Rumination and Dissociation: The Mediating Role of Poor Sleep Quality and Presleep Cognitions

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Rumination and dissociation are considered maladaptive cognitive-emotional responses to distress, which prevent its proper processing. The goal of the study was to explore the relationship between rumination and dissociation and possible mechanisms responsible for it. We hypothesized that rumination may exert influence on dissociation via four possible mediators: distress, perceived mental control, repetitive cognitive style, and poor sleep quality. Study 1 was conducted on a sample of 93 undergraduate students and pointed to a central role of sleep in this relationship. Study 2 included 218 undergraduate students and aimed to (a) replicate the results of Study 1 and (b) focus on the sleep factor and explore the role of bedtime strategies for dealing with negative thoughts. Both studies point to sleep quality as the central factor responsible for the positive link between rumination and dissociation. The repetitiveness and the negative valence of rumination predict poor sleep quality, which in turn predicts higher levels of dissociative experiences. We also found that ruminative individuals who cope with intrusive thoughts at bedtime using maladaptive and rigid strategies (aggressive suppression, behavior distraction and worry) slept poorly and reported more dissociative symptoms. We conclude that rumination and dissociation are linked through the disturbed cycle of wake and sleep states and impaired flexibility in transitioning between them. Implications for clinicians and researchers are discussed.

Keywords: rumination, dissociation, sleep, repetitiveness, suppression

Dissociation and rumination are both considered to be maladaptive cognitive-emotional responses to psychological stress (see Nolen-Hoeksema, 1991, for rumination; Gershuny & Thayer, 1999, for dissociation). A primary goal of our research was to examine the association between these divergent responses to stress.

Rumination involves repetitively focusing on one’s distress or sadness, and on the circumstances associated with those feelings, such as their possible causes and consequences (Conway, Csank, Holm, & Blake, 2000; Nolen-Hoeksema, 1991). Ruminative repetitive thoughts may also represent goal discrepancy, that is, the discrepancy between the actual and desired status of achieving one’s goals (Martin & Tesser, 1996). Whereas the latter definition conceptualizes rumination as a state response to a situation, the former (Conway et al., 2000; Nolen-Hoeksema, 1991) conceives of rumination as possessing a trait-like quality. To integrate this state-trait discrepancy, Watkins and Nolen-Hoeksema (2014) conceptualized rumination as a “mental habit,” suggesting that self-focused passive repetitive thoughts triggered by specific states of goal discrepancies may become habitual and eventually, resistant to change. Although the definitions of rumination vary, they share the experience of repetitive, intrusive, and negative cognitions (Querstret & Copley, 2013), and indeed, rumination plays a pertinent role in the development and persistence of negative moods (Smith & Alloy, 2009).
Thus, rumination is a maladaptive, yet stable, response to distress (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

Like rumination, dissociation is also considered to be a maladaptive response to stress. Dissociation is a multifaceted phenomenon (e.g., Holmes et al., 2005) that can be defined as the splitting of clusters of mental contents (e.g., thoughts, feelings, memories) from conscious awareness (Diagnostic and Statistical Manual of Mental Disorders, 5th ed. [DSM–5], American Psychiatric Association, 2013). According to a widely adopted framework for describing dissociative experiences, these experiences encompass three empirically derived factors based on factor analyses of the Dissociative Experiences Scale (DES-II; Carlson & Putnam, 1993). These include dissociative amnesia (difficulty in accessing autobiographical memory), derealization or depersonalization (altered experience of one’s surroundings or one’s self), and dissociative absorption and imaginative involvement (total immersion in an internal or external stimulus to the point of obliviousness to the environment, see Soffer-Dudek, Lassri, Soffer-Dudek, & Shahar, 2015).

Putnam (1991) and others have suggested that dissociation provides a mental escape from distress by denying introspective access to undesirable mental contents, a mechanism considered to be maladaptive in that it interferes with emotional processing of distressing experiences and hinders adaptive functioning (Foa & Hearst-Ikeda, 1996; Schauer & Elbert, 2010; Spiegel, 1991). Indeed, dissociation is related to the experience of psychological distress and to manifestations of psychopathology (Briere, Scott, & Weathers, 2005; Gershuny & Thayer, 1999; Soffer-Dudek, 2014; Soffer-Dudek & Shahar, 2009, 2011; van Ijzendoorn & Schuengel, 1996). Researchers have suggested that the tendency to dissociate, or to react with emotional detachment to extreme stress, may, over time, be used nonselectively when confronting even minor stressors (Perry, Pollard, Blakley, Baker, & Vigilante, 1995; Spiegel et al., 2011). Accordingly, a dispositional tendency for dissociative experiences may be activated as a response to stressful situations. Indeed, studies have documented that measures of both trait and state dissociation are highly correlated (r = .49–.67; Soffer-Dudek & Shahar, 2011) and that absorption, considered a trait predisposition (Tellegen & Atkinson, 1974), is higher among patients with posttraumatic stress disorder (PTSD) compared with controls (Armour, Contractor, Palmieri, & Elhai, 2014).

Although researchers have conceptualized both rumination and dissociation as maladaptive responses to distress, rumination involves a passive fixation on negative mental contents, which interferes with effective coping responses (Ehlers & Clark, 2000), whereas dissociation involves avoidance of contact with negative cognitive and emotional contents and resultant problems in effectively integrating and processing the diverse elements of such contents. The fact that both rumination and dissociation preclude adaptive emotional processing of cognition and affect and thus engender or prolong distress (Clohessy & Ehlers, 1999), may explain why researchers have linked rumination and dissociation with the same psychopathological disorders. More specifically, both rumination and dissociation after trauma predict PTSD (see Ehring, Frank, & Ehlers, 2008; Michael, Ehlers, Halligan, & Clark, 2005; Murray, Ehlers, & Mayou, 2002, for rumination, and Carlson & Rosser-Hogan, 1991; Murray et al., 2002, for dissociation) and are, more generally, related to (a) depression (see Just & Alloy, 1997; Michl, McLaughlin, Shepherd, & Nolen-Hoeksema, 2013; Nolen-Hoeksema & Morrow, 1993; Ruscio et al., 2015, for rumination; see Lipsanen, Saarijärvi, & Lauerma, 2004; Martinez-Tabaos, 1991; Wise, Mann, & Sheridan, 2000, for dissociation), (b) pathological worry/generalized anxiety disorder (see Dar & Iqbal, 2015; Ruscio et al., 2015; van Rijssoort, Emmelkamp, & Vervaeke, 2001, for rumination, and Muris, Merckelbach, & Peeters, 2003, for dissociation), and (c) obsessive–compulsive disorder (OCD; see Dar & Iqbal, 2015; Vaidya & Adhikari, 2014; Wahl, Ertle, Bohne, Zuroski, & Kordon, 2011, for rumination, and Paradisis, Aardema, & Wu, 2015; Rufer et al., 2015).

1 Although absorption is more common in normative populations than the other two factors, and hence has been traditionally considered as “nonpathological,” recent evidence supports the relevance of absorption to psychopathology (Soffer-Dudek et al., 2015). For example, researchers have found that absorption is related to symptoms of general distress, as well as to PTSD and obsessive–compulsive symptoms (Armour et al., 2014; Soffer-Dudek, 2016; Soffer-Dudek et al., 2015).
This transdiagnostic correspondence suggests that rumination and dissociation share common mechanisms. However, they differ in that whereas rumination involves difficulty in disconnecting from negative mental contents, dissociation involves an abnormal or maladaptive separation from such contents. Not surprisingly, their corresponding physical correlates are different: Whereas researchers have determined that rumination is associated with elevated heart rate and a high level of arousal (Ottaviani, Shapiro, Davydyov, Goldstein, & Mills, 2009), dissociation is also related to alterations in the sleep–wake cycle, but with equivocal findings. Some researchers have pointed to hypervigilance as characteristic of dissociation (e.g., Bernstein, Delker, Knight, & Freyd, 2015), whereas others have secured contrary evidence; specifically low heart rate and reduced arousal among dissociative individuals (e.g., Kooiman et al., 2004). Such differences, alongside salient similarities reviewed above, raise questions as to how rumination and dissociation are potentially related.

Several findings imply that the direction of the association between rumination and dissociation is positive, despite the salient differences noted. Armey and Crowther (2008) found that dissociation mediated the link between rumination and nonsuicidal self-injury. Researchers have also reported that dissociation partially mediates the relation between inner speech and self-referential ideas (Bellido-Zanin, Perona-Garcelán, Senín-Calderón, López-Jiménez, & Rodríguez-Testal, 2016); such inner speech characterizes rumination, which is related to verbal processes inherent in internal dialogue (Nolen-Hoeksema, 2004).

Additional support for a possible positive relationship between rumination and dissociation comes from studies of PTSD. PTSD is characterized by cognitive intrusions of mental images, memories, or otherwise intrusive thoughts related to the trauma. Such “flashback” experiences are defined in the DSM–5 as dissociative reactions (American Psychiatric Association, 2013). Although rumination often functions as a maladaptive cognitive strategy aimed at contending with these intrusions (Steil & Ehlers, 2000), rumination perpetuates PTSD symptomatology and paradoxically predicts more intrusions (Birrer & Michael, 2011). Together, these findings suggest that rumination may increase dissociation. Nevertheless, to date, research has not focused directly on the relationship between rumination and dissociation; thus, our knowledge about this relationship is limited.

Accordingly, two questions arise: First, is there a causal relationship between rumination and dissociation? Although the findings reviewed imply that rumination may increase dissociation, some of the findings are based on cross-sectional designs (e.g., Armey & Crowther, 2008) that preclude determining the direction of causality. Specifically, it is also possible that dissociation increases rumination, or that the relationship is spurious, meaning that rumination and dissociation may both be caused by a third factor, rather than influence each other directly. Second, to the extent that rumination increases dissociation, how does this process come about (i.e., via what mechanisms?).

The focus of our study pertains to the second question.2 We hypothesize that rumination increases dissociation via four potential mechanisms. First, distress: Rumination exacerbates distress or negative emotions (Nolen-Hoeksema et al., 2008), which may become overwhelming and induce a dissociative response. Second, repetitiveness: Rumination is characterized by repetition (Nolen-Hoeksema, 1991), which may induce dissociation. Pynte (1991), for example, suggested that if a word is repeated 10 times, it starts to feel disconnected from its meaning, implying that repetitive verbalizations, and by extension, repetitive thoughts, can promote dissociation. Prolonged staring at one’s face in a mirror can also increase the feeling of detachment from the reflected image, producing dissociative experiences (Brewin, Ma, & Colson, 2013; Brewin & Mersaditabari, 2013). Moreover, different forms of perseveration (e.g., prolonged fixation on an object, checking or repeat-

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2 Notably, because direction of causality may not be determined based on a cross-sectional design, we cannot distinguish whether the responsible mechanisms we detect are mediators or rather root causes for both rumination and dissociation (i.e., produce a spurious relationship). However, we can compare the magnitude of the effects of several potential responsible mechanisms, to determine key factors in the rumination–dissociation link.
ing sentences) can bring about dissociation by blocking the activation of associated concepts, a process labeled “semantic satiation” (Giele et al., 2013; Giele, van den Hout, Engelhard, & Dek, 2014; Sanbonmatsu, Posavac, Vamous, Ho, & Fazio, 2007; van den Hout, Engelhard, de Boer, du Bois, & Dek, 2008; van den Hout et al., 2009). Giele et al. (2016) found that word repetition is more likely to engender dissociative experiences among individuals with OCD, compared with healthy participants. Considering the high levels of dissociation in OCD (Goff, Olin, Jenike, Baer, & Buttolph, 1992; Paradisis et al., 2015; Watson et al., 2004), these findings suggest the possibility that the impact of repetitiveness on dissociative experiences is more robust when a predisposition to dissociation exists.

A third possible mechanism for why rumination would increase dissociation is fear of losing control. Ruminative thoughts often reflect a lack of perceived control (Nolen-Hoeksema, 2000; Papageorgiou & Wells, 2001). Similarly, experiencing lack of control is related to dissociation (Clohessy & Ehlers, 1999; Gershuny, Cloitre, & Otto, 2003), possibly because fear of losing control may produce a dissociative response (Gershuny & Thayer, 1999).

Finally, the fourth possible mechanism is impaired sleep. Increased rumination is associated with poorer sleep quality, longer sleep latency, and more frequent sleep disturbances (Carney, Edinger, Meyer, Lindman, & Istré, 2006; Cropley, Dijk, & Stanley, 2006; Thomsen, Mehlson, Christensen, & Zachariae, 2003). Rumination-based degradation of adaptive sleep is probably due to emotional and cognitive arousal stimulated by repetitive thoughts at bedtime that engender difficulty falling asleep and entering deep sleep (Thomsen et al., 2003). Notably, researchers have hypothesized that dissociation stems from altered sleep patterns (Lynn, Lilienfeld, Merckelbach, Giesbrecht, & van der Kloet, 2012; van der Kloet, Merckelbach, Giesbrecht, & Lynn, 2012). Specifically, dissociation appears to be related to a labile sleep–wake cycle and possibly represents intrusions of sleep elements into waking consciousness (Koffel & Watson, 2009; Mahowald & Schenck, 2001; Van der Kloet, Giesbrecht, Lynn, Merckelbach, & de Zutter, 2012) and waking elements into sleeping consciousness (Soffer-Dudek, 2017). Indeed, sleep prevention among nonclinical samples produces higher levels of dissociation and the practice of sleep hygiene reduces levels of dissociation (Giesbrecht, Smeets, Leppink, Jelicic, & Merckelbach, 2007; Soffer-Dudek et al., 2017; van der Kloet et al., 2012). Borders, Rothman, and McAndrew (2015) found that sleep problems mediated the associations between rumination and PTSD symptoms, which include dissociative responses such as intrusive images (DSM–5; American Psychiatric Association, 2013). According to the researchers, rumination prolongs cognitive and physiological arousal, impairing sleep, which in turn, prevents healthy emotional processing of traumatic memories.

The possibility that sleep mediates the relation between rumination and dissociation also raises the question of the role of different strategies for coping with intrusive thoughts before sleep. Specifically, people employ coping strategies that are more or less successful for contending with disturbing thoughts during bedtime. Harvey (2001) proposed a six-category classification scheme of strategies for coping with intrusive thoughts at bedtime: (a) aggressive suppression (e.g., “tell myself not to think about it”), (b) cognitive distraction (e.g., “think pleasant thoughts instead”), (c) reappraisal (e.g., “try a different approach for thinking about it”), (d) behavioral distraction (e.g., “occupy myself with work instead”), (e) social avoidance (e.g., “avoid discussing the thought”), and (f) worry (e.g., “focus on the negative thought”). Harvey (2000) hypothesized that the type of strategy that individuals use may influence the extent to which intrusive thoughts impair sleep quality. In accordance with this hypothesis, researchers have found that worry and aggressive suppression were especially maladaptive and related to poor sleep quality, depression, and anxiety (Harvey, 2001; Ree, Harvey, Blake, Tang, & Shawe-Taylor, 2005).

We contend that dysfunctional strategies may also determine the manner in which sleep quality and sleep consciousness are impaired, and its effect on dissociative symptoms. Specifically, the strategies may affect sleep–wake boundaries, which are hypothesized to be somewhat labile or fluid among dissociative individuals (van der Kloet, et al., 2012). However, to the best of our knowledge, the relationship between dissociation and strategies to cope with negative repetitive thoughts before sleep has not been explored to date. Accordingly, another aim of
our study was to examine this potential relationship.

To accomplish these aims, we conducted two studies. In both, we examined the potential mediating role of four mechanisms (i.e., distress, perceived mental control, repetitiveness, and sleep quality) in the link between rumination and dissociation, and we hypothesized a model that also includes associations among these potential mediating variables. Based on previous research, we assumed that a decrease in perceived mental control would predict distress (Gershuny et al., 2003), and that negative affect would predict poor sleep quality (e.g., Hall et al., 2000; Taylor, Lichstein, Durrence, Reidel, & Bush, 2005). Finally, we hypothesized that repetitiveness would predict poor sleep quality, based on findings that intrusive and repetitive thoughts impair sleep quality (Harvey, 2001). The hypothesized predictions are depicted in a path model (see Figure 1), which may be labeled a multiple-step multiple mediator model (Hayes, 2009).

In Study 2, we aimed to replicate the findings from Study 1 using a larger sample. Following findings from Study 1, we also expanded our focus on sleep as a mediator by assessing bedtime strategies for dealing with negative thoughts before sleep that play a mediating role in the path involving sleep quality. Because dissociation is related to worse prognosis in several anxiety and depressive disorders (e.g., Kleindienst et al., 2011; Rufer et al., 2006; Spitzer, Barnow, Freyberger, & Grabe, 2007), understanding the pathway from rumination to dissociation is important and may eventually aid in enhancing clients’ therapeutic gains and well-being.

Study 1

Method

Participants and procedure. Ninety-four undergraduate students (77.7% females, \( M_{\text{age}} = 24.09, SD_{\text{age}} = 1.48 \)) participated in the study in exchange for course credit. We assessed age, gender, socioeconomic status, religiosity level, and familial status. The demographic characteristics of the sample are presented in Table 1.

The participants signed up for a study labeled “Responses to mood and their relation to affect and cognition” via the institutional psychological experiments system. Through this system, they received a link to online survey software (Qualtrics, Provo, UT) containing the questionnaires for this study. They were asked to complete them in a quiet place, from their own home or laptop computer. After signing an electronic consent form, they completed the questionnaires in a single session and in a fixed order. Participants were instructed to respond to the questions as honestly as possible and to contact the researchers if they have any difficulties or concerns. The participants were subsequently debriefed regarding the purposes of the study. The procedure was completed in approximately 30 min. Ben-Gurion University’s institutional ethics review board approved the study. Notably, the data from one participant were eliminated from the analysis due to missing values, resulting in a sample of \( N = 93 \) (The analysis of missing data patterns is detailed in the results section).

Measures.

Rumination. The 22-item Ruminative Response Scale (RRS) is a reliable and valid mea-
sure of rumination (Nolen-Hoeksema & Morrow, 1991). According to Treynor, Gonzalez, and Nolen-Hoeksema (2003), the RRS contains three subscales which reflect depression (assessing depressive symptoms and including 12 items), brooding (assessing passive and repetitive focus on the negative symptoms and including five items), and reflection (assessing neutral self-focusing and insight and including five items). Because brooding better fits the definition of rumination, and is the factor that predicts depression (Treynor, et al., 2003), we relied solely on the brooding factor as a measure of negative, passive, and repetitive rumination. The Hebrew version of the questionnaire has good internal consistency and validity (e.g., Daches, Mor, Winquist, & Gilboa-Schechtman, 2010). Cronbach’s alpha in Study 1 was 0.77.

**Dissociation.** The 28-item Dissociative Experiences Scale (DES-II; Carlson & Putnam, 1993) measures the percentage of time the individual experiences dissociation on an 11-point scale. The three subscales of dissociation (absorption, amnesia, and depersonalization/derealization) were computed based on a large-scale factor analysis including both psychiatric and nonclinical subjects (Carlson et al., 1991). The Hebrew version has been used extensively in Israel and is reliable and valid (e.g., Somer, Dolgin, & Saadon, 2001; Soffer-Dudek & Shahar, 2009, 2011). Cronbach’s alpha in Study 1 was 0.94 for the total score, 0.85 for absorption, 0.87 for amnesia and 0.86 for depersonalization/derealization.

**Negative emotion.** The 10-item negative scale of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) includes items that measure negative feelings on a 5-point scale: distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid. We asked the participants to respond based on their emotions in the last 2 weeks. The PANAS is a reliable and valid measure (Watson et al., 1988). We used the Hebrew version of the questionnaire (Ben-Zur, 2002). Cronbach’s alpha in Study 1 was 0.85.

**Perceived mental control.** After answering the items of the RRS (that assesses responses to sad mood), the participants rated, using a single item, the extent to which they feel that they have control over such responses to sad mood on a 7-point scale. This procedure was validated in a previous study (Clohessy & Ehlers, 1999), in which the researchers measured perceived control of intrusive memories by asking the participants to rate the perceived controllability of an intrusive memory, following their description of the memory.

**Repetitiveness.** We used two factors of the Preservative Thinking Questionnaire (Ehring et al., 2011) that measure repetitiveness and difficulty in disengaging from specific thoughts on a 5-point scale, and include three items each. The questionnaire possesses good reliability and validity (Ehring et al., 2011). The items were translated and back-translated to ensure validity of the Hebrew version. Cronbach’s alpha in Study 1 was 0.94.

**Sleep quality.** The 19-item Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) assesses sleep quality during the past month. The PSQI possesses acceptable internal homogeneity, consistency, and validity (Buysse et al., 1989). The questionnaire includes seven subscales: Subjective Sleep Quality, Sleep Latency, Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of Sleeping Medication, and Daytime Dysfunction, as well as a total sleep quality score, which was used in this study. Shochat, Tzischinsky,

### Table 1
Demographic Characteristics of the Samples for Study 1 and Study 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study 1, N = 93</th>
<th>Study 2, N = 218</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, M (SD)</td>
<td>24.09 (1.49)</td>
<td>24.01 (1.30)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20 (21.5%)</td>
<td>47 (21.6%)</td>
</tr>
<tr>
<td>Female</td>
<td>73 (78.5%)</td>
<td>171 (78.4%)</td>
</tr>
<tr>
<td>Religiosity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secular</td>
<td>69 (74.2%)</td>
<td>178 (81.7%)</td>
</tr>
<tr>
<td>Religious</td>
<td>22 (23.7%)</td>
<td>37 (16.9%)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (2.2%)</td>
<td>3 (1.4%)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>88 (94.6%)</td>
<td>215 (98.6%)</td>
</tr>
<tr>
<td>Married</td>
<td>5 (5.4%)</td>
<td>3 (1.4%)</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-income family</td>
<td>35 (37.6%)</td>
<td>81 (37.2%)</td>
</tr>
<tr>
<td>Medium income family</td>
<td>17 (18.3%)</td>
<td>34 (15.6%)</td>
</tr>
<tr>
<td>High-income family</td>
<td>37 (39.8%)</td>
<td>89 (40.8%)</td>
</tr>
<tr>
<td>Missing</td>
<td>4 (4.3%)</td>
<td>14 (6.4%)</td>
</tr>
</tbody>
</table>

Note. SD = Standard Deviation.
Oksenberg, and Peled (2007) validated the Hebrew version of the PSQI. Cronbach’s alpha in Study 1 was .70.

Data analyses. After establishing the hypothesized positive correlation between rumination and dissociation, we sought to determine both the magnitude and the statistical significance of the indirect mediation paths hypothesized in Figure 1. To do this, we used bootstrapping with 1,000 resamples and 95% confidence intervals (bias-corrected accelerated), a recommended approach for testing for mediation (Preacher & Hayes, 2008). 3 We relied on the PROCESS macro (Version 2.15; Hayes, 2013) for SPSS (Version 23) to conduct the analyses. We used Models 4 and 6 in the PROCESS macro, which allow for the examination of several mediators at once (Model 4; e.g., A and B both mediate the link between X and Y) or a chain of mediators (Model 6; e.g., X predicts A, which predicts B, in turn predicting Y).

Results

First, missing data patterns were estimated using the missing values analysis function of SPSS (Version 23). Missingness in the study variables varied between 0 to 1.1%. Little’s missing completely at random test was nonsignificant, $\chi^2(2) = .03, p > .05$, suggesting that data were missing completely at random. The low percentage of missingness and the fact that missingness was completely at random suggest that nonresponse patterns in these data can be ignored (Tabachnick & Fidell, 2007). PROCESS employs listwise deletion and thus used 93 individuals rather than 94.

In Table 2, we present correlations, means and standard deviations of ruminative brooding, dissociation (total score and subscales), sleep quality, mental control and negative emotion. We report bootstrapped confidence intervals because the distribution of some of the factors was skewed. As hypothesized, the results point to a medium-sized positive correlation between rumination and dissociation ($r = .36, p < .001$, confidence interval [CI] [.19, .51]).

To explore the significance of the mediation paths from rumination to dissociation, we employed bootstrapping using Model 4 in PROCESS. Indirect effects were computed for each of 1,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles, based on the bias-corrected and accelerated method. Results of these analyses are presented in Table 3. Notably, sleep quality was the sole mediator, out of the four hypothesized mechanisms, significantly leading directly from rumination to dissociation. 4 Interestingly, however, there were also several combined indirect effects (using Model 6 in PROCESS, assessing mediation chains). First, rumination exerted an indirect effect on dissociation through the combined effect of repetitiveness leading to impaired sleep quality, as well as through the combined effect of negative emotion leading to impaired sleep quality. Second, we identified a significant indirect path from rumination to dissociation through the combined effect of lack of mental control leading to negative emotion. Figure 2 presents the path model with effect sizes of individual effects.

Because negative emotion did not emerge as a mediator in the rumination–dissociation link, despite our theoretical expectation that it would, we conducted an additional, exploratory analysis, in which we specified each of the 10 emotions included in this scale as possible mediators, in a simple mediation model from rumination to dissociation, which did not include other mediators assessed in this study (i.e., this model focused solely on negative emotion). We again used the PROCESS macro, Model 4, with 1,000 bootstrapped samples and 95% confidence intervals.

3 Notably, Baron and Kenny’s (1986) well-known strategy to examine mediation using four steps has been criticized because of low power and lack of quantification of the magnitude of the indirect effect. Rather, the existence of the effect is inferred logically by the outcome of a set of hypothesis tests (Hayes, 2009). The Sobel (1982, 1986) test has also been criticized; whereas it does produce an effect size for the indirect effect, it assesses the significance of that effect by assuming a normal distribution, yet indirect effects rarely distribute normally (Bollen & Stine, 1990). Thus, assessing the magnitude of the indirect effect by relying on bootstrapping and avoiding normality assumptions is preferable (Hayes, 2009).

4 When we examined each one of the dissociation subscales instead of the DES total score, we found that sleep was also the only statistically significant mediator in a rumination–amnesia link (standardized indirect effect = .12, CI [.04, .28]) and in a rumination–derealization/derealization link (standardized indirect effect = .10, CI [.03, .29]). None of the mediators was found to be statistically significant in the rumination–absorption link, although sleep verged on statistical significance (standardized indirect effect = .07, CI [.00, .18]).
Table 2
Correlations, Means, and Standard Deviations of Ruminative Brooding, Dissociation, Absorption, Amnesia, Depersonalization/Derealization, Sleep Quality, Mental Control, Negative Emotion, and Repetitiveness for Study 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brooding</td>
<td>9.17 (2.87)</td>
<td>1</td>
<td>.36**</td>
<td>.39**</td>
<td>.30**</td>
<td>.24*</td>
<td>.38**</td>
<td>-.40**</td>
<td>.36**</td>
<td>.59**</td>
</tr>
<tr>
<td>2. Dissociation</td>
<td>8.63 (8.33)</td>
<td>1</td>
<td>92**</td>
<td>92**</td>
<td>.79**</td>
<td>.40**</td>
<td>-.27**</td>
<td>.34**</td>
<td>.33**</td>
<td>.38**</td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.86, .96]</td>
<td>[.85, .96]</td>
<td>[.58, .90]</td>
<td>[.21, .59]</td>
<td>[.46, -.07]</td>
<td>[.13, .50]</td>
<td>[.14, .50]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Absorption</td>
<td>14.38 (11.16)</td>
<td>1</td>
<td>.76**</td>
<td>.56**</td>
<td>.34**</td>
<td>-.31**</td>
<td>.31**</td>
<td>.38**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.64, .87]</td>
<td>[.85, .90]</td>
<td>[.58, .90]</td>
<td>[.21, .59]</td>
<td>[.46, -.07]</td>
<td>[.13, .50]</td>
<td>[.14, .50]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Amnesia</td>
<td>3.77 (6.52)</td>
<td>1</td>
<td>.79**</td>
<td>.40**</td>
<td>-.18</td>
<td>.29**</td>
<td>.26**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.57, .91]</td>
<td>[.64, .78]</td>
<td>[.14, .53]</td>
<td>[.49, -.11]</td>
<td>[.12, .46]</td>
<td>[.20, .54]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Depersonalization/Derealization</td>
<td>3.28 (7.46)</td>
<td>1</td>
<td>34**</td>
<td>-.26</td>
<td>.26**</td>
<td></td>
<td></td>
<td>.19</td>
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<td></td>
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<tr>
<td>[95% CI]</td>
<td>[.09, .67]</td>
<td>[.36, .60]</td>
<td>[.36, .60]</td>
<td>[.49, -.11]</td>
<td>[.12, .46]</td>
<td>[.20, .54]</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>6. Sleep quality</td>
<td>5.38 (3.10)</td>
<td>1</td>
<td>57**</td>
<td>-.43**</td>
<td>-.48</td>
<td></td>
<td>-.08**</td>
<td>(.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.09, .57]</td>
<td>[.43, -.07]</td>
<td>[.05, .48]</td>
<td>[.08, .40]</td>
<td></td>
<td></td>
<td>(.40)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Mental control</td>
<td>4.82 (1.35)</td>
<td>1</td>
<td>22**</td>
<td>.27**</td>
<td>.40**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[-.42, -.01]</td>
<td>[.08, .44]</td>
<td>[.20, .58]</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>8. Negative emotion</td>
<td>24.37 (6.30)</td>
<td>1</td>
<td>51**</td>
<td>-.35**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>[95% CI]</td>
<td>[-.66, -.34]</td>
<td>[.51, -.35]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Repetitiveness</td>
<td>9.29 (5.47)</td>
<td>1</td>
<td>41**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.21, .58]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. CI = bootstrapped confidence intervals, using 1,000 resamples, calculated with the bias-corrected and accelerated method and rounded down to two decimals.

*p < .05. **p < .01.
The 10 subscales of the PANAS Negative Scale were specified as mediators together with brooding as the predictor and dissociation as the predicted variable. Only one emotion emerged as a statistically significant mediator, namely the “jittery” emotion. The bootstrapped standardized indirect effect of “jittery” was .07, and the 95% confidence intervals ranged from .01 to .19. The full results of the 10 emotions are presented in Table 4.

As stated in the introduction section, cross-sectional designs cannot differentiate mediators from confounds (i.e., a mediation relationship from a spurious one). Thus, we considered the possibility that our finding that sleep is the main factor responsible for the association between rumination and dissociation represents a spurious relation rather than mediation. Figure 3 presents this possible model with the appropriate correlation coefficients.

**Discussion**

Study 1 pointed to sleep quality as the main mediator in the rumination–dissociation link (both as a standalone mediator and in combination with repetitiveness or negative emotion), or, alternatively, as the main factor which causes both rumi-

---

**Table 3**

<table>
<thead>
<tr>
<th>Mediating path</th>
<th>Standardized indirect effect of the path</th>
<th>Coefficient</th>
<th>SE</th>
<th>[95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumination → sleep quality → dissociation</td>
<td>.10*</td>
<td>.05</td>
<td>[.03, .24]</td>
<td></td>
</tr>
<tr>
<td>Rumination → repetitiveness → dissociation</td>
<td>.06</td>
<td>.05</td>
<td>[-.01, .20]</td>
<td></td>
</tr>
<tr>
<td>Rumination → negative emotion → dissociation</td>
<td>.02</td>
<td>.05</td>
<td>[-.05, .12]</td>
<td></td>
</tr>
<tr>
<td>Rumination → mental control → dissociation</td>
<td>.05*</td>
<td>.03</td>
<td>[.01, .15]</td>
<td></td>
</tr>
<tr>
<td>Rumination → repetitiveness → sleep quality → dissociation</td>
<td>.02*</td>
<td>.01</td>
<td>[.00, .06]</td>
<td></td>
</tr>
<tr>
<td>Rumination → negative emotion → sleep quality → dissociation</td>
<td>.06</td>
<td>.05</td>
<td>[.01, .20]</td>
<td></td>
</tr>
<tr>
<td>Rumination → mental control → negative emotion → dissociation</td>
<td>.04*</td>
<td>.03</td>
<td>[.00, .13]</td>
<td></td>
</tr>
</tbody>
</table>

*Note. CI = confidence interval. Bootstrapping was performed using 1,000 resamples. CI = bootstrapped confidence interval, calculated with the bias-corrected and accelerated method and rounded down to two decimals. *p < .05.

---

![Figure 2](image-url) **Figure 2.** Results of the path model predicting dissociation in Study 1. Standardized direct effects are presented here; those which are statistically significant are italicized. Statistically significant indirect paths (as determined by the results presented in Table 2) are marked by full lines, while non-significant paths are marked by dotted lines. Notably, the line between negative emotion and dissociation is dashed, representing the fact that it exerted substantial influence in one indirect path, but not in another (see Table 3).
nation and dissociation. Additionally, we found that sense of control and negative emotion, together, constituted another significant path from rumination to dissociation. Our focus on negative emotion in a separate model revealed that the explanatory power of this construct in the rumination–dissociation link is based mainly on feeling jittery, which involves arousal and thus paradoxically also strengthens the importance of sleep–wake processes in this association.

However, although the indirect effect of negative emotion and sleep and the indirect effect of mental control and negative emotion were both statistically significant, their lower bootstrapped confidence intervals were very close to zero. It is important to remember that when indirect paths rely on a chain of mediators, rather than just one single mediator, the process of multiplication causes the magnitude of effects to become smaller and closer to zero. The proximity of the lower confidence interval to zero raises a question regarding the reliability of the effect. In addition, another limitation of Study 1 is the relatively small sample size. According to Green (1991), to examine a specific effect in a regression model, the required sample size would be 104 subjects plus the number of predictors in the model. Thus, our sample size of N = 93 is less than optimal for the statistical analyses conducted (e.g., the largest

Table 4

<table>
<thead>
<tr>
<th>Mediating path</th>
<th>Standardized indirect effect of the path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumination → upset → dissociation</td>
<td>.03</td>
</tr>
<tr>
<td>Rumination → distressed → dissociation</td>
<td>.04</td>
</tr>
<tr>
<td>Rumination → guilty → dissociation</td>
<td>.02</td>
</tr>
<tr>
<td>Rumination → scared → dissociation</td>
<td>.01</td>
</tr>
<tr>
<td>Rumination → hostil → dissociation</td>
<td>.02</td>
</tr>
<tr>
<td>Rumination → nervous → dissociation</td>
<td>−.01</td>
</tr>
<tr>
<td>Rumination → ashamed → dissociation</td>
<td>.03</td>
</tr>
<tr>
<td>Rumination → irritable → dissociation</td>
<td>−.00</td>
</tr>
<tr>
<td>Rumination → afraid → dissociation</td>
<td>−.02</td>
</tr>
<tr>
<td>Rumination → jittery → dissociation</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval. Bootstrapping was performed using 1,000 resamples. CI = bootstrapped confidence interval, calculated with the bias-corrected and accelerated method and rounded down to two decimals.

*p < .05.

Figure 3. A model depicting a spurious relationship, whereby sleep quality exerts influence on rumination and dissociation (Study 1). Standardized direct effects are presented here. All the effects are statistically significant at the p < .01 level.
model was the one in which 10 specific emotions were explored; optimally, this would require 115 subjects. Hence, our results might be biased by overfitting.

**Study 2**

The best way to address these issues is replicability with an independent, larger sample size, which is the main aim of Study 2. In addition, following our results focusing on poor sleep, we wished to explore the possible mediating role of the cognitive strategies individuals employ at bedtime in the face of intrusive negative thoughts.

**Method**

**Participants and procedure.** Two-hundred and 26 undergraduate students (78.8% females, $M_{age} = 24.01, SD_{age} = 1.3$), independent of volunteers in Study 1, participated in an online study in exchange for course credit. As in Study 1, demographic data were assessed, including age, gender, religiosity, socioeconomic status and familial status. The demographic characteristics of the Study 2 sample are also presented in Table 1.

The subjects enrolled to a study labeled “The relationship between responses to emotions and cognitive-emotional psychological measures” via the institutional psychological experiments system. Through this system, they received a link to online survey software (Qualtrics,) in which questionnaires were presented to them, and they were asked to complete them in a quiet place. After signing an online consent form, they completed the questionnaires in a single session and in a fixed order. The subjects were subsequently debriefed as to the purposes of the study. Subjects were instructed to respond to the questions as honestly as possible and to contact the researchers if they have any questions. The procedure was completed in approximately 30–35 min. The institutional ethics review board approved the study. Notably, the score of four participants on the DES fell beyond 3 standard deviation units from the mean in this variable. Upon closer examination, it seemed that at least two of these participants had highly inconsistent (seemingly random) result patterns on DES items, and one of them stated that Hebrew is not his native language. Thus, we were concerned that these participants may have misread the instructions or questionnaire items, or perhaps that they did not answer truthfully and systematically. Because single outliers may distort statistical analyses (Tabachnick & Fidell, 2007), we omitted these four participants from the analyses, which produced a better distributed sample. Additionally, four participants had missing values and were omitted via PROCESS software as in Study 1, resulting in a final sample of $N = 218$. The analysis of missing data patterns is detailed in the results section.

**Measures.** All of the measures administered in Study 1 and described above were administered in this study as well. Cronbach’s alphas for these measures in the current dataset were: 0.84 for rumination (which was administered along with the additional item probing perceived mental control, as before), 0.90 for dissociation (and 0.81, 0.62, 0.63 for absorption, amnesia, and depersonalization/derealization, respectively), 0.86 for negative emotion, 0.94 for repetitiveness, and 0.78 for sleep quality. In addition, we administered the following measure.

**Thought control strategies at bedtime.** The 35-item Thought Control Questionnaire Insomnia–Revised (TCQI-R; Ree et al., 2005) assesses bedtime thought control strategies. The TCQI-R instructions ask respondents to indicate the frequency with which they employ each thought control strategy while being kept awake by thoughts. The questionnaire comprises six factors: aggressive suppression (e.g., “try to push the thoughts out of my head”), cognitive distraction (e.g., “I call to mind positive images instead”), reappraisal (e.g., “I try to reinterpret the thought”), social avoidance (e.g., “I keep the thought to myself”), behavioral distraction (e.g., “I do something physical to block them like turn over or get out of bed”), and worry (e.g., “I dwell on other worries”), with a 4-point response scale, ranging from not at all to almost always. TCQI-R is reliable and valid (Ree et al., 2005). For the present study, the questionnaire was translated and back-translated to ensure validity of the Hebrew version. Cronbach’s alphas for the six subscales in this study were 0.72, 0.70, 0.80, 0.71, 0.74, and 0.73, respectively.

**Results**

Before running the analyses, we estimated missing data using missing values analysis, as
before. Missingness in the study variables was again well below 5%, this time ranging from 0% to 2.3%. Little’s missing completely at random test was again nonsignificant, $\chi^2(7) = 4.3$, $p > .05$, suggesting that data were missing completely at random. Thus, nonresponse patterns in these data also can probably be ignored (Tabachnick & Fidell, 2007).

In Table 5, we present correlations, means and standard deviations of ruminative brooding, dissociation (total score and subscales), sleep quality, mental control, and negative emotion. The results again indicated a medium-sized positive correlation between rumination and dissociation ($r = .40$, $p < .001$, CI [.28, .52]).

First, we examined the same model as in Study 1, using Model 4 in PROCESS. Again, sleep quality emerged as the only statistically significant direct mediator, whereas the effects of the other mediators (i.e., negative emotion, subjective feeling of mental control and repetitiveness) did not reach statistical significance.

Additionally, the effect of the combined path leading from rumination to dissociation through repetitiveness and sleep quality replicated, as did the effect of the combined path through negative emotion and sleep quality. However, the path leading from rumination to dissociation through the combined effect of subjective mental control and negative emotion, found in Study 1, did not reach statistical significance in this study. The significant indirect paths are presented in Table 6 and the path model with the individual direct effects is presented in Figure 4.

As in Study 1, we also explored the 10 specific emotions of the Negative Emotion Scale as possible mediators in a simple mediation model with no other predictors (PROCESS Model 4). As before, only the “jittery” emotion emerged as a statistically significant mediator (indirect effect = $.06$, CI [.02, .12]). The full results of the 10 emotions are presented in Table 7.

Next, we explored the role of the six different strategies to deal with intrusive thoughts before sleep as possible predictors of sleep quality in a combined indirect path leading from rumination to dissociation through cognitive strategies and sleep. We used Model 6 in PROCESS (which enables the exploration of a mediation chain) to explore which strategies predict poor sleep quality as part of a mediation path that exerts influence from brooding to dissociation. Figure 5 presents the model with the results of the analysis. As can be seen in the figure, three strategies emerged as statistically significant mediators: behavioral distraction (indirect effect = .01, $p < .05$, CI [.00, .02]), aggressive suppression (indirect effect = .02, $p < .05$, CI [.00, .05]), and worry (indirect effect = .01, $p < .05$, CI [.00, .03]).

Finally, as in Study 1, the results suggest another possible model in which poor sleep quality produces both rumination and dissociation. This model, along with the correlation coefficients between sleep, rumination and dissociation for Study 2, are presented in Figure 6.

Discussion

The main purpose of both Study 1 and Study 2 was to explore the relationship between rumination and dissociation while focusing on four possible hypothesized mediators, namely, negative emotion, lack of mental control, repetitiveness and poor sleep quality. First, we wish to note that poor sleep quality was significantly associated with dissociation (total score as well as all three subscales), bolstering a growing body of research attesting to the link between sleep and dissociation (e.g., Giesbrecht et al., 2007; Soffer-Dudek et al., 2017; van der Kloet et al., 2012). Second, support for the important role of poor sleep in dissociative experiences is embodied in our main findings that poor sleep was the key variable explaining the association between rumination and dissociation. Importantly, this finding replicated across two independent samples (Studies 1 and 2). Specifically, in both studies, sleep was the only direct mediator out of the four possible mechanisms examined. These findings coincide with the view of dissociation as a mixed state of consciousness, in which sleep elements intrude into waking consciousness, due to disturbed sleep–wake boundaries (Koffel & Watson, 2009; Mahowald & Schenck, 2001; van der Kloet et al., 2012).

---

5 When we examined each one of the dissociative subscales as alternative predicted variables instead of the total DES score, we found that sleep was the only statistically significant mediator in the rumination–absorption link (standardized indirect effect = .07, CI [.01, .13]) and in the rumination–amnesia link (standardized indirect effect = .07, CI [.02, .16]). None of the mediators were statistically significant in the rumination–depersonalization/derealization link (although sleep was close to significant; standardized indirect effect = .04, CI [−.01, .10]).
Table 5

Correlations, Means, and Standard Deviations of Ruminative Brooding, Dissociation, Absorption, Amnesia, Depersonalization/Derealization, Sleep Quality, Mental Control, Negative Emotion, and Repetitiveness for Study 2

<table>
<thead>
<tr>
<th>The variable, M (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brooding, 9.17 (2.87)</td>
<td>1</td>
<td>.40**</td>
<td>.44**</td>
<td>.30**</td>
<td>.29**</td>
<td>.37**</td>
<td>-.60**</td>
<td>.55**</td>
<td>.63**</td>
</tr>
<tr>
<td>Dissociation, 24.68 (19.42)</td>
<td>2</td>
<td>.95**</td>
<td>.83**</td>
<td>.62**</td>
<td>.31**</td>
<td>-.25**</td>
<td>.26**</td>
<td>.32**</td>
<td>.36**</td>
</tr>
<tr>
<td>Absorption, 14.14 (10.41)</td>
<td>3</td>
<td>.71**</td>
<td>.47**</td>
<td>.33**</td>
<td>-.31**</td>
<td>.29**</td>
<td>.36**</td>
<td>.23**</td>
<td>.48**</td>
</tr>
<tr>
<td>Amnesia, 2.61 (3.66)</td>
<td>4</td>
<td>.53**</td>
<td>.27**</td>
<td>-.17**</td>
<td>.18**</td>
<td>.21**</td>
<td>.08**</td>
<td>.33**</td>
<td>.18**</td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.32,.74]</td>
<td>[.12,.40]</td>
<td>[-.28,-.05]</td>
<td>[.04,.29]</td>
<td>[.08,.33]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depersonalization/Derealization, 1.62 (3.18)</td>
<td>5</td>
<td>1</td>
<td>.18**</td>
<td>-.15**</td>
<td>.12</td>
<td>.18**</td>
<td>.12</td>
<td>.18**</td>
<td>.12</td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.05,.32]</td>
<td>[-.27,-.06]</td>
<td>[.01,.25]</td>
<td>[.02,.37]</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sleep quality, 5.97 (2.54)</td>
<td>6</td>
<td>1</td>
<td>-.39**</td>
<td>.41**</td>
<td>.34**</td>
<td>.34**</td>
<td>.34**</td>
<td>.34**</td>
<td>.34**</td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[.50,.27]</td>
<td>[.29,.52]</td>
<td>[.20,.46]</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Mental control, 5.04 (1.34)</td>
<td>7</td>
<td>1</td>
<td>-.51**</td>
<td>-.60**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
</tr>
<tr>
<td>[95% CI]</td>
<td>[-.61,-.41]</td>
<td>[-.60,-.51]</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative emotion, 24.37 (6.30)</td>
<td>8</td>
<td>1</td>
<td>-.51**</td>
<td>-.60**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
<td>.41**</td>
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<tr>
<td>[95% CI]</td>
<td>[.21,.58]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetitiveness, 8.54 (5.56)</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>[95% CI]</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. CI = bootstrapped confidence intervals, using 1,000 resamples, calculated with the bias-corrected and accelerated method and rounded down to two decimals. *p < .05. **p < .01.
For example, depersonalization may be viewed as a state between dreaming and waking in which there is a gap between the experiencing self and the observing self, a gap that usually occurs in dreams and in dream-like states (van der Kloet et al., 2012).

Two additional indirect paths that emerged in both Studies 1 and 2 as exerting a significant effect of rumination on dissociation were those passing through either repetitiveness or negative emotion, leading in turn to poor sleep. This finding is in keeping with the idea that sleep is the proximal path to dissociation, even if other distal causes are also relevant (van der Kloet et al., 2012). In Study 1, the path going through a sense of lack of mental control to negative emotion also emerged as a statistically significant indirect effect, but this path did not replicate in Study 2, despite increased power due to a larger sample size. Another noteworthy finding, which replicated in Studies 1 and 2 was that when examining separately 10 types of negative emotions as mediators between rumination and dissociation, the only significant mediator was feeling “jittery.” The mediating effect of the “jittery” emotion paradoxically strengthens the main findings pertaining to sleep, by emphasizing that the responsible mechanism is not negative emotion per se (such as sadness, guilt, or shame) but rather characteristics of the sleep-arousal system. This finding is compatible with the mechanism mentioned in the introduction,

<table>
<thead>
<tr>
<th>Mediating path</th>
<th>Standardized indirect effect of the path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumination → sleep quality → dissociation</td>
<td>.06*</td>
</tr>
<tr>
<td>Rumination → repetitiveness → dissociation</td>
<td>.05</td>
</tr>
<tr>
<td>Rumination → negative emotion → dissociation</td>
<td>.01</td>
</tr>
<tr>
<td>Rumination → mental control → dissociation</td>
<td>-.04</td>
</tr>
<tr>
<td>Rumination → repetitiveness → sleep quality → dissociation</td>
<td>.02*</td>
</tr>
<tr>
<td>Rumination → negative emotion → sleep quality → dissociation</td>
<td>.02*</td>
</tr>
<tr>
<td>Rumination → mental control → negative emotion → dissociation</td>
<td>.06*</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval. Bootstrapping was performed using 1,000 resamples. CI = bootstrapped confidence interval, calculated with the bias-corrected and accelerated method and rounded down to two decimals.

*p < .05.

Figure 4. Results of the path model predicting dissociation in Study 2. Standardized direct effects are presented here; those which are statistically significant are italicized. Statistically significant indirect paths (as determined by the results presented in Table 6) are marked by full lines, while non-significant paths are marked by dotted lines.
according to which, dissociation is related to hypervigilance (Bernstein et al., 2015).

Taken together, our findings suggest that individuals who are both ruminative and dissociative have trouble sleeping at night and also feel restless during the day. These individuals experience more intrusion of sleep into waking in the form of dissociation. The lack of findings regarding traditional negative emotions (e.g., sadness, shame) as significant paths from rumination to dissociation is somewhat surprising and is incompatible with the notion that overwhelming negative emotions, brought on by ruminative cognitions, induce dissociation as a coping mechanism. Our findings unequivocally point to sleep-arousal processes as the central pathway from rumination to dissociation, at least in these two nonclinical student samples, and using a

Table 7

<table>
<thead>
<tr>
<th>Mediating path</th>
<th>Standardized indirect effect of the path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumination → upset → dissociation</td>
<td>-.04 .05 [−.14, .05]</td>
</tr>
<tr>
<td>Rumination → distressed → dissociation</td>
<td>-.04 .04 [−.12, .05]</td>
</tr>
<tr>
<td>Rumination → guilty → dissociation</td>
<td>-.02 .04 [−.10, .05]</td>
</tr>
<tr>
<td>Rumination → scared → dissociation</td>
<td>.02 .05 [−.07, .12]</td>
</tr>
<tr>
<td>Rumination → hostile → dissociation</td>
<td>−.02 .02 [−.07, .01]</td>
</tr>
<tr>
<td>Rumination → nervous → dissociation</td>
<td>.02 .03 [−.03, .08]</td>
</tr>
<tr>
<td>Rumination → ashamed → dissociation</td>
<td>.01 .02 [−.02, .06]</td>
</tr>
<tr>
<td>Rumination → irritable → dissociation</td>
<td>−.03 .03 [−.10, .02]</td>
</tr>
<tr>
<td>Rumination → afraid → dissociation</td>
<td>.03 .04 [−.05, .11]</td>
</tr>
<tr>
<td>Rumination → jittery → dissociation</td>
<td>.07* .03 [.06, .42]</td>
</tr>
</tbody>
</table>

Note. CI = confidence interval. Bootstrapping was performed using 1,000 resamples. CI = bootstrapped confidence interval, calculated with the bias-corrected and accelerated method and rounded down to two decimals.

*p < .05.

Figure 5. Path Model Predicting Dissociation with the six bedtime strategies to deal with intrusive thoughts as mediators linking rumination with poor sleep followed by dissociation (Study 2). Standardized indirect effects are presented here; those which are statistically significant are italicized. Statistically significant indirect paths are marked by full lines, while non-significant paths are marked by dotted lines.
cross-sectional design with trait (rather than state) measures.

Importantly, although the specification of the model (with rumination as the predictor and dissociation as the outcome) implies that rumination is the focal cause for all of the other constructs, it is vital to keep in mind that our research designs are cross-sectional, and thus it is not possible to infer the direction of causality of the relationships ascertained. We cannot conclude that rumination exerts its effect on dissociation, rather than the reverse causal arrow. Nevertheless, our data do allow us to conclude that out of the four mechanisms examined, poor sleep is the primary factor responsible for the association of rumination and dissociation. We will now review several alternative models that may be responsible for the pattern of results that emerged in our studies.

Sleep as a mediator between rumination and dissociation. One possibility is our hypothesized model, which provides the most explanatory power, suggesting that rumination brings about dissociation through impairing sleep quality. There is support for the notion that rumination causes poor sleep quality based on studies that induced (i.e., manipulated) rumination in the presleep period (Guastella & Moulds, 2007), and studies that established temporal directionality between rumination and sleep quality (Takano, Iijima, & Tanno, 2012; Zoccola, Dickerson, & Lam, 2009). In addition, support for the second part of this model (i.e., the effect of sleep on dissociation) comes from studies that manipulated sleep loss and revealed that dissociative experiences followed sleep deprivation (Giesbrecht et al., 2007; Selvi, Kılıç, Aydin, & Güzel Özdemir, 2015; Soffer-Dudek et al., 2017; van der Kloet, et al., 2012; van Heugten-van der Kloet, Giesbrecht, & Merckelbach, 2015). Related to this model of causality is the notion that ruminative individuals experience difficulty in the transitions from waking states to sleep and vice versa. Whereas ruminative thinking is characterized by directional, nonflexible, and focused thought (Davis & Nolen-Hoeksema, 2000; Martin & Tesser, 1996), sleep and dreaming involve free-associations and nondirectional thinking (Cai, Mednick, Harrison, Kanady, & Mednick, 2009; Hartmann, 1998). Rigid and repetitive cognitions at bedtime may prevent ruminative individuals from disengaging from linear thought processes and entering into a free and hyperassociative sleep state; when they do finally fall asleep, repetitive rigid mentation lingers in consciousness and disturbs sleep.

Both Studies 1 and 2 determined that repetitiveness as well as negative emotion were responsible for the effect of rumination on poor sleep, and that these combined effects exerted influence on dissociation. Interestingly, repetitiveness and negative emotion may be viewed as the structure and content of ruminative thoughts, respectively (see Watkins, 2008, for a discussion on the elements of thinking): Ruminatation is characterized by a rigid, passive, and repetitive structure and by a negative content...
value, including depression, pessimism and anxiety (e.g., Nolen-Hoeksema, 1991). Our findings imply that rumination predicts dissociation as a function of both content and structure, but that they exert their influence through poor sleep quality. These two aspects may impair sleep in different ways: repetitiveness, namely the perseveration of a thought, prevents the individual from entering a free-associating mode required for sleep and dreaming (Cai et al., 2009; Hartmann, 1998), whereas the negative emotional content of the thoughts increases distress, leading to hyperarousal.

The notion that rumination brings about poor sleep quality, which in turn causes dissociation, is compatible with our findings from Study 2 regarding cognitive bedtime strategies. Specifically, we found that three strategies, namely, worry, aggressive suppression, and behavioral distraction, played a role in a mediation chain from rumination through sleep to dissociation. Whereas some people contend with distressing thoughts by worrying about them, and this tendency may disrupt their sleep, other individuals attempt to avoid the negative content of their thoughts or otherwise disengage from this content actively, by aggressively suppressing it or distracting themselves. According to the findings of Study 2, both ways of coping are maladaptive and mediate the path between rumination and dissociation.

The role of worry is not surprising, considering the findings underscoring the adverse effects of worry and its relation to decreased sleep quality (Harvey, 2001; Ree et al., 2005). In addition, worry is commonly defined as a chain of negative, repetitive, and uncontrollable thoughts and images, a definition that is similar to rumination, as both are characterized by repetitiveness (Borkovec, Ray, & Stöber, 1998). However, the strategies of aggressive suppression and behavioral distraction both involve an active attempt to avoid thinking about distressing mental contents and thus can be considered opposite to rumination, which involves thinking attentively, repetitively, or frequently, about oneself and the world (Segerstrom, Stanton, Alden, & Shortridge, 2003). In a related vein, Szasz (2009) found that rumination mediates the effect of thought suppression on depression. He refers to rumination as an “ironic effect” of thought suppression (i.e., the suppressed thought reappears with repetitive intensity).

Some individuals who fail to obtain mental control lapse into a depressive cycle of thought suppression and rumination (Wenzlaff, 2004; Wenzlaff & Luxton, 2003).

Hence, our findings specify one mechanism through which rumination may bring about the blurring of sleep–wake boundaries, namely, through the strategy of attempting to aggressively push away the unwanted thoughts, which probably creates a vicious cycle of repetitive intrusions. The importance of this avoidance behavior in predicting poor sleep quality and dissociation is in keeping with recent studies demonstrating the “rebound effect” of thought suppression on dreams (Bryant, Wyzenbeek, & Weinstein, 2011; Kröner-Borowik et al., 2013; Schmidt & Gendolla, 2008; Taylor & Bryant, 2007; Wegner, Wenzlaff, & Kozak, 2004). Specifically, attempting to suppress a thought before going to sleep increases the likelihood that the suppressed thought will reappear in dreams, an effect that is even more prominent in the face of cognitive load (Bryant et al., 2011). This paradoxical effect may explain why dissociation, considered to be an avoidant coping style in which distressing contents are separated, or dissociated, from consciousness, is related to intrusions of wakefulness into sleep and vice versa (Soffer-Dudek, 2017). Moreover, our findings pertaining to the central role of distraction and suppression as mediators help to reconcile the seemingly contradictory nature of rumination and dissociation and explain the positive association they share.

**Alternative possible causal models.** As stated above, the cross-sectional nature of the research does not permit conclusions regarding causality or the differentiation between true mediation versus a spurious relation. An alternative plausible model, which may explain the pattern of results obtained in our studies, is a model in which sleep is actually the key factor that leads independently both to rumination and to dissociation (and possibly to the other factors such as negative emotion and repetitiveness), rendering the rumination–dissociation relation a spurious one. Sleep disturbance undermines executive control (Alhola & Polo-Kantola, 2007; Jones & Harrison, 2001; Lim & Dinges, 2010), possibly producing rumination, repetitive thoughts, distress and dissociative experiences. Indeed, researchers have found that worse executive functioning predicted abstract
repetitive thinking (Philippot & Agrigoroaei, 2016). Moreover, in a cross-sectional study, Cox, Ebütor, and Olatunji (2016) reported that executive functioning accounted for the relationship between sleep disturbance and mal-adaptive repetitive thought (worry and rumination). In addition, McKinnon et al. (2016) have linked dissociative experiences to deficits in executive functions. Thus, it is possible that poorer sleep quality leads to deficits in executive control, which in turn bring about rumination, dissociation, and distress. It is also noteworthy that when examining dissociative subscales, the factor for which the effect replicated reliably across Studies 1 and 2 was dissociative amnesia. A large body of research on the impact of sleep on memory consolidation (e.g., Boyce, Glasgow, Williams, & Adamantidis, 2016; Gais & Born, 2004; Stickgold, 2005) implies that sleep impairment may disrupt executive functioning, which is manifested in both rumination and dissociative amnesia.

A final possible causal model is one in which a different factor, not assessed in this study, produces rumination, dissociative experiences, and poor sleep quality, and thus the links among all of these factors are spurious, at least in part. An example of such a factor may be trauma or stress. Traumatic or daily stress may bring about dissociation (e.g., Carlson, Dalenberg, & McDade-Montez, 2012; Morgan et al., 2001), as well as rumination as a strategy to cope with the trauma (e.g., Gold & Wegner, 1995; Michael, Halligan, Clark, & Ehlers, 2007), and finally, decreased sleep quality (e.g., Åkerstedt, Kecklund, & Axelsson, 2007; Fortunato & Harsh, 2006; Kajeepeta, Gelaye, Jackson, & Williams, 2015; Van Reeth et al., 2000), which may account for the shared variance among these three factors.

Strengths, Limitations, and Conclusions

Our purpose in the present research was to examine whether there is a link between rumination and dissociation and to identify potential variables that explain this link. We found that poor sleep quality and strategies to deal with intrusive thoughts before sleep account for the association. Although our research cannot determine which of the several causal models is preferable, it enabled the identification of sleep–wake processes as the focal factor out of four hypothesized mechanisms. Future studies should explore the link between rumination and dissociation, for example, longitudinally and in the laboratory to allow for an examination of directionality. It is important to note, that although in Study 1 sleep fully mediated the link between rumination and dissociation, in Study 2, we only found evidence for partial mediation. Thus, future studies should explore additional potential explanatory factors, such as traumatic or daily stress.

Notably, another interesting finding was that subjective mental control was associated with dissociation. Previous studies have shown that stress that is experienced as uncontrollable is related to dissociative symptoms (Gershuny et al., 2003; Morgan et al., 2001). The present study broadens this relation to experiencing lack of control regarding mental content rather than an external event. This line of research is compatible with Ford (2013) who argues that dissociative experiences are related to alterations in self-regulation capacity. However, this factor was assessed with only a single item. This fact questions the validity of the item and possibly may explain why subjective mental control did not mediate the rumination–dissociation link. However, the findings regarding this factor’s relation with dissociation and its mediation role in a combined path in Study 1, suggest that it does account for enough variance to detect statistically significant effects. Future studies should assess mental control with a validated scale, rather than a single item. Another limitation of this item is that it probes subjective mental control regarding ruminative thoughts; therefore, it refers only to control over sad mood rather than control over other mental states (e.g., anxiety). Future studies could examine whether subjective mental control over additional mental states plays a role in the rumination–dissociation link.

There are several limitations and additional general issues in this research that should be addressed. First, both in Study 1 and Study 2, lower confidence intervals for some of the statistically significant effects approximated zero. Notably, effect sizes of indirect paths with multiple mediators (mediation chains) are small, because they are products of multiplication of several coefficients. Although this statistical limitation raises questions regarding reliability of the effects, these concerns are counteracted...
by replication of most of our findings from Study 1 to Study 2, attesting to the reliability of our results. Moreover, the examination of the different subscales of dissociation shows that the focal effect of sleep in the rumination–dissociation link is not specific to any dissociative subcomponent, but rather, is replicated across factors.

In the present research, we did not assess, or control for, order and context effects. Lemons and Lynn (2016) found that the relation between dissociation and trauma was stronger when the measures were administered together, and proposed that participants’ self-perceptions are influenced by expectations instilled by exposure to the mass media, which presents dissociation as closely linked with trauma. In our research, all variables were assessed in the same experimental context; thus, the strength of the relationships obtained might have been inflated. However, following the context explanation, all four possible mediation paths should have been affected to the same extent; hence, the finding that sleep is the most viable of all potential mechanisms remains valid. In addition, an inflation of relationships due to participants’ expectations would probably more likely enhance the effect of negative emotion on dissociation, rather than that of sleep. Thus, we do not believe that context effects provide a satisfactory explanation for our findings.

As for order effects, the order of the presented questions may impact the correlation between them (Schwarz, Strack, & Mai, 1991). It is possible that our result pattern was affected to some extent by the fact that we did not counterbalance the measures. Notably, sleep reports were unlikely affected by other variables, because the items assessing poor sleep are, for the most part, fairly objective (e.g., “During the past month, when have you usually gone to bed at night?”). Moreover, our measure of sleep is highly correlated with objective sleep measures (e.g., Buysse et al., 2008). More generally, all of the questionnaires used in both Studies 1 and 2 are well validated scales; thus, their sensitivity to noise (such as order) is probably limited, and the failure to counterbalance measures most likely does not explain the results in full.

Self-report measures may be vulnerable to bias stemming from overreporting symptoms and distress levels. Indeed, such bias exists among individuals with PTSD (Frueh, Hamner, Cahill, Gold, & Hamlin, 2000; Merckelbach, Langeland, de Vries, & Draijer, 2014). Nevertheless, Merckelbach et al. (2014) note that the overreporting bias is correlated with the level of distress, and is thus probably more prevalent in clinical populations than in student samples (as in our study). Finally, Merckelbach et al. (2014) note that overreporting often decreases effect sizes rather than increases them. Thus, our pattern of results probably cannot fully be explained by overreported symptoms of the participants. Indeed, McGrath, Mitchell, Kim, and Hough (2010) claim that a distorting effect of overreporting on research outcomes is limited.

Several additional limitations in our research should be noted. Both samples were gender-biased toward women and were nonclinical samples composed of relatively high-functioning college students. Nevertheless, the definition of the samples as nonclinical does not mean that none of the participants had clinical-range symptoms and disorders. In fact, because psychopathology levels found among college students are high (Stallman, 2010), and similar to the prevalence of psychopathology in same-aged nonstudents (Hunt & Eisenberg, 2010), our samples probably represent varying levels of mental health. Although we may be able to generalize our results to community samples, future research should explore the rumination–dissociation link among clinical samples. In addition, future studies should assess sleep quality with objective measures rather than only self-report.

Despite these limitations, the research has several important strengths, and it has implications for both basic science and clinical practice. Our research is the first study to focus on the relationship between rumination and dissociation and the mechanisms associated with this relationship. We replicated the main findings across two independent samples, thereby attesting to their reliability. Rumination and dissociation are both considered maladaptive response styles to distress that occur commonly among clinical populations, and both represent risk factors for psychological disorders (Kuyken, Watkins, Holden, & Cook, 2006; Ross, 1996; Spa-
Therefore, understanding their association and the mechanism responsible for the association may help us attend to the needs of clients in therapy, an imperative underscored by the fact that dissociation and rumination are both related to poorer prognosis and poorer response to treatment, possibly due to detachment from the therapeutic process (e.g., Ciesla & Roberts, 2002; Raes et al., 2006; Rufer et al., 2006). Perhaps clinicians who observe signs of ruminative thinking and poor sleep quality among their clients should pay attention to the possible existence of dissociative symptoms, which may be detrimental to the therapeutic process if they go unnoticed and untreated. Despite a surge of interest in the sleep-dissociation link in recent years, our research is also the first to explore the mechanisms by which cognitions prior to sleep onset are associated with dissociative experiences. Our findings imply that training clients to reduce the use of maladaptive strategies (namely, aggressive suppression, behavioral distraction, and worry) to cope with intrusive thoughts before sleep, alongside encouraging the adoption of sleep hygiene techniques, may lead to improved ability to regulate sleep–wake transitions and perhaps prevent or mitigate dissociation. We hope that the present study will contribute to designing interventions that will succeed in deterring the vicious cycle of maladaptive intrusions across the boundaries of sleep and wakefulness.

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