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Forgetting to forget: On the duration of voluntary suppression of neutral and emotional memories

Simon Nørby *, Martin Lange, Axel Larsen

Department of Psychology, University of Copenhagen, Denmark

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ABSTRACT

Can we control the content of our memory and forget what we do not want to think about by an act of will? If so, is forgetting temporary or permanent, and is it independent of the nature of what we wish to forget? Using Anderson and Green's (2001) "think/no-think" paradigm with neutral and emotional nouns, we found in agreement with other studies that memory for neutral words was reduced instantly upon repeated attempts at suppression. However, the effect was temporary and vanished after a period of one week, which strongly suggests that intended memory suppression interferes with immediate retrieval but does not lead to long-term forgetting. Furthermore, the amount of training that clearly reduced immediate recall of neutral items did not at all reduce recall of emotional items. This finding is in accordance with the notion that emotional items have a higher degree of salience and tend to attract more attention than neutral items.

1. Introduction

Can we forget unwanted memories by an act of will? Recent research suggests that it is possible to disregard recently encoded memories by the use of memory control strategies (see Bjork, Bjork, & MacLeod, 2006; Levy & Anderson, 2002). However, the generality of these findings remains to be settled and at least two issues ought to be addressed before the question about whether volitional forgetting can take place on unwanted memories may be properly answered. First, it should be determined if memory control strategies have more than a temporary effect on to-be-forgotten memories. If they do not, such strategies would appear to be rather futile in daily life where people may wish to forget unwanted memories over an extended period of time, or even permanently. Second, it should be examined if memory control strategies have a reliable effect on negative memories. If this is not the case, they may be rather ineffective on what are perhaps the most unwanted memories of all, that is, unpleasant recollections of past failures and troubling incidents. All recent experiments on volitional forgetting have to our knowledge investigated short-term effects and most have employed neutral stimuli material. Therefore, the primary objective of the present study was to investigate the long-term effect of volitional forgetting by employing a delayed re-test. A secondary objective was to further examine our ability to forget negative memories on the basis of some contradictory results concerning valence and forgetting (e.g., Depue, Banich, & Curran, 2006; Marx, Marshall, & Castro, 2008).

Several recent experimental paradigms suggest that we may be capable of forgetting recently encoded memories on purpose. In the popular think/no-think (TNT) paradigm, which we employed in the present study, participants are instructed to actively avoid that certain memories enter their minds. First, they learn a number of cue-target pairs. Then, in the critical phase, they are continuously exposed to cues and instructed to suppress the associated targets in relation to some of these cues (no-think condition) while rehearsing the targets for the rest of them (think condition). When tested later on, recall of items attempted suppressed is typically inferior to recall of a group of studied baseline targets not involved in the critical phase of the experiment (e.g., Anderson & Green, 2001; Anderson et al., 2004; Depue, Curran, & Banich, 2007; Depue et al., 2006; Hertel & Calcaterra, 2005; Levy & Anderson, 2008; however, see Bulevich, Roediger, Balota, & Butler, 2006). In the related list-method directed forgetting (DF) paradigm, the participants are instructed to ignore a previously studied list of items

* Corresponding author. Address: Department of Psychology, University of Copenhagen, Øster Farimagsgade 2A, 1353 Copenhagen K., Denmark. Tel.: +45 26236712.
E-mail address: simon.noerby@psy.ku.dk (S. Nørby).

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(list one) and focus on learning a new list. Experiments with this paradigm usually show that recall of list one items is inferior to recall of list one items among the participants in a control group who have been told to remember both lists of words (for reviews, see Bjork et al., 2006; MacLeod, 1998).

Suppression of memories that are not relevant to current action goals may be a prerequisite for optimizing behaviour for at least two reasons. First, it may help update the memory system when a learned response is replaced because it is invalid and no longer adequate (Bjork, 1989). For example, when trying to remember a new pin code for a credit card we cannot act quickly and adequately if we cannot avoid interference by effectively suppressing the memory of the old pin code. Second, it may sustain goal-directed information processing when a recollection is stopped altogether because it is distracting or unwanted (Anderson & Green, 2001; Levy & Anderson, 2002). For example, the prospect of attending a job interview might bring to mind memories of failed job applications and one may want to suppress such recollections so that it is possible to prepare properly for the interview. Results from the use of TNT and list-method DF paradigms where performance on memory tests fall below baseline conditions indicate that memory control strategies may succeed and that suppression may decrease recall of invalid or unwanted memories.

At this point it is not known whether observed decrements in recall are stable or transient despite the possibility that the answer to this question could have important clinical implications (see Gleaves, Smith, Butler, & Spiegel, 2004). However, some observations suggest that such decrements could be transitory. First, thought suppression requires mental effort, so when concentration slips or suppression is no longer reinforced, there is reason to believe that suppressed thoughts can re-emerge (see e.g., Wegner, 2009; Wenzlaff & Wegner, 2000). Second, the ubiquitous phenomenon of spontaneous recovery shows that material that cannot be recalled on an immediate test may be recalled on a delayed test. Spontaneous recovery has been demonstrated in a number of studies in which subjects have learned two paired-associate A–B, A–C lists and exhibited recovery of B items on delayed tests (for reviews, see Brown, 1976; Wheeler, 1995). As shown by others (Hertel & Calcaterra, 2005), the TNT paradigm may bear some resemblance to classical A–B, A–C paradigms.[1]

The principal goal of the present study was thus to investigate the duration of intended memory suppression in the TNT paradigm. A secondary objective was to explore the efficiency and duration of memory control of emotional items, and in particular to check a simple observation that seems to explain why some experiments on suppression of emotional memories report that such memories may be suppressed (Depue et al., 2006, 2007; Joormann, Hertel, Brozovich, & Gotlib, 2005), while other experiments report that such memories are difficult to suppress (Marx et al., 2008; see also Hertel & Gerstle, 2003). Specifically, it seems that memory suppression is found whenever participants with a high degree of confidence can predict the occurrence of emotional items, but not when the occurrence of emotional items is random and cannot be prepared for.

For historical, theoretical as well as practical reasons forgetting of emotional and especially negative material has particular interest. Negative material may be said to be unwanted in a strong sense because it is related to matters of personal concern. This is not the case with neutral material that is at the most undesired because it might distract current information processing, i.e., unwanted in a weak sense. One view suggests that we should be able to suppress negative emotional memories that are unpleasant and inconvenient, and that voluntary forgetting may succeed on emotional material (Conway, 2001; Depue et al., 2006; Levy & Anderson, 2008). In accordance with this view, Depue et al. (2006) employed the TNT paradigm with face-word pairs (Experiment 1) and face-picture pairs (Experiment 2) and found the largest suppression effect to be present on negative relative to neutral items. Also, Depue et al. (2007) employed the TNT paradigm in a fMRI study with face-picture pairs and found that negative pictures could be suppressed (no neutral control condition was employed). Finally, Joormann et al. (2005) reported evidence that positive as well as negative words were suppressed to a similar degree in the TNT paradigm. In sum, these studies suggest that negative memories may be suppressed, at least in some circumstances.

Another view suggests quite the contrary, namely, that it should be difficult to suppress negative emotional memories. Emotional stimuli presumably capture attention more easily and lead to more intensive processing than neutral stimuli (for a review, see Compton, 2003). Also, dedicated neurobiological processes seem to support the formation and storage of emotional memories (see LaBar & Cabeza, 2006). Finally, emotional experiences may be rehearsed more often than neutral experiences because the former but not the latter are personally significant. Therefore, one could expect emotional material to be encoded and consolidated better than neutral material. In accordance with this, many studies have found that emotional memories are retained better than neutral memories (for reviews, see Levine & Pizarro, 2004; Reisberg & Heuer, 2004). One reason may be that we have an evolutionary-based preference for emotional information. Specifically, negative emotions such as fear and disgust should support survival because they signal objects and situations that generally pose a threat and should be avoided. This suggests that negative emotional material should be fairly resistant to voluntary forgetting. Indeed, one recent study with the TNT paradigm found that negative target words were not suppressed (Marx et al., 2008; see also Hertel & Gerstle, 2003).

We conjecture that Depue et al.'s (2006) results were due to a particular feature in their study, namely, the use of a blocked design in which neutral and emotional stimuli were presented in separate blocks of trials, which may have caused habituation by making emotional items entirely predictable. Also, the results of Depue et al. (2007) and Joormann et al. (2005) may be explained in a similar fashion (see below for an elaboration on this point). Habituation consists of a decrease in responsiveness to repeated presentations of the same stimulus or stimuli of the same type. Subjects have been found to habituate to continuous presentations of emotional stimuli as measured by, for example, decreased activity in critical brain regions (e.g., Feinstein, Goldin, Stein, Brown, & Paulus, 2002; Wright et al., 2001) and of psychophysiological responses (e.g., Bradley, Lang, & Cuthbert, 1993). In the experiment reported here, we attempted to avoid habituation by mixing neutral and emotional items.

In sum, to test the generality of volitional forgetting with respect to duration and type of material, the specific goals of the present study were to determine whether intended memory suppression of neutral material is stable – and still measurable when a week has passed – and whether intended memory suppression of negative material can be counteracted or at least reliably reduced compared to neutral material by simply making the occurrence of negative stimuli unpredictable. We used the TNT paradigm and tested highly practiced suppression of neutral and negative nouns, both immediately following practice and after a retention interval of one week.

[1] A–B, A–C paradigms have typically been used to study retroactive interference in immediate tests. One recent study demonstrated that short-term retroactive interference may also be produced in the TNT paradigm (Hertel & Calcaterra, 2005). This study provided participants with a substitute target to use throughout the TNT phase and thereby created a sort of A–B, A–C paradigm. However, the present discussion should be understood in the context of studies that have employed delayed tests and found spontaneous recovery. Such results have been interpreted in terms of a decreasing influence of suppression on B items over time (e.g., Bjork, 2001; Postman, Start, & Fraser, 1968).