Control of Conscious Contents in Directed Forgetting and Thought Suppression

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PSYCHE, 4(16), November 1998
http://psyche.cs.monash.edu.au/v4/psyche-4-16-whetstone.html

KEYWORDS: directed forgetting, thought suppression, mental control, consciousness, memory, cognition, suppressors, censors.

Abstract

Directed forgetting is a successful method for thought control whereas thought suppression is notoriously ineffective. We tested a specific hypothesis about what difference between the two paradigms causes the difference in outcomes. Both paradigms instruct participants to suppress certain thoughts, but in thought suppression experiments participants are also told to report intrusions of unwanted thoughts. We added a condition to the typical directed forgetting experiment that instructed participants to report intrusions. When participants tried to forget a word list but also reported intrusions, forgetting did not occur. The results are important for understanding control of conscious contents and have implications for practicable applications of individual thought control.

1. Introduction

> All communities evolve some prohibitions and taboos to tell their members what they shouldn't do. That, too, must happen in our minds: we accumulate memories to tell ourselves what we shouldn't think. But how could we make an agent to prevent us from doing something that, in the past, has led to bad or ineffectual results? Ideally, that agent would keep us from even thinking that bad idea again. But that seems almost paradoxical, like telling someone, "Don't think about a monkey!" (Minsky, 1985, page 781).

Minsky (1981, 1985) pointed out that a large part of daily mental activity might involve telling ourselves what NOT to think or remember. For example, we may find that a certain train of thought leads to illogical consequences, and avoid it because it is unproductive and a waste of time. Minsky hypothesized two types of mental processes that accomplish this task of keeping unwanted contents from consciousness: suppressors and censors. Suppressors become active when an unwanted thought occurs and work to get us thinking some other more acceptable thought. After experience with avoiding certain thoughts, censors might be established. According to Minsky, censors operate before an unwanted thought has entered consciousness by recognizing thoughts which often precede the unwanted thought and then directing our thoughts down another path. Suppressors are consciously initiated and experienced whereas the work of censors occurs without the thought entering consciousness.

This paper focuses on the ability of consciousness to control its contents. Therefore we are most interested in processes similar to Minsky's suppressors. Psychology has empirically investigated these phenomena for many years in two experimental paradigms known as directed forgetting and thought suppression. We will summarize relevant past research and present new research intended to integrate findings from the two research paradigms.

Directed forgetting and thought suppression are two experimental paradigms wherein participants are asked to control their conscious contents. Both paradigms instruct participants are asked to keep certain thoughts out of consciousness, and yet the two paradigms are noted for apparently quite different results. In directed forgetting studies, some participants are instructed to forget previously learned material, and when later asked to recall it, are unable to recall as many items as participants who were instructed to remember the same material. The directed forgetting effect can thus be considered successful control over the contents of consciousness. In the thought suppression paradigm, some participants are asked not to think about a particular subject, but to report (e.g., by ringing a bell) if the forbidden thought does enter awareness. Suppression is difficult at best: participants in Wegner, Schneider, Carter and Whites' (1987) Experiment 1 rang a bell indicating unsuccessful thought suppression an average of seven times during a five minute period. Furthermore, participants who were first asked to suppress a

thought and then later asked to think about it showed a post-suppression rebound: they reported the thought many more times than participants who were asked to generate the thought without first having suppressed it. Thus, thought suppression can be considered a relatively unsuccessful method of control over the contents of consciousness.

An understanding of what causes the difference in outcomes between the two experimental paradigms will contribute to a scientific understanding of consciousness. As pointed out by Whetstone, Cross, and Whetstone (1996), successful directed forgetting seems to be a case of conscious initiation of unconscious processes that determine what will later enter consciousness. This might be taken as evidence that consciousness can have direct causal properties. The difference between paradigms also seems to be of applied importance. There are many instances where a person might like to forget some bit of information, whether it is as simple as an incorrect number or a thought that produces anxiety. In fact, the National Research Council's Committee on Techniques for the Enhancement of Human Performance has recommended that directed forgetting be investigated for practical applications, while advising against the use of thought stopping, a psychotherapeutic technique that is similar to thought suppression (Wegner, Eich & Bjork, 1994).

The purpose of the present study was to test the hypothesis that a specific difference between the two paradigms leads to successful control over the contents of consciousness in directed forgetting and unsuccessful control over the contents of consciousness in thought suppression. A discussion of the procedures and typical findings for each paradigm follows.

2. Directed Forgetting

2.1 Typical Procedures and Findings

There are procedural variations common with directed forgetting experiments. We confine the discussion to the list method of directed forgetting (Basden, Basden & Gargano, 1993). A typical list method directed forgetting experiment starts by instructing participants to study a short list of words presented one at a time. Following presentation of the first list, participants receive one of two between-list instructions. The remember group is told to remember the list they just studied, as well as the list they are about to study, for an upcoming memory test. The forget group is typically told the first list was "just for practice" and they should forget it because it might interfere with learning the second list. They are also told that they should remember the list they are about to study for an upcoming memory test. Both remember and forget groups then study the second list of words, followed by a short distracter task and a memory test. The memory test typically instructs participants to recall both word lists, and forget group participants are specifically told they should report any words they were previously told to forget. Findings from free recall tests demonstrate the directed forgetting effect: forget groups recall fewer List 1 words than remember groups.

2.2 Theoretical Interpretation

Currently, there is a consensus that the forget group's inability to recall List 1 words is largely due to retrieval inhibition of List 1 words (Basden, Basden & Gargano, 1993; Bjork, 1989; Geiselman, Bjork, & Fishman, 1983; Whetstone, Cross & Whetstone, 1996). As a result of the forget instruction, forget group participants consciously initiate some process that brings about temporary inhibition of List 1 memory representations. However, for those unfamiliar with this literature, it may be useful to review alternative hypotheses that have been tested and found wanting. One intuitively appealing hypothesis is differential rehearsal: remember participants, knowing that they will be tested on both lists, may engage in rehearsal of List 1 while studying List 2. They might then remember more List 1 words than forget participants simply because remember participants had more List 1 study time, not because forget participants could not remember List 1 words. There is only limited support for the differential rehearsal hypothesis. Whetstone, Cross, and Whetstone (1996) found that 50% of their remember participants claimed in a post-experimental questionnaire that they did engage in differential rehearsal. However, Whetstone et al. also found that the directed forgetting effect persisted even when the analysis included only those participants who did not engage in rehearsal of List 1 while studying List 2.

There are several other reasons to conclude that differential rehearsal is not a primary cause of the directed forgetting effect. First, the directed forgetting effect is typically found on recall but not subsequent recognition tests. If the effect were due to better List 1 learning by remember participants, then remember participants should outperform forget participants regardless of the type of test. Second, Whetstone et al. (1996) found something interesting about the few List 1 words that forget group participants could recall: These words were typed in at a computer keyboard more slowly than the same words typed in by remember group participants. On the other hand, there was no difference between groups in the time taken to enter recalled List 2 words. Whetstone et al. took this as evidence that even when List 1 words are recalled by forget group participants, retrieval inhibition led to less confidence. A third source of evidence against the differential rehearsal hypothesis is the phenomenon of release from directed forgetting: when participants are given a recognition test before a recall test, the directed forgetting effect is eliminated (e.g., Basden, Basden, and Gargano, 1993; Whetstone et al., 1996). Re-exposing forget group participants to some List 1 items on a recognition tests brings about a general release from forgetting. If List 1 words were simply learned more poorly by the forget group, one would not expect this manipulation to result in equal recall for List 1 by remember and forget groups. The release manipulation also eliminated the reaction time differences observed by Whetstone et al. (1996).

The fourth line of evidence that differential rehearsal is not a major cause of the directed forgetting effect comes from an experiment conducted by Geiselman, Bjork, and Fishman (1983). During study, List 1 items to be learned for a recall test were alternated with items that participants were told would only be judged for pleasantness. Participants were

later asked to recall learn items as well as judge items. Because participants should not have expected judge items to be tested, remember participants had no reason to rehearse those items while studying List 2. However, forget group participants performed more poorly than remember participants on both learn and judge items, which led Geiselman et al. (1983) to conclude differential rehearsal cannot be the major cause of the directed forgetting effect. They hypothesized that the effect was due to retrieval inhibition that did not differentiate between learn and judge words.

The evidence against differential rehearsal also argues effectively against motivational hypotheses such as the argument that the forget group can recall List 1 words but purposely withholds the words because they were told to forget them. If this were the case one would not expect the lack of between group differences found on recognition tests. Why should participants withhold items on a recall test but not on a recognition test? Furthermore, even if there were a plausible reason why participants should withhold on a recall test but not a recognition test, a supporter of the motivational hypothesis should be hard pressed to explain why participants show a release from directed forgetting as explained earlier, as the release takes place on a recall test.

These converging lines of evidence against differential rehearsal and motivational hypotheses are further bolstered in a recent study by Bjork and Bjork (1996). This study capitalizes on the well-documented memory phenomenon of proactive interference, wherein participants recall fewer items from a given set if an additional set was first studied. In the directed forgetting paradigm, List 1 would be expected to cause proactive interference with memory for List 2. Bjork and Bjork (1996) instructed both remember and forget groups to recall only List 2 and found proactive interference for remember but not forget groups. However, when directed forgetting was released for forget participants by providing a few of the List 1 words on a prior recognition test, proactive interference was reinstated on the recall test. As Bjork and Bjork noted, motivational hypotheses are unable to explain such effects, as forget participants were not even asked to recall words to be forgotten.

Although failing to support differential rehearsal and motivational hypotheses, the accumulated evidence points toward a retrieval inhibition mechanism that effectively keeps items from voluntary recall although the items can be brought to mind when cues are available as reminders. The retrieval inhibition hypothesis has also been supported in two studies that combined the directed forgetting paradigm with part-set retrieval cues (Goernert, 1992; Goernert & Larson, 1994). The part-set phenomenon occurs when participants are given part of a set of studied words as retrieval cues on a memory test. In a standard memory experiment, having the cues available actually decrements recall for the rest of the studied words, possibly because the cues disrupt pre-existing retrieval cues established by participants while studying the words (Watkins, 1975). Goernert (1992) and Goernert and Larson (1994), studied the effects of part-set cueing on directed forgetting. As in standard memory experiments, remember participants given part-set cues performed more poorly on List 1 retrieval than did remember participants not given cues. Conversely, forget participants given part-set cues increased their recall relative to

forget participants not given part-set cues. Thus the part-set cues released the directed forgetting.

The findings discussed in this section support the hypothesis that the primary cause of list method directed forgetting is retrieval inhibition. As a result of the forget instruction, participants initiate some mental process that is effective for controlling the contents of consciousness.

3. Thought Suppression

3.1 Typical Procedures and Findings

A thought suppression experiment typically consists of two five minute phases, an expression phase, where participants are asked to think about a particular subject, such as a white polar bear, and a suppression phase, where participants are asked to suppress thoughts about a particular subject (Wegner, Schneider, Carter & White, 1987). The order of the two phases is counterbalanced between-subjects, resulting in an initial expression group and an initial suppression group. Wegner et al. (1987) made two noteworthy observations: first, suppression is difficult regardless of whether suppression precedes or follows expression. For example, in Experiment 1 participants in both groups indicated an occurrence of the forbidden thought an average of seven times in five minutes. Also Wegner et al. observed a post-suppression rebound effect: participants who initially suppressed thoughts of the white bear more often expressed these thoughts during their subsequent expression period than participants who expressed white bear thoughts without first having suppressed them. Post-suppression rebound has also been observed when instead of being told to express thoughts of a white bear, participants are told to think about whatever comes to mind (e.g., Clark, Ball, & Pape, 1991).

3.2 Theoretical Interpretation

The finding that thought suppression is difficult while it is being carried out supports our intuitions about the paradoxical nature of the task. As expressed by Minsky at the beginning of this paper, instructions to suppress are like saying "Don't think about a monkey." In order to comply with the instructions, one has to remember the instructions, which include the forbidden thought, which means we are thinking the forbidden thought and have failed to comply with the instructions.

The post-suppression rebound effect suggests that unlike directed forgetting, thought suppression does not result in the inhibition of information. Wegner and Erber (1992) proposed a two component model of thought suppression to explain post-suppression rebound. The first component is a controlled distracter search. The distracter search is intentional and under conscious control, allowing the participant to redirect attention

from the unwanted thought to selected distracters. This component demands processing resources, and it can be compromised when other demands are placed on the processing system. The second component, the automatic target search, is an unconscious mechanism that monitors the status of consciousness. The purpose of this mechanism is to ensure that the unwanted material has not reentered consciousness. Inadvertently, through its periodic checking, the automatic target search keeps the unwanted material activated and readily accessible to conscious awareness. Though this mechanism is thought to be intentionally initiated, it operates outside of consciousness and is unaffected by limited processing capacity. The automatic target search may be what makes thought suppression difficult. While checking to see if the unwanted thought has entered awareness, this mechanism keeps the thought activated. At the same time, the controlled distracter search must work to draw attention away from the unwanted thought. If something interferes with the distracter search, the unwanted thought is then more likely to enter awareness. Support for this idea comes from two experiments by Wegner and Erber (1992), who induced participants to vary their processing load while suppressing or concentrating on certain thoughts. In Experiment 1, participants suppressed or expressed while performing a concurrent task. The concurrent task was the generation of associates to randomly presented words, some of which were semantically related to the suppressed word. Half of the participants were under no time pressure to generate associates and half were asked to generate associates very quickly. Wegner and Erber found that when participants were given unlimited time, those who expressed produced the target word in response to a semantically related word more often than those who suppressed. Under time pressure however, those who suppressed were more likely than those who expressed to respond with the target word to semantically related words. Wegner and Erber concluded that suppressed material is highly accessible to consciousness during suppression and will enter consciousness when few resources are available for the controlled distracter search.

In Wegner and Erber's (1992) Experiment 2, participants suppressed or expressed target thoughts and performed a Stroop color naming task in which the colored word could be unrelated, semantically related, or identical to the target word. Attentional resources were varied by having participants perform the Stroop task while mentally rehearsing one digit (low cognitive load) or nine digits (high cognitive load). The dependent variable of interest was color naming reaction time (RT). Wegner and Erber found that for the low cognitive load group, there were no RT differences between unrelated, related, or identical targets. This was true of both those who expressed and those who suppressed. However, for the high load group, there was a difference in the pattern of RT findings between suppressers and expressers. Expressers revealed no differences in patterns of RT findings regardless of cognitive load. However, suppressers in the high load group, but not those in the low load group, named the color of identical targets more slowly than they named the color of unrelated or related targets. This experiment again showed that when attentional resources were strained, suppressed thoughts were hyperaccessible.

Wegner and colleagues have hypothesized two causes of post-suppression rebound: failure of the suppression mechanism due to demand on attentional resources, as discussed in the previous section, and contextual association of the suppressed thought

with current environmental stimuli. The second explanation for post-suppression rebound is based on evidence that participants generally choose to distract themselves from a suppressed thought by thinking about some aspect of the immediate environment. The unfortunate side-effect of this occurs when the automatic target search activates the suppressed thought. After activation, the suppressed thought tends to become associated with whatever else occupies working memory at the time. By this account, post-suppression rebound occurs because various aspects of the participant's environment become associated with the suppressed thought. Wherever the person who has engaged in suppression turns their attention, they are likely to encounter something that calls to mind the once suppressed thought.

Evidence supporting the contextual association hypothesis comes from Wegner, Schneider, Carver and White's (1987) Experiment 2. This experiment used the standard thought suppression design, with two groups counterbalanced for order engaging in both suppression of and expression of a particular thought. A third group was similar to the initial suppression group, except that they were given focused distracter instructions. The focused distracter group was told during the suppression phase that whenever the suppressed thought occurred to them, they should think of a red Volkswagen. The purpose of this instruction was to create a scapegoat distracter thought, unrelated to the suppression context. The red Volkswagen rather than the experimental context should then become associated with the suppressed thought. Because the red Volkswagen was not part of the experimental context it would not be activated during the expression phase, thereby minimizing suppression rebound. Wegner et al. (1987) compared the expression conditions for all three groups and found that the focused distracter group showed a smaller post-suppression rebound effect than the initial suppression group.

Further support for the context hypothesis comes from a study conducted by Wegner, Schneider, Knutson, and McMahon (1991). In this study participants engaged as usual in an initial expression or initial suppression condition. Both groups then engaged in two expression conditions, the first in a context different from the initial condition, and the second in a context identical to the initial condition. Wegner et al. (1991) found only a marginal rebound for initial suppressors in a changed context, but when they returned to the original context, the initial suppression group showed a much larger rebound effect.

Recently, Macrae, Bodenhausen, Milne, and Jetten (1994) have suggested that neither contextual associations nor depleted attentional resources can fully explain post-suppression rebound. Macrae et al. point out that in the original experiments conducted by Wegner et al. (1987), participants experienced rebound but did not engage in any activities during suppression that might have depleted attentional resources. As for context, in Macrae et al's (1994) Experiment 2, participants changed contexts (going to a different room) between suppression and expression conditions yet still experienced rebound. Also, as mentioned in the previous paragraph, Wegner et al. (1991) did find marginally significant rebound in their changed context condition although the effect was smaller than when participants returned to the original context.

Although context and attentional resources can effect rebound, Macrae et al. suggested that priming resulting from repeated activation of the suppressed thought is all that is necessary to produce the effect. The theory assumes that the more often a thought is activated, the easier it becomes for the thought to be re-activated. As a participant is suppressing thoughts of a white bear, the automatic target search activates the target thought each time it checks on the thought's awareness status. Thus the initial suppression group has increased activation of the target thought compared to the initial expression group. The increased activation subsequently produces post-suppression rebound. Macrae et al. tested the priming hypothesis using a lexical decision task. Participants were asked to write a five minute essay about "skinheads." Half of the participants were further instructed to suppress stereotypical thoughts about skinheads while writing the essays. Following the essay, all participants--including a control group that did not write an essay--engaged in a lexical decision test that contained stereotypical words about skinheads, matched distractor words, and nonwords.

Macrae et al. found that whereas the control group showed little difference in reaction time between distracter and stereotypical words, both essay groups made faster lexical decisions for stereotypical words than distracter words. This supports the idea that writing the essays primed the stereotypes. Furthermore, the group that suppressed stereotypical thoughts made faster lexical decisions to stereotypical words than the group that did not engage in suppression. This is consistent with the hypothesis that the target search repeatedly activated stereotypical thoughts, making them more easily activated when the distractor search ceased.

4. Comparison of Directed Forgetting and Thought Suppression Paradigms

There are several obvious procedural differences between the thought suppression and directed forgetting paradigms. In order to try to determine which differences are non-trivial we first specify what procedures overlap in the two paradigms. Next, we discuss one difference between the paradigms that we believe is responsible for the conflicting outcomes of directed forgetting and thought suppression.

Table 1: Comparison of directed forgetting and thought suppression procedures.

	Directed Forgetting	**Thought Suppression**
Study	forget group studies List 1	initial suppression group told what to suppress
Forget/Suppress	forget group tries to forget initial List 1 and study List 2	suppression group engages in thought suppression
Test	forget group tested for recall	initial suppression group engages in

	and recalls fewer List 1 words than remember group	concentration on target thought and reports it more often than initial expression group

We conceive of the directed forgetting paradigm as overlapping the thought suppression paradigm as depicted in Table 1. The initial suppression group in the thought suppression paradigm parallels the forget group in the directed forgetting paradigm. The forget group initially studies List 1 with an intent to remember before they are told to forget the list. In the thought suppression paradigm, the initial suppression group must first learn what to suppress before suppression can take place--even if it is a single thought--so we conceive of the initial suppression group being told what to suppress as comparable to the forget group studying List 1. In the directed forgetting experiment the forget group next studies List 2 while forgetting List 1. This parallels the suppression phase of the thought suppression paradigm. Finally both paradigms test for evidence of suppression or intentional forgetting. The directed forgetting experiment typically assesses List 1 memory with recall or recognition whereas the thought suppression experiment assesses reports of the thought when participants are told to try to think about the thought.

Thought suppression experiments require that participants report occurrences of target thoughts both during the suppression and expression phases. In directed forgetting experiments, when participants are studying List 2, they are not told to report if List 1 words intrude. Although Wegner and Erber (1992) seem to imply that the automatic target search is an inevitable consequence of thought suppression, it may be that the target search is initiated by the report instruction. Regardless of whether the automatic target search is initiated by the instructions to suppress or by the instruction to report thought intrusions, the absence of a report instruction in directed forgetting suggests that if this instruction is added to the typical forget instructions, a target search should take place, which could then disrupt the directed forgetting effect.

5. Current Experiment

Wegner and Erber's two factor theory suggests a possibility for a critical difference between the paradigms. The automatic target search said to be activated in thought suppression may not occur during directed forgetting. In order to replicate conceptually the automatic target search in a directed forgetting experiment, we instructed some participants not only to forget List 1, but to indicate if words from List 1 did happen to occur to them while studying List 2. The instruction to report intrusions of List 1 words should activate a target search, which should keep material to be forgotten in a state of activation, thus interfering with inhibitory processes. We therefore expected that if the target search is a critical difference between the paradigms, the forget group that was not instructed to report intrusions should show a typical directed forgetting effect, whereas the forget group that was instructed to report intrusions should show a diminished

directed forgetting effect or no effect at all.

5.1 Method

5.1.1 Participants

Participants were 64 students from introductory psychology classes who volunteered in exchange for partial class credit. They were randomly assigned to one of four conditions and participated in groups of up to ten, depending on how many volunteered for a particular time slot.

5.1.2 Design

The experiment was a 2 x 2 x 2 mixed factorial design with the conditions of list (List 1, List 2), forget instruction (remember, forget), and report instruction (report List 1 intrusions, no reporting of instructions). List was manipulated within participants, and forget instructions and report instructions were varied between participants.

5.1.3 Materials

Ten IBM compatible computers assigned participants to conditions, presented instructions and stimuli, randomized presentation order of words in List 1 and List 2, and collected data. The experimental session was programmed with the Micro Experimental Laboratory 2.0 software (Schneider, 1990). Word lists were drawn from 20 common nouns taken from a list supplied with the software (Schneider, 1990). For each participant words were randomly chosen by the computer to appear in List 1 or List 2. Twenty additional words from the same source were used as distracters for the recognition test. A two minute paper and pencil arithmetic distracter task was given between presentation of List 2 and memory testing. The arithmetic task consisted of 42 multidigit addition, subtraction, and multiplication problems.

5.1.4 Procedure

The experiment took about 30 minutes to complete. All participants present at a session began the experiment at the same time; however, the reading of instructions was self-paced. The beginning instructions were somewhat different from those we have used previously (i.e., Whetstone, Cross, and Whetstone, 1996). In an attempt to induce participants to pay close attention to the instructions, the first screens informed them that the purpose of the experiment was to observe how well they learned material given certain instructions. The importance of scrupulously following the instructions was emphasized. All participants were also led to believe that in some conditions instructions were presented both visually and verbally but that they were in the visual-only instruction condition.

Following the screens stressing the importance of following instructions, participants were told they would see a series of words one at a time at four seconds per word. They were further instructed to "Try to remember the words the best you can." Participants pressed a key when they were ready to begin the experiment. This began List 1 presentation. Ten words were then presented in a different random order for each participant, one word at a time for four seconds each.

Following presentation of List 1, further instructions were given. Participants in the remember groups were told they were to remember the words they had studied as well as new words about to be presented for a subsequent recall test. Participants in the forget groups were told the words they had just studied were practice and that they should forget them. They were also told to try to remember the new words about to be presented for a recall test. Half the participants in both remember and forget groups were given specific instructions to report intrusions of List 1 words. The instruction read "If you happen to think about words from the first list while studying the words for the second list, press the space bar each time you do so."

To ensure that all participants had time to read them, the instructions were displayed until participants pressed a key indicating they had completed reading. Time to read the instructions between lists 1 and 2 was recorded from the onset of the display until participants pressed the space bar to continue. This was done to ensure that there were no differences in the average time taken to read the instructions by participants in the forget versus remember groups.

Following between-list instructions, List 2 was presented in the same manner as List 1. At the conclusion of List 2 study, the computer presented participants with instructions to begin a paper and pencil arithmetic task. Participants were given two minutes to complete as many problems as possible. After two minutes had passed the computer signaled participants to return their attention to the screen to begin the testing phase of the experiment. In the testing phase participants completed a recall test followed by a recognition test.

The recall test displayed 20 blank lines on the computer monitor and participants had four minutes to type as many words as they could remember from both lists. Participants in the forget group were also given specific instructions to recall those words they had been told to forget. As participants typed each word, the letters appeared on the screen. Participants were able to use the backspace key to correct mistakes. The recall test was terminated by participants when they could no longer recall any words or when four minutes had passed. If non-ASCII characters were entered, the computer prompted participants to re-enter the word. The recognition test presented participants with the 20 nouns from lists 1 and 2 and 20 new words they had not studied. The words were presented one at a time in a different random order for each participant. Participants indicated by keypress whether they had studied the word in either list. Participants in the forget group were specifically instructed to characterize as old any previously studied word, regardless of forget instructions.

Finally, participants were asked if anyone had revealed details of the experiment to them before participating. Data from those few who answered affirmatively were discarded before analysis, and they were replaced. Participants were dismissed after reading a debriefing statement that also explicitly asked them not to tell anyone details of the experiment as participant testing was still underway.

5.2 Results

Between-list instructions were self-paced and timed by the computer. This was done as a check to ensure that participants in remember groups were not rehearsing List 1 words while supposedly reading the instructions (Whetstone, Cross, & Whetstone, 1996). Mean reading times (in seconds) for the remember/no report, forget/no report, remember/report, and forget/report groups were 12.7, 12.6, 16.1, and 21.2. The reading times for report groups were significantly longer than times for the no report groups $F(1,60) = 15.08$, $p. < .001$, $MSE = 38120691$. This was expected because of the added instructions for reporting List 1 intrusions. The interaction of report and between-list instructions (remember or forget) was marginally significant $F(1,60) = 2.83$, $p. = .098$, $MSE = 38120691$, reflecting the fact that the forget instructions took longer to read for report groups than remember instructions. However, this is of little interest for present purposes as the check was performed to make sure that remember instructions did not take longer to read than forget instructions.

Table 2: Percent recall (and standard deviations) for word lists as a function of between-list instruction and report instructions.

		List 1	**List 2**
No Report	**Remember**	30.0 (11.0)	39.4 (24.4)
	Forget	17.5 (14.4)	54.4 (27.8)
Report	**Remember**	30.0 (08.2)	38.1 (16.4)
	Forget	31.9 (12.2)	41.8 (18.3)

Note. N=16 in all conditions.

Our major hypotheses concerned the mean percent recall scores which are presented for each group in Table 2. As can be seen from the table, the directed forgetting effect appears to be disrupted by instructions to report List 1 intrusions while studying List 2. Participants who were not asked to report List 1 intrusions while studying List 2 show a standard directed forgetting effect: the forget group recalled fewer words from List 1 than the remember group. However, participants who did receive the instruction to report List 2 intrusions do not show a difference in List 1 recall between the remember and forget groups.

In order to test the hypothesis that report instructions disrupted the directed forgetting

effect, a 2 (List 1 vs. List 2) x 2 (remember vs. forget) x 2 (report vs. no report) repeated measures analysis of variance was performed. A significant three way interaction was found, F (1,60) = 4.57, p. = .037, MSE = 2.87. Planned comparisons were conducted on the differences between remember and forget groups for both lists as a function of whether participants were instructed to report List 1 intrusions while studying List 2. There were significant differences found. First, the forget/no report group recalled fewer List 1 words than the remember/no report group, t (30) = 2.77, p. = .01, replicating a standard directed forgetting effect. Second, the forget/no report group showed significantly poorer List 1 performance than the forget/report group, t (30) = 3.05, p = .005, confirming the hypothesis that instructions to report List 1 intrusions disrupted the directed forgetting effect.

Participants in the report groups were asked to press the computer keyboard space bar each time the target thought occurred to them. We examined the number of space bar presses for each participant in report groups and found that three of sixteen participants in the forget/report group pressed the space bar during List 2 study (one twice, one three times, and one four times), whereas eleven of sixteen participants in the remember/report group pressed the space bar during List 2 study (number of presses ranged from 2 to 7). We wondered whether the act of actually pressing the space bar made any difference to recall scores.

Table 3: Percent recall in report conditions as a function of whether participants reported List 1 intrusions during List 2 study.

		List 1 (N)	**List 2 (N)**
Reported Intrusions	**Remember**	31.0 (11)	35.5 (11)
	Forget	30.0 (3)	54.4 (3)
Did Not Report Intrusions	**Remember**	28.0 (5)	44.0 (5)
	Forget	32.3 (13)	37.0 (13)

Table 3 presents mean recall for participants in the report conditions as a function of whether they reported List 1 intrusions by pressing the space bar. As can be seen in the table, the act of reporting by pressing the space bar did not seem to make any significant difference to the pattern of results reported in Table 2. Most importantly, when the three forget/report participants who actually reported are removed from analysis, the remaining forget/report participants still recall as many List 1 words as remember/report participants. In other words, the forget/report participants continue to fail to show a directed forgetting effect.

Table 4: Percent recognition (and standard deviations) for word lists as a function of between-list instruction and report instructions.

		List 1	**List 2**

No Report	**Remember**	90.6 (08.5)	86.9 (13.0)
	Forget	89.4 (12.9)	87.5 (15.7)
Report	**Remember**	90.6 (10.6)	90.6 (10.6)
	Forget	88.1 (12.2)	88.1 (13.8)

Note. N=16 in all conditions.

Table 4 presents mean percent yes/no recognition scores for each group. As expected, and has been found in previous list method directed forgetting experiments, the differences between remember and forget groups that were apparent in recall are not apparent in recognition. In fact, recognition was quite high for all groups, implying that although the forget/no report group could not consciously recall List 1 words, the words were learned. A 2 (List 1 vs. List 1) x 2 (remember vs. forget) x 2 (report vs. no report) repeated measures analysis of variance found no significant effects.

6. Discussion

Directed forgetting is commonly recognized as a successful means of control over the contents of consciousness whereas thought suppression is more commonly thought of as an unsuccessful means of control over the contents of consciousness. Because the two paradigms are attempts at mental control, it is of both theoretical and applied significance to understand what causes the difference in outcomes. The purpose of this experiment was to test the hypothesis that directed forgetting allows successful thought control because it does not normally initiate an automatic target search for intrusions into consciousness of material to be forgotten. The addition of the report instruction to directed forgetting instructions in this experiment was meant to create a condition where compliance with instructions would require a target search. In order to be able to report List 1 intrusions while studying List 2, the participant must in some way monitor consciousness for intrusions of the material to be forgotten.

The report instruction in this experiment had no effect on recall for the remember/report group but it eliminated the directed forgetting effect for the forget/report group, thus supporting the hypothesis that the conditions present in a directed forgetting experiment do not normally initiate a target search. One criticism of this interpretation might be that the effective part of the report instruction was the motor task demands of pressing the space bar rather than the attempt to monitor awareness that interfered with List 2 learning. There are two reasons why we do not accept this interpretation. First, only three participants in the forget/report group actually reported intrusions during List 2 study, so the difference between the two forget groups does not appear to be the act of pressing the space bar. Furthermore, if pressing the space bar made a difference there should be some noticeable recall

differences between the remember/no report and the remember/report groups, as most of the later group did press the space bar while studying List 2. However, recall performance for these two groups is virtually identical.

We discussed earlier three theoretical explanations for post-suppression rebound: contextual association, where suppressed thoughts nevertheless become temporarily conscious and are associated with the contents of working memory; the resource depletion explanation, where the resource-demanding distracter search fails for some reason and lets unwanted thoughts resurface through an automatic target search; and the priming explanation, where unwanted thoughts repeatedly receive increased activation through the operation of an automatic target search.

The current findings do not offer support for the contextual association explanation of thought suppression because results similar to unsuccessful thought suppression were obtained even though most forget/report group members did not report intrusions of List 1 words during List 2. Assuming that failure to report indicates List 1 words did not become conscious during List 2 study, List 1 words should not have become associated with List 2 words by virtue of having entered working memory. The resource depletion and priming explanations can fit the results with some modification. An explanation assuming depleted resources might assume that the target search initiated by the report instruction for the forget/report group was resource demanding rather than automatic. This non-automatic target search then drained resources needed for both keeping attention away from material to be forgotten and focused on material to be remembered, resulting in a failure to inhibit List 1 words. The priming explanation merely needs to assume that the target search is not an inevitable consequence of thought suppression (or at least not an inevitable consequence of directed forgetting). The instruction to report, however, did successfully launch the target search, which kept the forget material primed although not necessarily consciously activated. This could explain why the directed forgetting effect was disrupted although few forget/report participants actually reported List 1 intrusions.

Practical applications of these findings await further specification of why directed forgetting does not initiate a target search. One possibility is that the target search hypothesized by Wegner and Erber (1992) is not invariably released as a result of instructions to suppress but is rather a consequence of instructions to report intrusions of the suppressed thought. An obvious test of this hypothesis would be a thought suppression experiment which did not include report instructions in some conditions. In fact, the first author of this paper recently attempted a test of the hypothesis using a modified thought suppression paradigm. However, the experiment failed to replicate thought suppression rebound in control conditions, and therefore the effectiveness of the experimental manipulation could not be assessed.

As mentioned at the beginning of this paper, the directed forgetting and thought suppression paradigms seem most closely related to Minsky's concept of suppressors.

An interesting direction for future research would be to extend the paradigms to Minsky's concept of censors by examining the effects of repeated attempts to forget or suppress particular thoughts.

Author Note

Mark Cross conducted this experiment for partial fulfillment of East Carolina University's Masters Thesis requirements. The data were presented at the 1997 Southern Society for Philosophy and Psychology conference in Atlanta, GA. We would like to thank Robert Bjork for his insightful comments in discussions about the experiment. We also thank two anonymous reviewers and Bill Banks for helpful comments on an earlier draft of this paper. Debbie DeYulia helped to test participants in this study.

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