of PTSD (Harvey & Bryant, 1999; Harvey et al., 2003; Levin & Nielsen, 2007; Spoormaker & Montgomery, 2008). For example, people with nightmares before and after traumatic events had more severe PTSD symptoms than those without nightmares (Mellman, David, Bustamante, Torres, & Fins, 2001; Mellman, David, Kulick-Bell, Hebding, & Nolan, 1995). However, it has been found that insomnia and daytime sleepiness also predict later development of PTSD, suggesting that sleep complaints in general may be risk factors for PTSD (Koren, Arnon, Lavie, & Klein, 2002). It is also important to keep in mind that sleep disturbances after a trauma may be early symptoms of PTSD, rather than risk factors for PTSD (Koren et al., 2002). It is more likely the case that multiple daytime and nighttime symptoms of PTSD emerge (or become worse) following a trauma.

Unfortunately, chronology of nighttime and daytime symptoms following trauma is not clear from the studies that have been conducted to date, and several studies have been unable to find links between traumatic events and dissociation (Giesbrecht, Merckelbach, & Geraerts, 2007; Kihlstrom, 2005; Merckelbach & Giesbrecht, 2006). In addition, many of the studies that report a link between trauma and dissociation are based on retrospective self-reports without independent corroboration (Kihlstrom, 2005; Kihlstrom et al., 1994). People with strong dissociative tendencies may also be high in fantasy proneness, suggestibility, and susceptibility

to pseudomemories, which may lead to inaccurate reports of past trauma (Merckelbach & Muris, 2001).

Although longitudinal studies are clearly desirable, cross-sectional studies can be utilized to examine the relations among trauma, sleep, and dissociation, provided that the study design takes into account the problems associated with retrospective reports of traumatic events. Ideally studies would obtain corroboration of trauma reports from existing records, family members, or friends of the participant. However, in cases in which investigators must rely on retrospective self-report, there is evidence that scales containing objective and specific items referring to childhood abuse (e.g., struck with specific objects) rather than general global ratings (e.g., "My parents used harsh discipline with me between the ages of 5 and 10") correspond to objective records of abusive experiences independent of current mood (Prescott et al., 2000). Objective and specific definitions are also helpful because there is evidence that people high in dissociation are more likely to report negative experiences in general, not just traumatic events and are more likely to endorse vague traumatic events rather than specific events (Johnson, Edman, & Danko, 1995; Merckelbach & Jelicic, 2004).

Personality Traits

Personality traits also have been invoked to explain the overlap of unusual sleep experiences and daytime symptoms of dissociation and schizotypy. Numerous studies have shown that common personality traits are related to both sleep experiences and to measures of dissociation and schizotypy. The primary personality traits included in these studies are (1) absorption, which is the tendency to become immersed in daydreams, fantasies, or real-life experiences, commonly measured by the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974) and (2) fantasy proneness, in which people have a history of intense and realistic fantasies

or imaginings, commonly measured by the Inventory of Childhood Memories and Imaginings (ICMI; Wilson & Barber, 1981). The Creative Experiences Questionnaire (CEQ; Merckelbach, Horselenberg, & Muris, 2001) is also used to measure fantasy proneness and is based on the ICMI.

Several studies have reported relations among primary personality traits (e.g., absorption, fantasy proneness) and sleep experiences. Retrospective dream recall, lucid dreaming, and dream salience (i.e., bizarreness, vividness, colorfulness, impact of dreaming) are significantly related to fantasy proneness and absorption as measured by the ICMI and TAS (Levin & Young, 2001-2002; Schredl & Erlacher, 2004). In addition, people with frequent nightmares score higher on measures of absorption and fantasy proneness then those reporting less frequent nightmares (Levin & Fireman, 2001-2002). Beyond nightmares and dreaming, the remaining unusual sleep experiences measured by the ISES have also been linked to fantasy proneness and absorption (Fassler et al., 2006; Giesbrecht & Merckelbach, 2006; Knox, 2008; Spanos et al., 1995).

The primary personality traits that have been linked with unusual sleep experiences also show relations with dissociation and schizotypy (Butler, 2006; Kihlstrom et al., 1994). This finding may be due in part to overlapping content; items on measures of absorption and fantasy proneness show substantial overlap with items on measures of dissociation and schizotypy (Merckelbach et al., 2001; Tellegen & Atkinson, 1974; Wilson & Barber, 1981). Symptoms of dissociation are significantly correlated with fantasy proneness in psychiatric patients (Merckelbach, Campo, Hardy, & Giesbrecht, 2005) and with markers of imagination and fantasy in community members (Goldberg, 1999). Measures of dissociation and schizotypy have also shown significant relations to absorption and fantasy proneness in students (Fassler et al., 2006;

Giesbrecht & Merckelbach, 2006; Giesbrecht, Merckelbach, Kater et al., 2007; Knox, 2008; Merckelbach & Giesbrecht, 2006; Merckelbach, Muris, Horselenberg, & Stougie, 2000; Merckelbach, Rassin et al., 2000). This research suggests that varying levels of dissociation, schizotypy, and sleep experiences can be explained, at least in part, by individual differences on primary personality traits.

Moving beyond the primary personality traits of absorption and fantasy proneness, higher order personality traits have also shown relations with unusual daytime and nighttime experiences. Higher order personality traits are often conceptualized using the five factor model of personality, which includes the traits of Neuroticism, Extraversion, Conscientiousness, Agreeableness, and Openness (Goldberg, 1993; Watson, Clark, & Harkness, 1994). In general, Neuroticism and Openness are the Big Five traits that show substantial correlations with measures of dissociation, schizotypy, and sleep experiences (Goldberg, 1999; Watson, 2001, 2003b). Despite these substantial associations, measures of schizotypy, dissociation, and unusual sleep experiences tend to be more strongly related to each other than with measures of the Big Five, as was discussed earlier (Knox, 2008; Watson, 2001, 2003b).

It appears that the link between unusual sleep experiences and dissociation/schizotypy cannot be entirely explained by the Big Five personality traits. Some authors have argued for the existence of a sixth higher order trait that would encompass unusual cognitions and perceptions during the day and at night, as well as the primary personality traits of absorption and fantasy proneness. This trait has been named “schizotypy” (Claridge, Clark, & Davis, 1997), “transliminality” (Thalbourne & Houran, 2000), and “thin boundaries” (Hartmann, 1991). Several studies have presented structural evidence supporting the existence of a sixth higher order factor of personality that encompasses unusual cognitions and perceptions. Tackett,

Silberschmidt, Krueger, and Sponheim (2008) found that measures of positive and disorganized symptoms of schizotypy, including the Magical Ideation and Perceptual Aberration scales, as well as SPQ scales measuring odd speech and behaviors, suspiciousness, odd beliefs, ideas of reference, and unusual perceptions, loaded onto a Peculiarity factor. Watson, Clark et al. (2008) label this trait Oddity and present a series of studies exploring the structure of this construct. Scales that consistently load on the Oddity factor include symptoms of dissociation (e.g., Obliviousness/Amnesia) and positive/disorganized symptoms of schizotypy (e.g., Unusual Beliefs and Experiences, Mistrust, and Eccentricity/Oddity). In addition, scales measuring OCD and fantasy proneness also loaded on this factor. There is also some evidence that lower order Openness scales that load primarily on the Openness factor (e.g., fantasy, ideas, aesthetics) also show moderate cross-loadings on the Oddity factor. Finally, the authors suggest that scales measuring unusual sleep experiences (e.g., narcolepsy symptoms, nightmares, vivid dreams) would also load on this factor, although measures of unusual sleep experiences were not included in these studies.

The structural studies reviewed above suggest that symptoms of dissociation and schizotypy, as well as unusual sleep experiences and certain lower order personality traits (e.g., fantasy proneness, absorption), can be conceptualized as facets of the Oddity factor. There are three main directions for future research in this area: (1) structural studies with more comprehensive assessment batteries; (2) studies examining the temporal stability of the facets of the Oddity factor, specifically unusual sleep experiences; and (3) studies integrating biological variables with personality measures. We will review each of these topics in more detail.

First, it will be important for future studies to include a comprehensive assessment battery in order to verify the lower order facets of Oddity. Along with symptom measures of

dissociation, schizotypy, PTSD, and unusual sleep experiences, measures of personality traits hypothesized to be both inside and outside the domain should be included. Several research projects are currently underway to further explicate this Oddity factor (e.g., Chmielewski & Watson, 2007, October; Stringer et al., 2009). Second, it is necessary to determine if the proposed facets of the Oddity factor show temporal stability. Although it has been shown that measures of dissociation and schizotypy are stable over two months (Raine, 1991; Watson, 2003a), the trait-like nature of unusual sleep experiences is much more uncertain (Van Dongen, Vitellaro, & Dinges, 2005). There is some evidence that self-reported dream frequency shows evidence of stability over 22 weeks (Schredl, Funkhouser, Cornu, Hirsbrunner, & Bahro, 2001), but more research is needed (see also Watson, 2003b). The third area for future research is integrating personality measures and biological variables, which will increase our understanding of this sixth personality dimension. For example, it has been suggested that there may be associations between this personality dimension and markers of mixed sleep-wake states (Hartmann, 1991; Spanos et al., 1995).

Conclusion

The primary goal of this review was to examine the evidence for a common domain of sleep, dissociation, and schizotypy. It is clear from the studies included in this review that unusual sleep experiences (e.g., nightmares, vivid dreams, narcolepsy symptoms, complex behaviors at night) are associated with symptoms of dissociation/schizotypy in both clinical and non-clinical samples. 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-related symptoms thought to be outside the boundaries of the hypothesized domain. However, there is some evidence that unusual sleep experiences, dissociation, and schizotypy are

more strongly related to each other than to other measures of daytime symptoms (e.g., negative affectivity/neuroticism, depression, anxiety, substance use) and sleep complaints (e.g., insomnia and lassitude). By including more comprehensive assessment batteries, studies can begin to determine the exact boundaries of the domain.

Another direction for future research will be to examine the association of unusual sleep experiences and dissociation/schizotypy at a specific symptom level. Although there is limited evidence suggesting a continuity of symptoms (e.g., individuals who experiences flashbacks during the day are particularly prone to nightmares, whereas individuals who experience periods of automatic and unremembered behavior during the day also perform automatic behaviors during the night), this research is still very preliminary.

Finally, studies are needed to substantiate the theories for the overlap of nighttime and daytime symptoms. This article has reviewed three primary theories for this overlap, including biological abnormalities, stress/trauma, and personality traits. Despite an abundance of theories, the causal sequence of events leading to unusual cognitive and perceptual experiences during the day and at night is unclear. It is likely that biological and environmental factors interact to produce daytime and nighttime experiences. However, this interplay would necessarily be complex and at the moment it is not well understood. Mapping the domain of dissociation, schizotypy, and unusual sleep experiences and determining the etiology of these symptoms represents an exciting area for future research.

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Table 1

Factor Structure of Measures of Negative Affectivity, Obsessive Compulsive Disorder (OCD), Dissociation, and Unusual Sleep Experiences

	Negative Affectivity	OCD	Dissociation	Unusual Sleep Experiences
BFI Neuroticism 2	**.91**	-.07	-.04	.04
BFI Neuroticism 1	**.86**	.02	-.09	.08
PSWQ 2	**.79**	.18	-.13	.04
PSWQ1	**.74**	.21	-.14	.02
PANAS NA 2	**.69**	-.12	**.36**	-.11
PANAS NA 1	**.67**	-.05	.27	-.09
SCOPI 1	-.02	**.90**	-.05	.07
SCOPI 2	.03	**.88**	-.03	.02
OCI-R 1	.06	**.71**	.21	-.08
OCI-R 2	.07	**.65**	.26	-.09
DES 2	-.00	.01	**.78**	-.02
DES 1	-.08	.11	**.72**	.01
DPS 2	.07	.06	**.57**	.28
DPS 1	.01	.06	**.54**	**.33**
ISES GSE 1	.03	-.04	.04	**.84**
ISES GSE 2	-.03	-.01	.09	**.81**

Note. n = 376. Factor loadings of |.30| and higher are highlighted. 1 = Time 1 measures. 2 = Time 2 measures. BFI = Big Five Inventory. PSWQ = Penn State Worry Questionnaire. PANAS NA = Positive and Negative Affect Schedule, Negative Affect. SCOPI = Schedule of Obsessions, Compulsions, and Pathological Impulses. OCI-R = Obsessive Compulsive Inventory-Revised. DES = Dissociative Experiences Scale. DPS = Dissociative Processes Scale. ISES GSE = Iowa Sleep Experiences Survey, General Sleep Experiences scale.

Table 2

Inter-factor Correlations of Negative Affectivity, Obsessive Compulsive Disorder (OCD), Dissociation, and Unusual Sleep Experiences

	1	2	3	4
1. Negative Affectivity	.__			
2. OCD	.52	.__		
3. Dissociation	.26	.45	.__	
4. Unusual Sleep Experiences	.27[b]	.34[b]	.45[a]	.__

Note. n = 376. Within the Unusual Sleep Experiences row, correlations differ from one another (p < .05, 2-tailed), unless marked with the same superscript.

Table 3

Factor Structure of Measures of Sleep, Dissociation, Schizotypy, Depression, and Anxiety

	Factor 1	Factor 2
Magical Ideation	**.82**	-.13
DPS	**.80**	.02
QED	**.78**	.02
CES	**.76**	.10
ISES General Sleep Experiences	**.74**	.03
Perceptual Aberration	**.72**	.02
STA	**.65**	.21
ISES Lucid Dreaming	**.42**	-.07
ISDI Nightmares	**.37**	.18
IDAS Dysphoria	.13	**.81**
IDAS Lassitude	-.10	**.77**
IDAS Insomnia	.01	**.71**
ISDI Fatigue	-.08	**.58**
IDAS Ill Temper	.19	**.56**
IDAS Social Anxiety	.27	**.50**
IDAS Traumatic Intrusions	**.35**	**.48**
ISDI Initial Insomnia	.00	**.44**
IDAS Panic	**.37**	**.44**
IDAS Suicidality	.26	**.43**
IDAS Appetite Gain	.01	**.40**
IDAS Appetite Loss	.12	**.33**
IDAS Well Being	.03	**-.44**

Note. n = 374. Factor loadings of |.30| and higher are highlighted. DPS = Dissociative Processes Scale. QED = Questionnaire of Experiences of Dissociation. CES = Curious Experiences Survey. ISES = Iowa Sleep Experiences Survey. STA = STQ Schizotypal Personality scale. ISDI = Iowa Sleep Disturbances Inventory. IDAS = Inventory of Depression and Anxiety Symptoms.