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Unnoticed intrusions: Dissociations of meta-consciousness in thought suppression



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ABSTRACT

The current research investigates the interaction between thought suppression and individuals' explicit awareness of their thoughts. Participants in three experiments attempted to suppress thoughts of a prior romantic relationship and their success at doing so was measured using a combination of self-catching and experience-sampling. In addition to thoughts that individuals spontaneously noticed, individuals were frequently caught engaging in thoughts of their previous partner at experience-sampling probes. Furthermore, probe-caught thoughts were: (i) associated with stronger decoupling of attention from the environment, (ii) more likely to occur under cognitive load, (iii) more frequent for individuals with a desire to reconcile, and (iv) associated with individual differences in the tendency to suppress thoughts. Together, these data suggest that individuals can lack meta-awareness that they have begun to think about a topic they are attempting to suppress, providing novel insight into the cognitive processes that are involved in attempting to control undesired mental states.

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1. Introduction

From stressful upcoming events to past loves, there are often things that people would prefer to avoid thinking about. Although it would certainly be nice if it were possible to be able to promptly forget anything one wished to not think about, the conscious attempt to suppress or avoid certain thoughts is difficult and can even backfire, in some cases leading to suppression-induced obsession (see Wegner, 1992). This “ironic” return of unwanted thoughts was first shown experimentally in a study in which individuals asked not to think about a white bear for a period of time later reported thoughts of a white bear more frequently than those not given this instruction (Wegner et al., 1987). Other studies on suppression have found similar results, showing that attempts to suppress a thought often lead to an increase in its occurrence, either immediately or after the suppression has ended (for reviews see Wegner (1994) and Wenzlaff and Wegner (2000)).

Research on thought suppression has generally assumed that the difficulty people have in suppressing unwanted thoughts results from some interplay between unconscious and conscious thought. In an influential theory, Wegner (1992, 1994, 1997) has argued that the recurrence of unwanted thoughts is due to a two-stage process in which an automatic monitor searches preconsciousness for thoughts that require suppression, followed by a cognitively-demanding (and conscious) process of actually suppressing the thought. As Wegner (1997) states, “because the monitor searches for potential

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mental contents that signal failure of mental control, it increases the accessibility of these contents to consciousness” (p. 299). While considerable research supports this theory (e.g., Wegner, 1994; Wenzlaff & Wegner, 2000), research in other domains (in particular in the related area of mind-wandering), suggests that the challenges surrounding attempts at thought control may in addition occur at the conscious level. Specifically, recent investigations of mind-wandering have documented the value of a distinction between two different levels of conscious thought: *experiential consciousness* – thoughts that occur without explicit self-reflection, and *meta-awareness* – thoughts that are accompanied by the explicit awareness of having the thought (e.g., Schooler, 2002; Schooler, Mrazek, Baird, & Winkelman, in press; Schooler et al., 2011).

In order to assess mental lapses that occur with versus without meta-awareness, research on mind-wandering has employed two self-report measures: (i) *self-catching*, in which individuals are asked to press a response key every time they notice that they have been engaging in unrelated thoughts and (ii) *experience sampling*, in which individuals are periodically interrupted by a prompt which asks them about the content of their current conscious experience (e.g., Reichle, Reineberg, & Schooler, 2010; Sayette, Reichle, & Schooler, 2009; Sayette, Schooler, & Reichle, 2010; Schooler, 2002; Schooler et al., 2011; Smallwood & Schooler, 2006). For example, Schooler, Reichle, and Halpern (2005) asked participants to self-report whenever their minds wandered while reading, and intermittently probed participants to report on whether they were mind-wandering at that moment. Despite the fact that readers were asked to self-report an episode of mind-wandering as soon as it occurred, they were nonetheless sometimes “caught” engaging in off-topic thoughts at the experience-sampling probes. Furthermore, the frequency of probe-caught episodes of mind-wandering was associated with worse comprehension on a post-reading test, but those episodes that were self-caught were not, suggesting that reading comprehension is particularly disrupted by mind-wandering episodes that evade detection.

Building on the hypothesis that the capacity to notice off-task thoughts is crucial to the effective regulation of behavior, subsequent research has shown that when participants describe their mind-wandering at probes as lacking explicit meta-awareness, this is associated with greater propensity for error (Smallwood, McSpadden, & Schooler, 2007, 2008), worse reading comprehension (Smallwood et al., 2008) and more careless responding in a go/no-go task (Smallwood, McSpadden, & Schooler, 2007). Moreover, manipulating external focus through alcohol (Sayette et al., 2009) or craving (Sayette et al., 2010) has been shown to increase reports of mind-wandering at probes while reducing the proportion of these lapses that are explicitly noticed. Together these data highlight the importance of the distinction between the occurrence of specific thoughts and the explicit recognition (i.e., meta-awareness) of what one is thinking about (for recent reviews see Schooler et al., 2011, in press).

The distinction between thoughts that occur with versus without meta-awareness could provide novel insight into the cognitive processes that are involved in attempting to suppress thoughts for several reasons. First, previous studies examining self-reports of failures of thought suppression have largely relied on a self-catching methodology. This leaves open the possibility that individuals may experience conscious thoughts regarding the content they are trying to avoid but fail to self-catch those experiences due to dissociations of meta-awareness (Schooler, 2002; Schooler et al., 2011, in press). Given prior demonstrations of qualitative differences between thoughts that occur with versus without meta-awareness, the fact that previous investigations have relied exclusively on self-catching raises the possibility that processes and characteristics previously ascribed to suppressed thoughts might only apply to those thoughts that reach meta-awareness. Second, recognition that one’s mind has drifted back to the topic one wishes to avoid is potentially a necessary first step in the process by which control can be initiated. Understanding failures of thought suppression can therefore be advanced by understanding the circumstances in which the monitoring of such thought is compromised. As research on mind-wandering has shown, effective metacognitive monitoring of thought may be hindered when the mental resources required to monitor thought are dampened (Sayette et al., 2009, 2010) and thus unable to engage in effective top-down control.

Most fundamentally, the distinction between consciousness and meta-awareness introduces another level at which the monitoring of suppressed thoughts could take place. As noted above, in prior theoretical discussions of thought suppression, Wegner (1994) has reviewed considerable evidence indicating that thought suppression involves the interplay of two juxtaposed processes: a control process that attempts to think about anything but the undesired thought, and an automatic process that searches for failures of the control process. For example, when executive resources are available (thereby enabling the control process that avoids unwanted thoughts) participants are generally quite effective at minimizing such thoughts (Wegner & Erber, 1992). However, when resources are limited (thereby undermining the control process), suppressed thoughts “rebound” in frequency. This latter finding suggests that in the absence of the control process, the automatic monitor primes and then finds the very thoughts the individual is seeking to avoid. Although considerable research has amassed in support of this ironic process model, one question has gone largely unaddressed, namely: What exactly is the automatic monitor monitoring? Wegner (1997) suggests that the automatic monitor searches the contents of preconsciousness. Although such a speculation is certainly plausible, it raises the question of why the monitor would search the contents of preconsciousness when such thoughts might otherwise never reach consciousness. While it may be of questionable value to dredge up suppressed thoughts that are outside of consciousness, there can be little question that one would want to know when an unwanted thought is currently in consciousness. In short, the fact that consciousness and meta-awareness can become dissociated suggests an additional potential locus for monitoring suppressed thoughts: namely, monitoring the contents of consciousness in order to alert the mind when it is currently engaging in the very thought it is intending to avoid.

2. Experimental overview

In the current studies, we combined experience-sampling and self-catching methodologies (referred to as the self-caught/probe-caught paradigm) to explore the interaction between thought suppression and individuals' explicit awareness of thoughts that they are currently attempting to suppress. In each study we used a paradigm in which participants tried to suppress thoughts about a previous romantic relationship partner (see Wegner & Gold, 1995). As commonly done in this procedure, we asked participants to press a response key every time they noticed they were thinking about their previous partner, thereby providing a measure of suppressed thoughts that reached meta-awareness. In addition, participants were also periodically probed and asked to indicate whether they were thinking about their previous partner at that particular moment, providing a measure of suppressed thoughts that escaped explicit detection.

With this design, we first investigated whether people can experience thoughts they are attempting to avoid in the absence of meta-awareness. If this is the case, participants should be caught engaging in thoughts of their previous partner at experience-sampling probes, even in the context of an experiment in which they are asked to report such thoughts as soon as they occur.

Second, we explored whether, relative to self-caught thoughts, probe-caught thoughts involving the previous romantic partner would be associated with a greater decoupling of attention from the external environment. In the current studies, we measured thought suppression during reading. This paradigm enabled us to assess whether probe-caught thoughts in a suppression context would be associated with a greater decoupling of attention from the primary task of reading, as previous research has shown in the context of probe-caught thoughts more generally (Schooler et al., 2005; Smallwood et al., 2008).

Third, we investigated the effects of cognitive load on probe-caught and self-caught suppressed thoughts. As noted, previous studies have found that cognitive load increases the recurrence of suppressed thoughts (Wegner & Erber, 1992). However, given previous findings which suggest that the capacity to monitor thought requires cognitive resources (Sayette et al., 2009, 2010; Schooler, 2002; Smallwood & Schooler, 2006), load may not only undermine the control processes necessary for suppression, but also the ability to notice the occurrence of a suppressed thought.

Fourth, we evaluated the relationship between the emotional significance of the thought individuals were attempting to suppress and the capacity to notice the occurrence of those thoughts. Wegner and Gold (1995) found that participants who suppressed thoughts of a "hot-flame" (a previous partner they still desired) self-reported fewer thoughts than cold-flame participants. However, other research has shown that emotionally significant thoughts are in general more difficult to suppress (e.g., Petrie, Booth, & Pennebaker, 1998). One possibility is that emotionally salient thoughts are more absorbing, making them more difficult to suppress from consciousness, as prior work suggests, and therefore also easier to become "caught-up" in and more difficult to explicitly reflect upon. According to the present framework, an alternative possibility that is consistent with both of these findings is that individuals with a desire to reconcile with a previous partner may think about their partner more but be less likely to acknowledge that they are doing so.

Finally, we examined how explicit awareness of unwanted thoughts relates to individual differences in two alternative chronic tendencies: the tendency to suppress thoughts and the tendency to repress emotional experiences. Given that probe-caught mind-wandering has been shown to increase when individuals are in a negative mood (Smallwood and O'Connor, 2011) or score highly on indexes of depression (Smallwood et al., 2007), and that chronic suppression is associated with negative emotions such as anxiety and dysphoria (Wegner & Zanakos, 1994), individuals with chronic suppression tendencies may be more likely to experience unnoticed suppressed thoughts. Alternatively, if a failure to notice suppressed thoughts corresponds to a defense mechanism that leads individuals to ignore the fact that they are experiencing certain thoughts, then individuals who tend to repress emotional experiences should exhibit a high number of thoughts that evade self-catching.

3. Study 1

We used a self-caught/probe-caught paradigm to assess thought intrusions during a reading task in which participants were asked to try not to think about a previous romantic relationship partner. Given that participants were instructed to report the occurrence of thoughts of their previous partner as soon as they recognized them, reports of having those thoughts at experience-sampling probes correspond to situations when participants have not recognized the occurrence of the thought. On the basis of previous mind-wandering research (Schooler et al., 2005; Smallwood et al., 2008), we hypothesized that thoughts about a past relationship partner that the participant failed to notice would be particularly associated with detriments in reading comprehension.

3.1. Method

3.1.1. Participants

Participants were 81 undergraduate students (22 males, 59 females) who participated in exchange for extra credit. Data from two participants were excluded because their data files were not saved properly. To be eligible for this and all subsequent studies, participants were required to have had a significant romantic relationship in which they were no longer involved.

3.1.2. Procedure

Participants were asked to recall a past romantic relationship and were given 2 min to think about the relationship. Participants were then asked to type in the initials of their previous partner and were asked several questions about their relationship, including how long the relationship lasted and how long ago it ended. Participants were then instructed to suppress thoughts of their prior relationship partner for the duration of the experiment. The experimental task consisted of four sections. The first three parts were reading sections composed of three different non-fiction articles of unrelated subject matter taken from online professional journals. The reading passages were presented one page at a time and each article was divided into five sections of approximately equal length, with the participant advancing to the next section at their own pace. The fourth section consisted of a “quiet” section in which participants viewed a fixation point on a computer screen. The order of the reading sections was counterbalanced using a Latin-square design.

All participants were asked to press the space bar each time they noticed that they had a thought about their previous partner. Half of the participants additionally received experience-sampling probes in which they were periodically interrupted by a screen that asked: “Just now, were you thinking about your previous relationship partner?” Participants responded by pressing “y” for Yes and “n” for No. Probes appeared approximately every 30 s, with a range of 8–150 s, and thought probe timing was independent of self-catching. After the computer portion of the study, participants completed a 15-question comprehension test.

3.2. Results and discussion

Participants self-caught significantly more thoughts of their previous partner in the self-caught-only condition compared to the self-caught-plus-probe condition in both the reading ($M = 33.9$ and 15.6 respectively, $t(77) = 3.14$, $p < .01$) and quiet sections ($M = 17.1$ and 9.5 , $t(77) = 2.49$, $p < .05$). This finding suggests that thought probes caught thoughts that (at least sometimes) would have been eventually noticed by the participants themselves. With the addition of probes, participants were caught engaging in thoughts of their previous partner 18% of the time while reading ($M = 3.83$, $SD = 3.73$) and 22% of the time while sitting quietly ($M = 1.80$, $SD = 1.42$).

No difference was observed in reading comprehension between the self-caught-only condition ($M = 10.78$, $SD = 2.17$) compared to the self-caught-plus-probe condition ($M = 10.44$, $SD = 2.10$, $t(77) = 0.68$, $p > .50$), indicating that the experience-sampling method did not in itself alter reading comprehension performance. Simultaneous linear multiple regression analysis revealed that the frequency of probe-caught thoughts of the past romantic partner significantly predicted reading comprehension ($b = -.25$, $SE = .09$, $t(41) = -2.86$, $p < .01$) while self-caught thoughts of the suppression target did not predict comprehension ($b = 0.03$, $SE = .02$, $t(41) = 1.31$, $p = .20$). This analysis suggests that probe-caught suppressed thoughts are particularly associated with decoupling of attention from what is being read. These findings mirror prior research indicating that probe-caught mind-wandering episodes are significantly more disruptive to reading comprehension than are those that individuals catch themselves (Schooler et al., 2005; Smallwood et al., 2008).

4. Study 2

Study 2 was designed to replicate the finding that individuals can lack meta-awareness of the fact that they have begun to think about a suppression target, while also addressing the influence of cognitive load. Previous studies (e.g., Wegner & Erber, 1992) have generally found that cognitive load increases the recurrence of suppressed thoughts. In the current study, we wanted to explore whether load elicits a comparable effect on noticed and unnoticed suppressed thoughts. Prior evidence suggests that mental content is more difficult to regulate under cognitive load. For example, probe-caught estimates of depressive rumination for dysphoric individuals increase when the task has a working memory component (Smallwood et al., 2007). Moreover, given previous findings which suggest that the capacity to monitor thought requires cognitive resources (Sayette et al., 2009, 2010; Schooler, 2002; Smallwood & Schooler, 2006), cognitive load may not only increase the occurrence of suppressed thoughts, but also reduce people’s meta-awareness of their thoughts (Sayette et al., 2009; Smallwood & Schooler, 2006).

In this experiment we also assessed participants’ desire to reconcile with their previous partner. Previous research (Wegner & Gold, 1995) has shown that individuals who still want to be with their ex-partner self-report fewer thoughts about their partner. However, it is unclear whether this decrement in the number of reported thoughts is attributable to a reduction in the occurrence of thoughts or a reduction in self-report. Indeed, other research suggests that emotionally significant thoughts are in general more difficult to suppress (e.g., Petrie et al., 1998). According to the present framework, an alternative hypothesis is that suppressed thoughts of a “hot flame” (a previous romantic partner that the person still desires) may be more difficult to suppress because of their emotional salience but also less likely to be reported.

4.1. Method

4.1.1. Participants

Participants were 74 undergraduate students (29 male, 45 female; mean age = 20.3) who participated in exchange for extra credit. Two participants were excluded: one for not understanding the instructions and the other for receiving the wrong test materials.

4.1.2. Procedure

The procedure for Study 2 was identical to Study 1 with the following exceptions: (1) all participants were asked to self-report thoughts of their previous partner and received thought probes, (2) following Wegner and Erber (1992), participants received a low or high cognitive load manipulation by giving them 30 s to memorize for subsequent recall either a 1-digit (low load) or 9-digit (high load) number just prior to beginning the computer session, and (3) participants were asked to indicate the extent to which they still wanted to be involved with their previous romantic partner on a 7-point scale.

4.2. Results and discussion

Participants reported that the probes caught them thinking about their previous partner before they had realized it at a similar rate ($M = 14\%$) as participants who received probes in Study 1. Replicating Study 1, a linear regression analysis revealed that the frequency of probe-caught suppressed thoughts ($M = 4.36$, $SD = 4.36$) predicted performance on the reading comprehension test ($b = -.14$, $SE = .06$, $t(70) = -2.24$, $p < .05$), while self-caught thoughts ($M = 21.0$, $SD = 18.9$) were not a significant predictor of comprehension ($b = .002$, $SE = .015$, $t(70) = 0.161$, $p = .87$).

Participants under high load reported that they were thinking about their previous partner at the probes more often ($M = 5.40$) than those under low load ($M = 3.38$, $F(1, 70) = 4.02$, $p < .05$). For self-caught thoughts, no differences were observed between high ($M = 22.14$) and low load ($M = 19.91$) [$F(1, 70) = .24$, $p = .62$]. Mean probe-caught and self-caught suppressed thoughts under high and low load are presented for both reading and quiet sections in Fig. 1. These results suggest that participants under high load were more likely to report thinking about their previous relationship but were no more likely to notice these thoughts. These findings extend previous results indicating that mental content is more difficult to regulate under load (e.g., Smallwood et al., 2007), and are consistent with the idea that mental resources may be important in monitoring consciousness during suppression (Sayette et al., 2009, 2010; Smallwood & Schooler, 2006).

Finally, we explored the relationship between participants' desire to reconcile with their ex-partner and the frequency of self-caught and probe-caught thoughts they had about that person. A simultaneous multiple regression model revealed that together self-caught and probe-caught thoughts of the past relationship partner accounted for approximately 20% of the variance in desire to reconcile [$R^2 = .202$; $F(2, 69) = 8.73$, $p < .001$]. Individuals who reported a strong desire to reconcile had fewer self-caught thoughts ($b = -.038$, $SE = .01$, $t(70) = -3.09$, $p < .01$) and more probe-caught thoughts ($b = .21$, $SE = .05$, $t(70) = 3.92$, $p < .001$) about their past partner. The results of this analysis are presented in Table 1 for all participants, as well as separately for high and low cognitive load conditions. The results reveal that for both high and low load conditions, desire to reconcile was associated with fewer self-caught thoughts and more probe-caught thoughts of the previous relationship.

We additionally observed an association between desire to reconcile and the amount of time since the relationship ended ($r(70) = -.34$, $p < .01$), indicating that more recent relationships were associated with a stronger desire to reconcile. In order to evaluate the association between self-caught and probe-caught thoughts and desire to reconcile independent of recency effects, we therefore conducted an additional multiple regression analysis with time since the relationship ended included as a covariate (entered as Step 1 in a hierarchical linear regression model). Controlling for time since the relationship ended, the results remained consistent: individuals who had a strong desire to reconcile had fewer self-caught thoughts ($b = -.032$, $SE = .013$, $t(70) = -2.52$, $p = .014$) and more probe-caught thoughts of their previous partner ($b = .18$, $SE = .06$, $t(70) = 3.21$, $p = .002$).

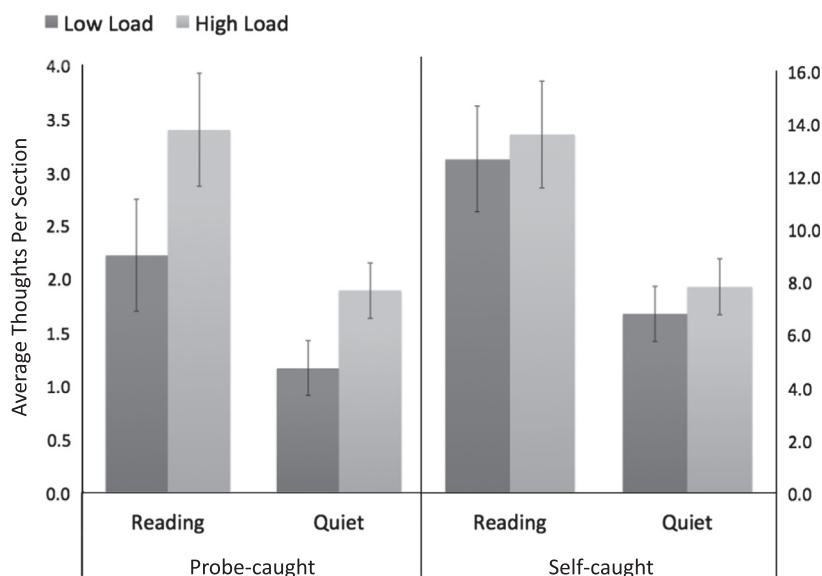


Fig. 1. Cognitive load increases the report of probe-caught but not self-caught suppressed thoughts.

Table 1

Regression analysis predicting desire to reconcile for all participants, and participants who received a high or low cognitive load manipulation.

Variable	All			High load			Low load		
	B	SE B	β	B	SE B	β	B	SE B	β
Probe-caught	0.21***	0.05	.48***	0.19*	0.07	.44*	0.24*	0.10	.49*
Self-caught	−0.04**	0.01	−.37**	−0.04*	0.02	−.34*	−0.04*	0.02	−.46*
R ²		.20***			.21*			.15	
F		8.73***			4.33*			3.03	
N		72			35			37	

* $p < .05$.** $p < .01$.*** $p < .001$.

The negative relationship between self-caught unwanted thoughts and desire to reconcile is consistent with Wegner and Gold's (1995) finding that people who wanted to be with their partner self-reported fewer thoughts about them under suppression instructions. However, this result was reversed for probe-caught thoughts, indicating that desire to still be with a partner was positively associated with the likelihood of being caught by experience-sampling probes thinking about that partner. In summary, the desire to be with a partner was simultaneously associated with an increased likelihood of thinking about the partner and a decreased probability of spontaneously noticing such thoughts.

5. Study 3

Study 3 was designed to (1) replicate the results from Studies 1 and 2 that probe-caught thoughts of a previous romantic partner are particularly damaging to reading comprehension using a different set of reading passages and comprehension questions, (2) replicate the finding that desire to reconcile with a previous partner is associated with an increased likelihood of probe-caught unwanted thoughts, and (3) examine how individual differences in the tendency to repress emotional experiences and chronically suppress thoughts are related to the ability to successfully suppress thoughts of a past romantic partner.

Specifically, in this study we used an individual differences approach to explore two alternative relationships between individuals' chronic thought suppression patterns and the capacity to notice that a suppression target had entered consciousness. According to one view, some individuals may chronically fail to acknowledge their suppressed thoughts to themselves. This hypothesis is one way of interpreting the relationship between meta-awareness of suppressed thoughts and desire to be in the relationship that was observed in Study 2. Accordingly, individuals who still desire to be in the relationship may fail to acknowledge the thoughts to themselves as a defense mechanism, thereby leading them to fail to report the thoughts even though they regularly experience them. If such defense mechanisms contribute to failures to self-catch suppressed thoughts, then individuals with a tendency to repress emotions (Weinberger, Schwartz, & Davidson, 1979) may be especially susceptible to experiencing suppressed thoughts without acknowledging them to themselves.

An alternative account of individual differences in the capacity to suppress thoughts is suggested by research on individuals' tendency for chronic thought suppression. Wegner and Zanakos (1994) introduced a measure of individuals' chronic tendency to struggle with unwanted thoughts, the WBSI (White Bear Suppression Inventory), and found that individuals who scored high on this measure also were inclined towards depressive and anxious affect. The authors concluded, "anxiety-producing thoughts and depressing thoughts... represent two broad classes of thinking that could often prompt suppression in a person so inclined" (p. 619). Given that probe-caught mind-wandering has been shown to increase when people are in a negative mood (Smallwood and O'Connor, 2011) or score highly on indexes of depression (Smallwood et al., 2007), individuals with chronic suppression tendencies may be more likely to be caught thinking about suppression targets. Importantly, although a priori it was possible that reduced meta-awareness of suppressed thoughts could be associated either with a tendency to repress or a tendency to suppress thoughts, it was very unlikely that both relationships would be observed, as Wegner and Zanakos (1994) found that the WBSI was inversely correlated with repression.

5.1. Method

5.1.1. Participants

Participants were 84 undergraduate students (27 male, 59 female; mean age = 19.6) who participated in exchange for partial fulfillment of a course requirement.

5.1.2. Procedure

The procedure for Study 3 was identical to Study 1 with the following exceptions: (1) a new set of reading passages was used that consisted of excerpts of non-fiction science writing from Bill Bryson's *A Short History of Nearly Everything* (Bryson, 2003), (2) all participants were asked to self-report thoughts of their previous partner and received thought probes, (3) participants completed an 8-item questionnaire (Wegner & Gold, 1995) assessing the extent to which they wished they were

still involved with their previous romantic partner, and (4) individual differences in the tendency to repress emotional experiences and suppress thoughts were assessed. Weinberger et al. (1979) defined repressors as individuals who score normatively low on a measure of trait anxiety (the Taylor Manifest Anxiety Scale) but normatively high on a measure of defensiveness (the Marlowe-Crowne Social Desirability Scale). Thus, following Weinberger et al., our repression measure was a composite computed from scores on these two different scales, and consisted of two groups composed of individuals with low repressive tendencies and individuals with high repressive tendencies. Following Wegner and Zanakos (1994), the White Bear Suppression Inventory (WBSI) was used to assess individual differences in chronic thought suppression.

5.2. Results and discussion

Consistent with Studies 1 and 2, participants were caught thinking about their previous relationship partner on average 16% of the time ($M = 4.13$, $SD = 4.56$), and caught themselves thinking about their partner on average 11.42 times ($SD = 12.41$). Replicating Studies 1 and 2, a simultaneous linear multiple regression model revealed that the frequency of probe-caught thoughts of the past romantic partner predicted reading comprehension ($b = -.18$, $SE = .08$, $t(82) = -2.26$, $p < .05$) while self-caught thoughts did not predict comprehension ($b = -.00002$, $SE = .001$, $t(82) = .02$, $p = .98$), again suggesting that only failures of suppression that people did not notice were associated with impaired comprehension of the material.

Next we examined the relationship between probe-caught and self-caught suppressed thoughts and desire to reconcile with one's previous partner. Simultaneous multiple regression revealed that together self-caught and probe-caught thoughts of the previous partner accounted for approximately 11% of the variance in desire to reconcile [$R^2 = .107$; $F(2, 81) = 4.86$, $p < .01$]. Individuals who reported a stronger desire to still be in their previous relationship were more likely to be caught thinking about their previous partner ($b = 1.58$, $SE = .60$, $t(82) = 2.64$, $p < .01$), but were no more likely to catch themselves thinking about their partner ($b = .002$, $SE = .009$, $t(82) = .26$, $p = .79$). As in Study 2, we additionally observed an association between desire to reconcile and the amount of time since the relationship ended ($r(82) = -.39$, $p < .001$), indicating that more recent relationships were associated with a stronger desire to reconcile. To examine the association between self-caught and probe-caught thoughts and desire to reconcile independent of recency effects, we conducted an additional regression analysis controlling for time since the relationship ended. Again we observed that individuals who had a strong desire to reconcile were more likely to be caught thinking about their previous partner ($b = 1.54$, $SE = .56$, $t(82) = 2.78$, $p < .01$), but were no more likely to catch themselves thinking about their partner ($b = .0001$, $SE = .009$, $t(82) = -.02$, $p = .98$). These findings are consistent with the proposal that individuals with a desire to reconcile actually think about their previous partner more often, but are not more likely to self-report this fact.

Finally, we examined the relationship between the relative frequency of probe-caught and self-caught thoughts of the previous relationship and both the tendency for repression and for suppression. There was no difference between high and low repressors in their tendency to report thoughts of the romantic partner as revealed by either the self-caught ($F(1, 82) = .01$, $p = .91$) or probe-caught ($F(1, 82) = .17$, $p = .68$) measures. In contrast, a simultaneous linear regression analysis revealed that individuals who frequently suppress thoughts were more likely to be caught having thoughts about their previous partner at the probes ($b = 1.49$, $SE = .42$, $t(82) = 3.54$, $p = .001$), while no such relationship between chronic thought suppression and self-caught thoughts was found ($b = -.008$, $SE = .007$, $t(82) = -1.2$, $p = .22$). Additionally, consistent with Wegner and Zanakos (1994), there was a strong positive relationship between scores on the WBSI and Taylor Manifest Anxiety scale ($r(82) = .58$, $p < .000001$), a measure that reflects individuals' sensitivity to (rather than repression of) their negative emotional affect. This observation lends further support to the proposal (Wegner & Zanakos, 1994) that thought suppression as measured by the WBSI and repression as traditionally defined are distinct trait variables.

6. General discussion

In three experiments, participants were instructed not to think about a prior romantic relationship, were asked to indicate when they failed at this activity, and periodically received experience-sampling probes that assessed the contents of their thoughts. Despite the fact that they were instructed to report thoughts of their previous partner as soon as they occurred, participants were frequently caught engaging in those thoughts at experience-sampling probes. This finding reveals that individuals can lack meta-awareness that they have begun to think about a topic they are attempting to suppress and provides important insight into what happens when the mind fails to expel a thought from consciousness. Specifically, the finding that probe-caught suppressed thoughts were associated with the largest deficits in reading comprehension suggests that this measure captures episodes during which participants' conscious thoughts are particularly decoupled from one's primary task (Schooler et al., 2005; Smallwood et al., 2008). Moreover, high cognitive load increased the frequency that thoughts of a previous relationship partner were caught at probes, suggesting that a dual-task context makes it harder to notice the occurrence of a thought one is attempting to avoid (Wegner, 1994, 1997). Finally, an individual's desire to rekindle a prior relationship was associated with an increased likelihood that they were caught engaging in thoughts about that person, indicating that the emotional salience of thoughts may contribute to failures of suppression, which can initially re-enter consciousness in the absence of explicit awareness.

A compelling explanation for the distinction between the probe and self-caught measures is that they access different elements of an individual's conscious experience. As the probe-caught measure does not rely on the individual to spontaneously report the occurrence of the thought, it can capture elements of the experience that people have difficulties in recognizing or admitting to themselves. By contrast, self-caught thoughts have already been identified by the individual and so this measure captures elements of the experience that the individual has independently recognized. One feature that may contribute to an individual's capacity to explicitly reflect on the current contents of thought is how absorbing the thought is. Accordingly, interesting, unpleasant or otherwise salient thoughts may be easier to become "caught-up" in, making them more difficult to explicitly reflect upon. This could help to explain why individuals who still desired their previous partner were more likely to be caught thinking about them at experience-sampling probes, as well as why those thoughts involved greater decoupling of attention from the primary task.

Consistent with this interpretation, research has shown that the mind-wandering state often involves conscious processing of relatively complex trains of thought, which may occupy the same executive systems required for maintaining attention on the primary task (Smallwood, 2010; Smallwood & Schooler, 2006). For example, mind-wandering is more frequent when the primary task does not involve a working memory component (Baird et al., 2012; Smallwood, Nind, & O'Connor, 2009). Additionally, the content of mind-wandering frequently involves executive functions such as processing current concerns (Klinger, 1999) and making plans for the future (Baird, Smallwood, & Schooler, 2011; Smallwood, Nind, & O'Connor, 2009). Furthermore, neuroimaging findings that show that mind-wandering in the absence of meta-awareness activates executive prefrontal structures such as the dorsolateral prefrontal cortex and anterior prefrontal cortex (Christoff, Gordon, Smallwood, Smith, & Schooler, 2009). If the recruitment of processes necessary for meta-awareness are occupied by processing the conscious thoughts themselves, then this could help to explain why the capacity to effectively monitor the contents of our thoughts is often compromised.

An alternative account of thoughts that are in principle available for report but fail to be reported in the moment is that such states are unconscious or "preconscious", and are only mobilized into consciousness when a probe directs an individual's attention towards them (e.g., Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Dennett, 1991). Although it is difficult to conclusively differentiate between these alternative accounts (Schooler et al., in press), the fact that, in line with previous findings (e.g., Schooler et al., 2005; Smallwood et al., 2008) unnoticed thoughts required cognitive resources and were disruptive to primary task performance lends support to individual's self-reports that they were experiencing the thoughts consciously prior to the onset of experience-sampling probes.

The current experiments suggest that differentiating between probe-caught and self-caught thoughts could help shed light on the cognitive processes that are involved in attempting to control undesired mental states. As recognition that an unwanted thought has occurred is likely a necessary first step in the process by which control can be initiated, meta-awareness could plausibly make it easier for individuals to dispel the thought from consciousness. According to this view, meta-awareness could potentially contribute directly to the regulation of suppression, as the ability to assess the current state of the mind enables the detection of mental content that could be missed by more low-level implicit monitoring systems (Schooler, 2002). An alternative possibility, and the one that we favor, however, is that the capacity to monitor thought is indirectly related to control (see Schooler et al., 2011 for a discussion of these different views). From this perspective, the ability to take stock of our conscious experience allows the individual to initiate downstream changes that will ultimately allow thought to be better controlled, for example by engaging in practices aimed at curbing dysfunctional thinking (e.g., Baumeister & Masicampo, 2010; Beck, 1979).

The value of distinguishing between awareness and meta-awareness of thoughts during attempts at suppression is further underscored in the present research by the relation between suppressed thoughts and whether the target of thought suppression was a "hot flame" (a previous partner that the person still desired). Wegner and Gold (1995) found that individuals self-reported fewer thoughts of a "hot flame" under suppression instructions. Although we replicated this effect in Study 2, this result is somewhat counterintuitive because the most obvious consequence of a desire to reconcile would be to increase rather than decrease the frequency of thoughts with this particular content. By contrast, the relationship between probe-caught thoughts of a past romantic partner and desire to reconcile with that partner was positive in both Studies 2 and 3. This result may indicate that individuals who still wanted to be in the relationship thought about the relationship more, but were less likely to recognize (and therefore report) that they were thinking about it. This finding is consistent with previous research demonstrating that suppressing emotionally relevant thought is more difficult (e.g., Petrie et al., 1998), and further highlight that the self-catch measure does not necessarily accurately reflect the frequency of conscious thoughts of suppressed content. As a result, conclusions regarding the frequency of suppressed thoughts that are based exclusively on measures that require self-catching should be treated with caution.

The tendency to be caught thinking about the suppression target was found to have no association with individual differences in the tendency to repress thoughts but a strong relationship with the tendency to report chronically struggling with suppressing thoughts. These findings further Wegner and Zanakos's (1994) conclusion that "thought suppression is tapping something quite unlike repression as traditionally defined and measured." While our data revealed a strong association between individual differences in chronic thought suppression and probe-caught thoughts of the suppression target, individual differences in the number of self-caught thoughts were not related to suppression tendencies. A possible implication of these findings is that the tendency to struggle with thought suppression is related to less sensitive meta-awareness of the contents of thought. While high scores on the WBSI thought suppression measure by definition indicate that an individual

have awareness of the fact that they frequently struggle to suppress thoughts, individuals who scored high on this measure had the most difficulty recognizing the onset of thought about the suppression target when it occurred.

The proposal that deficits in the capacity to effectively metacognitively monitor the contents of thought is related to chronic suppression tendencies is consistent with the fact that unwanted thoughts are associated with negative affective conditions such as dysphoria and anxiety (Wegner & Zanakos, 1994). If spontaneous thoughts associated with negative states are not recognized, this may enable them to proceed without repair. Moreover, given that attempts to control thinking can often backfire, problems in identifying unwanted thoughts, followed by ineffective control strategies, could lead to a perseverative cycle that extends the amount of time devoted to those thoughts. If correct, this helps to explain why chronic suppressors are generally bad at suppressing thoughts (Wegner & Zanakos, 1994), as well as the effectiveness of therapy techniques that encourage individuals to engage in mental practices that encourage recognition of thought content (e.g., Beck, 1979; Teasdale et al., 2000).

Finally, the present findings may also help to clarify several features of Wegner's (1994, 2009) ironic model of thought suppression. As noted above, according to this model, thought suppression involves two juxtaposed processes: a cognitively demanding *control process* that attempts to suppress the thought and a non-cognitively demanding *monitoring process* that searches for control failures. This ironic process model has proven successful in accounting for many diverse findings (see Wegner (2009), for a review), yet little is known about the search functions the automatic monitor provides. Wegner (1997) suggests that the monitor searches preconsciousness to catch unwanted thoughts before they reach the threshold of awareness. Although plausible, there is a self-destructiveness to a process that brings suppressed thoughts into consciousness before they arrive on their own accord. The fact that consciousness and meta-awareness can become dissociated suggests that monitoring for unwanted thoughts may also occur at a conscious level. Indeed, as discussed above, a search of the contents of consciousness itself could be a useful way to prevent perseverating on negative thoughts.

The notion that the automatic monitoring process must work in conjunction with meta-awareness in order to explicitly note the occurrence of unwanted thoughts offers another reason for why cognitive load exacerbates the impact of suppression. Given that meta-awareness is resource demanding, load may not only undermine the control processes necessary for suppression, but also the ability to notice and explicitly reflect on the current contents of thought. Under load the automatic monitor may be unable to trigger meta-awareness and the ensuing control processes necessary to reinstate suppression. Such an account is consistent with recent neuroimaging data indicating transient increases in the brain's control systems following reports of unwanted thoughts (Mitchell et al., 2007). Thus, adding further irony to an already ironic process, it seems our capacity for noticing unwanted thoughts may be minimized at precisely those times at which unwanted thoughts are most likely to occur.

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