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Dreaming of white bears: The return of the suppressed at sleep onset

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Abstract

The present study examined the effects of thought suppression on sleep-onset mentation. It was hypothesized that the decrease of attentional control in the transition to sleep would lead to a rebound of a suppressed thought in hypnagogic mentation. Twenty-four young adults spent two consecutive nights in a sleep laboratory. Half of the participants were instructed to suppress a target thought, whereas the other half freely thought of anything at all. To assess target thought frequency, three different measures were used in the wake state and mentation reports were repeatedly prompted by a computer at sleep onset. In support of the hypothesis, results revealed a reversal of target thought frequency at sleep onset: Participants instructed to suppress reported fewer target thoughts than did controls before falling asleep, but more target thoughts afterwards.

Keywords: Mental control; Thought suppression; Intrusive thought; Sleep onset; Insomnia

1. Introduction

In the course of the 20th century, Freud's (1900/1953) formula of the return of the repressed in dreams has acquired an almost proverbial status despite continuing controversy about its empirical validity. An often overlooked historical fact in the debates surrounding this notion is that Freud was not the first to come up with it. As early as 1816, Herbart predicted a "rise" of "repressed representations" in dreams (1816/1891, pp. 407, 412), and a few years later, Schleiermacher more specifically postulated a reappearance of the repressed at sleep onset: "As we approach sleep and to the same degree that willful activities require effort, a surge of unwanted representations can be noticed. This may be considered as the first root of dreams" (1830/1862, p. 350). The phenomenon had thus been described decades before the dawn of psychoanalysis and its theoretical premises.

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However far its origins may stretch back, the idea of the return of the repressed in dreams has only recently received experimental support. Wegner, Wenzlaff, and Kozak (2004) asked more than 300 undergraduate students to complete a 5-min stream-of-consciousness writing task before going to sleep. Participants were randomly assigned to one of three conditions: (a) a suppression condition in which they were instructed not to think about a target person, (b) an expression condition in which they were instructed to focus on thoughts of a target person, and (c) a mention condition in which they were instructed to think about anything at all after noting a target person's identity. The self-selected target person was either a "crush" (defined as "a person you have never been in a romantic relationship with—but whom you have thought about in a romantic way") or a "noncrush" (described as "a person you feel fondly about, but to whom you are not attracted"; Wegner et al., 2004, p. 233). Upon awakening the following morning, participants were asked to record all dreams from the night and to rate how much they had dreamt about the target. Analysis of the reports and ratings revealed that suppression instructions had increased dreaming about the target more than had expression or mention instructions. Interestingly, this suppression-induced "dream rebound" was observed regardless of affective attraction to the target person, which led the authors to conclude that "suppressed thoughts apparently assert themselves in dreams whether they are about wished-for targets or not" (Wegner et al., 2004, p. 235).

Ironic process theory (Wegner, 1994) offers a framework that may accommodate these results. This theory was developed to account for paradoxical effects of thought suppression in the wake state: Starting with the seminal white-bear study (Wegner, Schneider, Carter, & White, 1987), numerous investigations have shown that suppression tends to induce a hyperaccessibility of the target thought that may manifest itself in a rebound of target thought frequency (for reviews, see Rassin, 2005; Wenzlaff & Wegner, 2000). Ironic process theory posits that thought suppression involves the interplay of two processes: (a) a conscious and effortful operating process that seeks distracters (thoughts other than the to-be-suppressed target), and (b) a largely unconscious and less effortful monitoring process that watches for intrusions of the target in order to alert the first process of the need to renew distractions. The rebound of the target is explained by the assumption that when the operating process is voluntarily relinquished or disrupted by other cognitive demands, the monitoring process continues its vigilance for unwanted thoughts, thereby enhancing their activation. According to Wegner et al. (2004), the sleep-related deactivation of prefrontal areas of the cortex (Hobson, Pace-Schott, & Stickgold, 2000; Muzur, Pace-Schott, & Hobson, 2002), which are involved in executive functions in the wake state, might impair the operating process and in this way open the gate for a dream rebound of suppressed thoughts. However, as Wegner et al. (2004) add, this explanation is not without alternatives: The finding that weak semantic associations are generally more accessible after forced awakenings from REM sleep than at other times (Stickgold, Scott, Rittenhouse, & Hobson, 1999) suggests, for example, that specific sleep-related brain activation patterns might enhance weak monitoring processes independently of any attenuation of the operating process.

The findings of Wegner et al. (2004) have lately been replicated and extended by Taylor and Bryant (2007). Using a similar procedure, these authors asked 100 undergraduate students to complete a 5-min stream-of-consciousness writing task prior to sleeping, during which they were instructed either not to think about their most negative and distressing intrusive thought (suppression condition) or to think about anything at all (control condition). Upon awakening the next morning, participants completed a dream diary. In addition, they were administered the White Bear Suppression Inventory (Wegner & Zanakos, 1994) to assess their general suppression tendency. Results indicated that participants with a high level of suppression tendency who were instructed to suppress dreamt more about the target thought than did high suppressors in the control condition, whereas there was no difference between low suppressors in the suppression and control conditions. These findings suggest that individual differences in reliance on mental control strategies may mediate the effects of thought suppression on dream content.

To our knowledge, there has so far been only one experimental investigation (Harvey, 2003) into the effects of thought suppression on mental activity at sleep onset. In this study, 30 insomniacs and 30 good sleepers were instructed either to suppress a self-selected thought during the presleep period (suppression condition) or to relax and let thoughts come and go (control condition). On the basis of sleep diaries completed the next morning, it was found that participants in the suppression condition estimated their sleep-onset latency to be longer and their sleep quality to be poorer than did participants in the control condition. This effect held both for insomniacs and for good sleepers. Contrary to expectations, suppression did not lead to a rebound of the target thought: Participants instructed to suppress reported, in fact, fewer target thoughts during the presleep period than did controls. As Harvey noted, it is possible that the retrospective nature of the sleep diary introduced inaccuracies. Hypnagogic phenomena are indeed extremely difficult to remember if they are not recorded immediately after they occur (Schacter, 1976). Furthermore, the predicted rebound of the suppressed target thought might have occurred *after* sleep onset, which would have precluded it from emerging in the participants' ratings about the *presleep* period.

The aim of the present study was to examine the effects of thought suppression on wake and hypnagogic mentation using a two-group experimental design (control vs. suppression). In two respects, our experimental protocol went beyond the previously published studies into the effects of thought suppression on dreamlike mentation: (a) We conducted experimental awakenings in order to collect "on-the-spot" mentation reports rather than retrospective morning reports; and (b) we chose the time window of sleep onset to more precisely trace modifications of target thought frequency as a function of sleep-related fading of mental control. On the basis of Wegner's (1994) ironic process theory, we hypothesized that the decrease of attentional control over mentation in the transition to sleep (Vogel, 1991)—probably due to the deactivation of areas of the prefrontal cortex (Muzur et al., 2002)—should lead to a deterioration of the controlled distracter search and, because of the ongoing automatic monitoring, to a rebound of a suppressed target thought. More specifically, we predicted that in comparison with participants in the control condition, those in the suppression condition would report fewer target thoughts in the wake state, but more target thoughts once they began to fall asleep.

2. Method

2.1. Participants

Twenty-four participants were recruited through announcements in introductory psychology courses at the University of Geneva. The sample consisted of 18 women and 6 men, aged 19–28 ($M = 21.88$, $SD = 2.33$). In return for their participation, they received transcripts of their mentation reports.

2.2. Procedure

All participants spent two consecutive nights in a sleep laboratory. Each was randomly assigned to either the control condition or the suppression condition, under the constraint that both conditions contain the same proportion of men and women. Upon arrival at the laboratory on the first night (around 8 pm), participants were given a written instruction explaining that the study was about "the way thoughts succeed one another in the wake state and during sleep" (see Table 1 for the stages of the procedure). In order to familiarize the participants with the technique of stream-of-consciousness, they were then asked to lie down on a bed, close their

Table 1
Stages of the experimental procedure

Stage	Task
1	Stream-of-consciousness (5 min; 1st day only)
2	Contemplation of white-bear photograph on computer screen (1 min; 1st day only)
3	Visualization of white-bear photograph (1 min; 1st day only)
4	Stream-of-consciousness (5 min)
5	Hand-count (5 min)
6	Break (60 min)
7	Stream-of-consciousness (5 min)
8	Hand-count (5 min)
9	Hypnagogic reports (maximum of 10 awakenings during 60 min)
10	Morning interview

Note. Stages 1–3 took place only on the first day. Starting from stage 4, participants in the suppression condition were repeatedly asked to suppress target-related thoughts, whereas participants in the control condition were allowed to think of anything at all.

eyes, and verbalize whatever crossed their mind in the next 5 min, starting from the moment the experimenter left the room. All sessions of thinking aloud were tape-recorded and transcribed; participants were assured that the recordings and transcripts would be treated anonymously.

After the trial session of stream-of-consciousness, participants were seated in front of a computer screen and instructed to contemplate the picture that would be displayed for 1 min. They were shown a photograph (dimensions 12.7×18.2 cm) featuring three white bears gazing in the same direction, one of them lying on his back with his head resting on a block of ice. Next, participants were asked to lie down on the bed, close their eyes, and visualize this picture for another minute, starting from the moment the experimenter left the room.

At this point of the protocol, the ways of the two experimental groups parted: From then on, members of the suppression group were repeatedly given the instruction to "suppress any thought or image in connection with the white bears," whereas members of the control group were told that they were "free to think of what they wanted—thus, your thoughts may or may not include the white bears." To control for priming effects, the target thought was mentioned an equal number of times in each set of instructions. In order to assess target thought frequency in the wake state, three different measures were used: (a) stream-of-consciousness, that is, tape-recorded sessions of thinking aloud (as described earlier) during which participants had to indicate each target thought occurrence (duration: 5 min); (b) hand-count, that is, sessions during which participants were lying on the bed with their eyes closed and clicking a handheld counter whenever they thought of the target (duration: 5 min); and (c) "postcard" (Trinder & Salkovskis, 1994), that is, a card on which participants had to make a check mark for each target thought during the day between the first and the second night in the sleep laboratory. The postcard contained one column for the morning (defined as the period "between breakfast and lunch"), one for the afternoon ("between lunch and dinner"), and one for the evening ("between dinner and arrival at the laboratory").

In order to evaluate target thought frequency at sleep onset, participants were repeatedly prompted for mentation reports by the Nightcap sleep-monitoring system (Rowley, Stickgold, & Hobson, 1998). This system comprises a piezoelectric eyelid sensor and computes the number of eyelid movements for each sleep epoch of 250 ms; an eyelid movement is identified whenever a voltage in excess of 10 mV is observed within a sleep epoch. On the basis of these data, periods of "eyelid quiescence" of different durations are determined, which have been shown to correlate strongly with subjective sleep-state estimations and objective sleep-state measures obtained with the classic polysomnographic triad (EEG, EMG, and EOG; Cantero, Atienza, Stickgold, & Hobson, 2002; Rowley et al., 1998). As compared with retrospective reports given in the morning, forced awakenings have a double advantage: They allow one to determine the sleep stage in which a mental experience occurs, and they minimize time-lag-related recall difficulties (Schacter, 1976). Awakenings were conducted in a pseudorandom order, balanced across participants and nights, after 15, 45, 75, 120, and 180 s of objective sleep. Additional reports were requested after 3, 6, and 9 min of wake before initial sleep onset and after 3 min of wake after any forced awakening; the wake state captured by these awakenings has been shown to correspond to relaxed wakefulness dominated by continuous alpha EEG (Rowley et al., 1998). The number of report requests was limited to a maximum of 10 per night, with no more than five from periods of wake; the time window for requests was restricted to the first hour after participants had retired for the night (for more details, see Stickgold, Malia, Maguire, Roddenberry, & O'Connor, 2000).

Before retiring for the night, participants in the suppression condition were given the following written instruction [modification of the wording for the control condition in brackets]:

> As long as you are awake, you are asked to continue to suppress any thought or image in connection with the white bears [You are free to think of what you want to, thus your thoughts may or may not include the white bears]. When you are awakened by the computer, you are asked to verbalize the mental contents that crossed your mind *before* the awakening and to dictate your report into the microcassette recorder.

At the end of each report, participants were asked to indicate on a 5-point scale developed by Foulkes and Vogel (1965) the wake state they were in just before being prompted: (1) awake and alert, (2) awake but drowsy, (3) drifting off to sleep, (4) in light sleep, or (5) in deep sleep. Additional information about the hypnagogic experiences was gathered in a morning interview (Montangero, Pasche, & Willequet, 1996).

The first author who was blind to condition and a second rater who was blind to condition and hypotheses coded the stream-of-consciousness protocols and the hypnagogic reports for target thought occurrences. In addition, the two raters screened the hypnagogic reports containing the target for content that had already been mentioned during the stream-of-consciousness sessions. For the stream-of-consciousness protocols, each explicit mention of white bears in general or of the photograph of three white bears was scored as a target thought occurrence; regarding the hypnagogic reports, each description of a hypnagogic thought or image referring to white bears in general or to the three white bears on the photograph was scored as a target thought occurrence. Interrater reliability amounted to a minimum of .95.

3. Results

3.1. Target thought frequency in the wake state

Table 2 presents means and standard deviations for target thought occurrences in the two experimental conditions (control, suppression) as assessed by the three different measures used in the wake state (stream-of-consciousness, hand-count, postcard).

3.1.1. Stream-of-consciousness

Inspection of the results reveals that, in accord with our hypothesis, members of the control group reported more target occurrences than did members of the suppression group across the four sessions of stream-of-consciousness (see Fig. 1a, where the data of the respective sessions of the first and second day are collapsed). In a 2×4 analysis of variance (ANOVA) with experimental condition as between-factor and session as within-factor, the main effect of the experimental condition proved significant, $F(1,22) = 8.23$, $p < .01$, $\eta^2 = .27$ ($M = 5.67$, $SD = 5.38$ [control]; $M = 1.98$, $SD = 2.27$ [suppression]), as did the main effect of session, $F(3,66) = 7.37$, $p < .001$, $\eta^2 = .25$ ($M = 6.08$, $SD = 4.70$ [1st session]; $M = 3.67$, $SD = 4.64$ [2nd session]; $M = 2.79$, $SD = 4.35$ [3rd session]; $M = 2.75$, $SD = 3.71$ [4th session]). The interaction effect between the two factors was not significant, $F(3,66) = 1.27$, $p = .29$, $\eta^2 = .055$.

3.1.2. Hand-count

An analogous pattern of results emerged for the second measure: Across the four sessions of hand-count, controls indicated more white-bear thoughts than did participants with suppression instructions (see Fig. 1b, where the data of the respective sessions of the first and second day are collapsed). In a 2×4 ANOVA with experimental condition as between-factor and session as within-factor, the main effect of the experimental con-

Table 2
Means and standard deviations of target thought occurrences in the wake state

Measure	Control	Suppression
Stream-of-consciousness		
Session 1	8.58 (4.81)	3.58 (3.06)
Session 2	5.92 (5.62)	1.42 (1.56)
Session 3	4.33 (5.63)	1.25 (1.66)
Session 4	3.83 (4.75)	1.67 (1.92)
Hand-count		
Session 1	12.75 (6.50)	8.08 (5.74)
Session 2	10.25 (7.53)	4.92 (3.40)
Session 3	7.83 (5.22)	4.33 (2.77)
Session 4	7.25 (5.51)	4.00 (2.34)
Postcard		
Period 1 (morning)	3.18 (4.51)	1.75 (1.64)
Period 2 (afternoon)	5.09 (4.87)	2.75 (2.92)
Period 3 (evening)	1.91 (1.64)	2.33 (2.17)

Note. Standard deviations appear in parentheses. Each session of stream-of-consciousness and of hand-count lasted 5 min; sessions 1 and 2 took place on the first day, sessions 3 and 4 on the second day. The postcard was filled in during the second day.

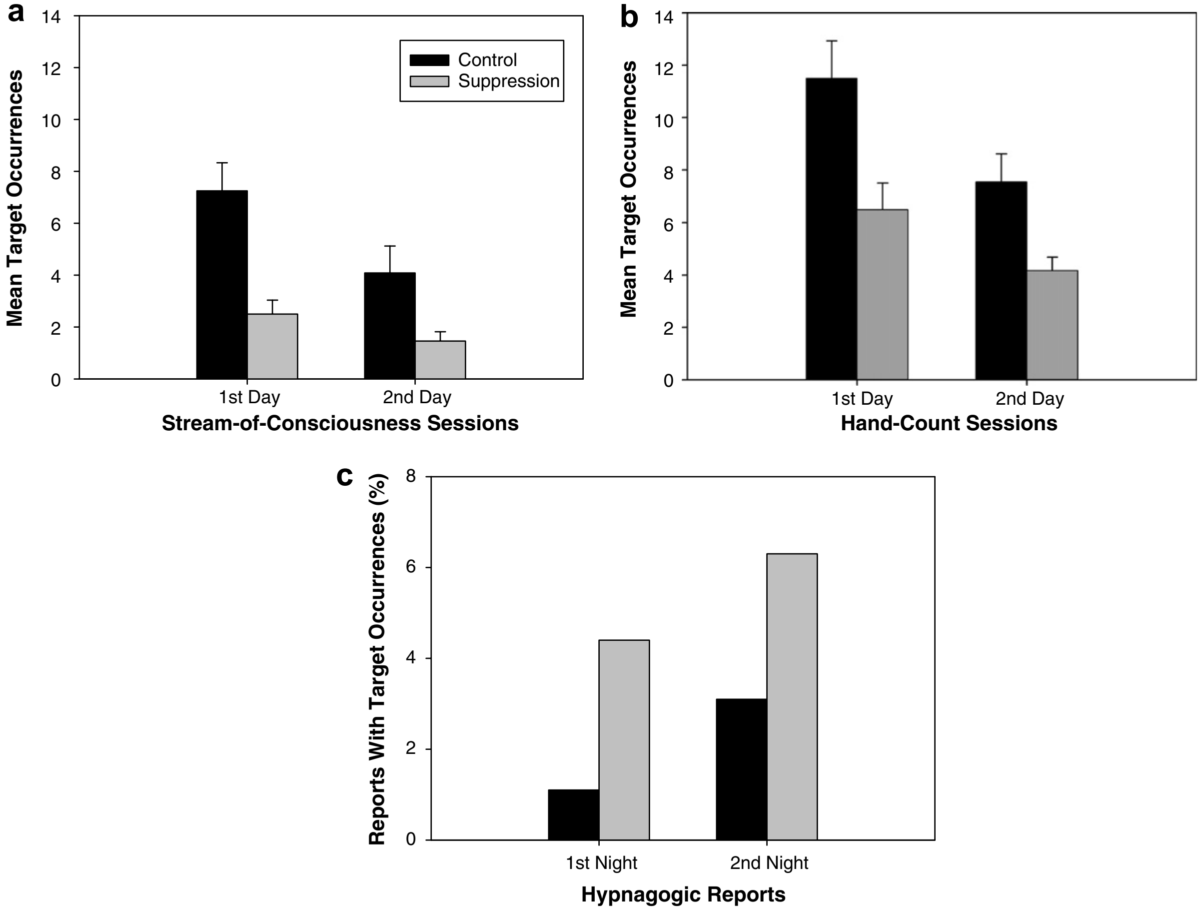

Fig. 1. Target thought frequency in the wake state and at sleep onset: (a) Mean number of target thoughts during the 5-min stream-of-consciousness sessions on the first and second day (each column represents the collapsed data of two sessions; error bars show standard error); (b) mean number of target thoughts during the 5-min hand-count sessions on the first and second day (each column represents the collapsed data of two sessions; error bars show standard error); (c) percentage of hypnagogic reports ($N = 374$) containing the target thought.

dition turned out to be significant, $F(1,22) = 4.92$, $p < .05$, $\eta^2 = .18$ ($M = 9.52$, $SD = 6.44$ [control]; $M = 5.33$, $SD = 4.02$ [suppression]), as did the main effect of session, $F(3,66) = 15.61$, $p < .001$, $\eta^2 = .42$ ($M = 10.42$, $SD = 6.45$ [1st session]; $M = 7.58$, $SD = 6.33$ [2nd session]; $M = 6.08$, $SD = 4.46$ [3rd session]; $M = 5.63$, $SD = 4.46$ [4th session]). The interaction effect between the two factors was not significant, $F\,(3,66) = 0.81$, $p = .49$, $\eta^2 = .035$.

3.1.3. Postcard

As regards the postcard, controls indicated—by comparison with participants in the suppression condition—more white-bear thoughts in the morning and in the afternoon, but slightly fewer in the evening. In a 2×3 ANOVA with experimental condition as between-factor and period as within-factor, the main effect of the experimental condition was not significant, $F(1,21) = .95$, $p = .34$, $\eta^2 = .043$ ($M = 3.39$, $SD = 4.05$ [control]; $M = 2.28$, $SD = 2.37$ [suppression]), whereas the main effect of period was, $F(2,42) = 4.76$, $p < .05$, $\eta^2 = .19$ ($M = 2.43$, $SD = 3.35$ [morning]; $M = 3.87$, $SD = 4.10$ [afternoon]; $M = 2.13$, $SD = 1.96$ [evening]). The interaction effect between the two factors was not significant, $F(2,42) = 2.59$, $p = .087$, $\eta^2 = .11$. Post hoc t tests did not reveal any significant difference between controls and participants instructed to suppress in terms of target thought frequency in the morning, afternoon or evening, all ps > .18.

3.2. Target thought frequency at sleep onset

A total of 374 hypnagogic reports with content were collected at sleep onset, corresponding to a mean of 7.79 reports per participant and night. Both experimental conditions contributed in a similar way to this sample: 189 reports ($M = 7.88$ per participant and night) were recorded in the control condition and 185 reports ($M = 7.71$ per participant and night) in the suppression condition. The respective means of participants' ratings of their wake state on the scale ranging from 1 (*awake and alert*) to 5 (*in deep sleep*) for the six different awakening latencies were as follows: Wake: $M = 1.54$; 15 s of objective sleep: $M = 2.51$; 45 s: $M = 2.95$; 75 s: $M = 3.00$; 120 s: $M = 3.21$; and 180 s: $M = 3.29$. These data indicate that in parallel to the objectively measured process of falling asleep, participants subjectively experienced a continuous decrease in wakefulness and a corresponding increase in sleepiness.

Analysis of target thought frequency in the 374 hypnagogic reports (174 wake reports and 200 sleep reports) revealed that 8 participants out of 12 (66.7%) in the suppression condition provided at least one white-bear report, whereas only 3 participants out of 12 (25.0%) did so in the control condition—a difference that proved statistically significant, $\chi^2(1, N = 24) = 4.20$, $p < .05$, $\varphi = .42$. The respective proportions of reports containing the target thought were as follows: In the suppression condition, 4 out of 90 first-night reports (4.4%) and 6 out of 95 second-night reports (6.3%) related to the polar bears; in the control condition, 1 out of 92 first-night reports (1.1% of these reports) and 3 out of 97 second-night reports (3.1%) showed a white-bear trace (see Fig. 1c). Given the special structure of the data set (the reports depended on the participants, and the number of reports per participant varied) the significance of the difference between the respective proportions of target-containing hypnagogic reports could not be estimated using classical statistical tests. To overcome this difficulty, we conducted a bootstrap test (Efron & Tibshirani, 1993) that resampled the participants to obtain a sampling distribution under the null hypothesis (H_0) of no difference between the two conditions. The observed difference between the respective proportions of target-containing reports amounted to .0329. The bootstrap test involving 10,000 samples yielded a p value of .065, which means that 6.5% of the bootstrap samples showed differences superior to .0329 under H_0. Thus, the difference between the two conditions in terms of target occurrences in the hypnagogic reports reached marginal statistical significance.

When considering only the subsample of 200 sleep reports, prevalence of white-bear reports was 33.3% in the suppression group and 0.0% in the control group—a difference that was significant in a Fisher's exact test with Overall's correction, $p < .05$, $\varphi = .56$. The respective proportions of target-containing reports were as follows: In the suppression group, 2 out of 50 first-night reports (4.0%) and 3 out of 51 second-night reports (5.9%) referred to the polar bears; in the control group, in contrast, none of the first-night and second-night reports made reference to the white bears. For the previously mentioned reasons, we conducted a bootstrap test (Efron & Tibshirani, 1993) in order to examine the significance of the difference between the respective proportions of target-containing sleep reports. The observed difference between the respective proportions of target-containing reports amounted to .0495. The bootstrap test involving 10,000 samples yielded a p value of .028, which means that 2.8% of the bootstrap samples showed differences superior to .0495 under H_0. Thus, consistent with our hypothesis, participants instructed to suppress produced significantly more target-containing sleep reports than did controls.

When differentiating between wake states described as "awake and alert" vs. "awake but drowsy" or "drifting off to sleep", analysis of target thought frequency as a function of awakening latency revealed that the reversal between the two experimental conditions set in as participants entered a state of drowsiness (see Fig. 2). Before, in a state subjectively qualified as "awake and alert", participants in the control condition reported more target thoughts than did those in the suppression condition—a pattern echoing the one found for the stream-of-consciousness and the hand-count sessions. Afterwards, as participants drifted off to sleep, those with suppression instructions reported more target thoughts than did controls.

Exploratory content analysis revealed that 60.0% of the hypnagogic target thought occurrences in the suppression condition were preceded or accompanied by thoughts that had earlier been used as distracters during the stream-of-consciousness sessions. In contrast, none of the hypnagogic target occurrences in the control condition appeared in succession or juxtaposition to previously reported thoughts. For example, when prompted by the computer, one female participant in the suppression condition reported the following sequence of hypnagogic images: First, she briefly saw a picture of cherries with a text column alongside, which

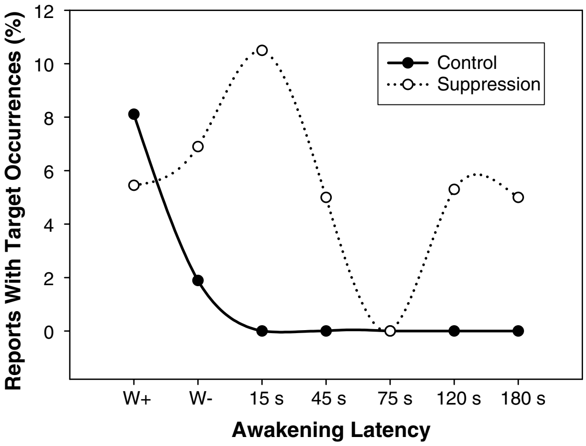

Fig. 2. Percentage of hypnagogic reports ($N = 374$) containing the target thought as a function of awakening latency. W+ = wake state subjectively qualified as "awake and alert"; W− = wake state qualified as "awake but drowsy" or "drifting off to sleep"; 15–180 s: awakening latency after sleep onset.

resembled a recipe in a magazine she had read in the afternoon as she explained in the morning interview. Then, a vision of a myriad of small leaves pervaded her mind, abruptly followed by an image of a fern in a pot on the white, round table in her parents' garden. At this point, the picture of the face of a white bear intruded upon her. During the second stream-of-consciousness session of the same evening, she had repeatedly talked about her parents' garden in an attempt to escape white-bear thoughts.

4. Discussion

This experiment examined the effects of thought suppression on wake and hypnagogic mentation during a period of two days. In support of our hypothesis, results revealed a reversal of target thought frequency at sleep onset: While awake, participants instructed to suppress indicated fewer target thoughts across repeated stream-of-consciousness and hand-count sessions than did controls; in contrast, when falling asleep, participants in the suppression condition reported more target thoughts than did controls following computer-provoked awakenings. By demonstrating a suppression-induced rebound of a neutral thought in hypnagogic mentation, our research corroborates and complements previous studies showing a dream rebound for positive ("crush"), slightly positive or neutral ("noncrush"; Wegner et al., 2004), and negative target thoughts ("most negative and distressing intrusive thought"; Taylor & Bryant, 2007). Taken together, these findings suggest that, in accordance with the literature on thought suppression in the wake state (for a meta-analysis, see Abramowitz, Tolin, & Street, 2001), the rebound results from processes that enhance the target's accessibility regardless of its affective attributes.

A more fine-grained analysis of target thought frequency before and after the moment of sleep onset showed that the suppression-induced rebound set in as participants entered a state of drowsiness, precisely when attentional control over mentation is expected to decrease (Vogel, 1991). In accord with ironic process theory (Wegner, 1994), this finding suggests that "successful" suppression depends on the availability of controlled processing resources: As soon as they diminish, a surge of the suppressed tends to occur. Another finding from our study suggests that, in departure from ironic process theory, automatic monitoring processes might not be the only driving force behind the rebound effect. Exploratory content analysis indicated that a majority of hypnagogic target intrusions in the suppression condition were preceded or accompanied by thoughts that had been used as distracters during the stream-of-consciousness sessions. A possible explanation for this result is that the recurrent coactivation of the target and distracter thoughts in the wake state created associative links between the two, the latter thereby becoming reminders of the first. Such an interpretation would be in line with previous studies suggesting an implication of distracter associations in the postsuppression rebound: This effect has, for example, been found to be attenuated if potential distracters in the immediate environment are replaced between a suppression and a subsequent expression period (Wegner, Schneider, Knutson, & McMahon, 1991; see also Wenzlaff & Wegner, 2000).

Another challenge for any theoretical account of the return of the suppressed in dreams arises from the fact that nonsuppressed representations have also been shown to be incorporated into hypnagogic mentation (e.g., Stickgold et al., 2000) and dreams (e.g., Nikles, Brecht, Klinger, & Bursell, 1998). A candidate concept for integrating the two seemingly inconsistent lines of research is activation. In cognitive terms, it could be argued that suppression leads to a higher level of activation than does concentration (Wegner & Erber, 1992; Wegner & Smart, 1997; Wenzlaff & Bates, 2000) and that the corresponding levels of accessibility carry over into dreams (cf. Wegner et al., 2004). Alternatively, activation might be framed in motivational terms: It could, for example, be surmised that (a) both suppression and concentration constitute varieties of goal-directed behavior that need mental effort, (b) suppression induces a higher level of activation and/or a prolonged period of activation given that its goal (no intrusion at all) seems harder to attain and that difficult goals need more effort to be accomplished (Gendolla & Wright, 2005; Wright & Brehm, 1989), and (c) the resulting levels of accessibility transfer into dreams. In support of these assumptions, it may be mentioned that providing participants instructed to suppress with a feedback of goal attainment has been demonstrated to eliminate the postsuppression rebound (Martin, Tesser, & McIntosh, 1993), and that current-concern-related contents (i.e., representations related to the pursuit of currently active goals) have been shown to be more frequently incorporated into dreams than nonconcern-related contents (Nikles et al., 1998). The question of the respective influences of cognitive and motivational sources of activation on the suppression-related dream rebound clearly merits further investigation.

A methodological issue raised by our findings concerns the measurement of target thought occurrences. As compared with the stream-of-consciousness and hand-count sessions, the ‘‘postcard’’ on which participants had to make a check mark for each target thought during the day between the first and the second-night at the sleep laboratory yielded results that were less clear: Even though participants with suppression instructions reported on the whole fewer target thoughts than did controls, mean values for both groups were comparatively low and the difference between the two was not statistically significant. A flaw of this measure emerged from participants' comments: Some of them reported having made the check marks only at the end of each measurement period (morning, afternoon, or evening). The vagueness of the results obtained with this measure might thus be explained by its unintended retrospective nature, which could have led to an underestimate of thought frequency. In their meta-analysis of 28 controlled thought-suppression studies, Abramowitz et al. (2001) did indeed find that when compared with retrospective reports, concomitant thought-recording techniques, such as ‘‘streaming’’ or ‘‘event marking’’ (e.g., ringing a bell), yielded greater effect sizes. A more systematic use of multimethod approaches in future research on thought suppression could provide more clarity about inherent properties of different assessment techniques.

A clinical implication of our findings is that they may contribute to a new understanding of the mechanisms underlying insomnia. There is growing evidence for an implication of thought suppression in the maintenance of this disorder (for reviews, see Espie, 2002; Harvey, 2005). Research has, for example, shown that insomniacs report using suppression during the presleep period more than good sleepers do (Harvey, 2001), and that the more frequent use of suppression is associated with more frequent sleep-interfering thoughts and poorer sleep quality (Ree, Harvey, Blake, Tang, & Shawe-Taylor, 2005; Schmidt, Gay, & Van der Linden, in press). By demonstrating for the first time a rebound of a suppressed thought at sleep onset, our study suggests that insomniacs' reliance on suppression could result in a vicious circle: The hypnagogic rebound of unwanted, negatively toned thoughts might increase the level of arousal sufficiently to interrupt the process of falling asleep, and in response, suppression efforts might be intensified. Mindfulness-based stress reduction programs for sleep disturbances (e.g., Bootzin & Stevens, 2005) may owe part of their effectiveness to the fact that they defuse such vicious circles by encouraging insomniacs to confront what they customarily suppress.

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