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Retrieval-induced forgetting of emotional traits and its effect on implicit attitudes

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Abstract

Memory is fundamental for multitudinous cognitive functions. The function of current interest is retrieval and the effect it has on the accessibility of stored information. Besides facilitating recall of previously retrieved items, retrieval may also inhibit information that is associated to the same cue as the retrieved items. This study examines the effect of retrieval practice on person memory for neutral and emotional traits. The study also investigates if forgetting a person's traits changes the implicit attitude towards that person. The results showed retrieval-induced forgetting for negative traits but not for neutral and positive traits. When the recall performance was assessed with focus on emotional accuracy rather than on the recall of specific words, the forgetting effect for negative traits diminished, suggesting that the general concepts of good and bad were not as susceptible to retrieval inhibition as the specific traits. Further, retrieval-induced forgetting of negative traits did not lead to changes in implicit attitudes, thus, suggesting that implicit attitudes are not dependent of the explicit accessibility of information that they were originally based on.

Keywords: Retrieval-induced forgetting; Person memory; Retrieval Inhibition; Negativity bias; Implicit Attitudes

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Introduction

The human memory is a complex system involving numerous processes. Some of these are still waiting to be discovered, others cannot be explained yet, whereas regarding some, researchers have come quite far in their endeavour to explain and understand. What we know so far gives us a glimpse of how fascinating the human memory is. We are capable of learning several different languages, a lot of details about a special topic, how to ride a bike and find our way back home, while continuously filling our memory store with new impressions and events in our life. We have an extraordinary memory for pleasant and unpleasant experiences, persons we have briefly met a long time ago appear still familiar when meeting later in life and there are fragrances we just sensed once that we will never forget.

Nevertheless, we all have experienced disappointing moments about our capability to remember; such as standing in front of the fridge and suddenly you cannot remember why you opened it; or not knowing the credit card pin code you have used for several years. It is annoying when a great idea pops up in your mind and in the next second it is gone. So, why do we forget? Would it not be wonderful if you would never forget a thing you once had learned? But imagine you had a perfect memory storing every bit of information you read or heard, everything that happened in your life, unable to ever forget what you once encountered. This would imply several things. First of all, you would have to be quite careful in choosing what to experience or to learn in order to avoid too much unpleasant or irrelevant information filling your memory. Second, even if you would choose carefully, an enormous amount of information would accumulate in your memory and require plenty of cognitive resources filtering out the information you want to access.

From this point of view it appears quite obvious that forgetting might be useful and functional. Forgetting is probably not just an unintended side effect due to time passing by; rather, it is likely to facilitate the very act of accessing and recalling relevant information in memory. This function should be especially necessary if highly similar information interferes with the information that is to be retrieved. Imagine that you want to phone a friend and are trying to remember his or her new telephone number. As you have used the old number for several years, it is likely to interfere when searching your memory for the new one. In this case, the old number has to be inhibited if the new number is to be successfully retrieved. When constantly retrieving the new number, the old number will eventually be forgotten.

But is it possible then that the act of remembering itself can lead to forgetting? If so, can all kind of information succumb to forgetting or is there knowledge that crucial that it is preserved? For instance, information about other people that surround us or influence our lives in some way can be critical to remember, especially if we want to lead a successful and secure life. Can we ever forget that a person tells mean lies about others and is better not trusted or that someone else has been really helpful? Taking a step further, how does our memory affect our way to think and feel? Are our attitudes towards others dependent on what we know about them? These kinds of questions are dealt with in the present study, as it examines if emotional information about other persons is susceptible to forgetting and if such forgetting can alternate one's implicit attitudes towards those persons. So far, extensive research on the features of forgetting has been conducted and the results are striking.

Retrieval-induced forgetting

An astonishing memory effect that might seem quite paradoxical at first sight was examined in a study by Anderson, Bjork and Bjork (1994). In three related experiments, the authors showed that the very act of remembering may lead to forgetting. More specifically, it was not the remembered item itself that became more susceptible to forgetting, quite the opposite. Retrieving the item increased the probability that it was remembered even at a later time. Instead, the ability to recall other items associated to the same retrieval cue was impaired. Similar effects were found in earlier studies on for example output interference (Tulving & Arbuckle, 1963; Smith, 1971) showing that an item's recall probability depends on its serial position in the testing sequence, with a declining recall probability for later positioning.

The paradigm

The paradigm employed by Anderson et al. (1994) is known as the retrieval-practice paradigm and consists of three main phases: a study phase, a retrieval practice phase, and a test phase. During the study phase the participants are instructed to learn a series of category-exemplar pairs (e.g. *Fruit Orange*). Hence, all members of one category (e.g. *apple, banana, mango*) share a common cue (e.g. *Fruit*) and are therefore supposed to compete for conscious retrieval when the category is presented as retrieval cue. After the study phase, the participants engage in retrieval practice for half of the items from half of the categories. Accordingly, there are two different conditions, the practice condition (P) comprising the categories that appear during retrieval practice and the control condition (C) consisting of the categories that are not presented during the retrieval practice phase. Furthermore, the

exemplars of the P-categories can be characterised as either P+ items, referring to items that are to be retrieved during the second phase or as P− items, referring to items that are not subject to retrieval practice themselves whereas their other related category members are. Also, the exemplars of the C-categories either constitute C+ or C− items, although this classification is a theoretical one meaning that in a counterbalanced experiment C+ items are potential P+ items and C− items are potential P− items.

The retrieval practice is probed by the presentation of the category name (cue) together with an exemplar stem (e.g. *Fruit Or_____*) and the participants are requested to complete the word stem with the matching word they have studied under the first phase. As it has to be unambiguous which of the learned word that is to be retrieved, all members of one category begin with a unique word stem. Retrieval practice is repeated several times for each of the items included in this phase (P+) in order to maximise its effect.

The experiment is concluded by a test phase consisting of a cued-recall test on all exemplars from all categories. The effect of retrieval practice on memory is then tested by comparing the recall rate for unpractised items from practised categories (P−) with the recall rate for unpractised items from unpractised categories (C−). Therefore, as both P− and C− are the items of interest when examining retrieval-induced forgetting, they will also be referred to as targets from here on. Recall that the only difference between C− and P− items is whether the other half of the exemplars of their respective category is retrieved during the second phase (P+) or not (C+). Neither C− nor P− items are ever subject to retrieval practice themselves.

Two important effects have been repeatedly shown in experiments on retrieval-induced forgetting. First, the highest recall rate is found for the P+ items in comparison to all other items. This is not very surprising as the P+ items were practised during the second phase. The other and more interesting effect is that the recall rate for P− items is significantly lower than the recall rate for C− items. It is this relative decrease in the ability to recall P− items that is referred to as retrieval-induced forgetting. Hence, retrieval-induced forgetting is empirically defined as the detrimental effect that retrieving a subset of items has on the later recall of other items that are associated with the same cue or configuration of cues (Storm, Bjork, & Bjork, 2005). During the recent decade, extensive research has been conducted on the phenomenon of retrieval-induced forgetting in order to examine its further properties and underlying mechanisms. In the following section, a brief overview of this literature will be given.

Properties

Duration

The forgetting effect seems to be of rather long-lasting nature, as it persists even after a 20 minutes delay between retrieval practice and the test phase (Anderson et al., 1994). On the other hand, evidence was provided by MacLeod and Macrae (2001) that retrieval-induced forgetting might recover over time. In their study, participants were tested either immediately after retrieval practice or on the following day. Astonishingly, retrieval-induced forgetting was detected on the immediate test, but not for the participants tested with a 24 h delay. As Anderson (2003) points out, these findings suggest that the inhibitory effects of retrieval practice diminish over time in at least some circumstances with some types of materials. Yet, it cannot be concluded that this recovery from inhibition *always* occurs. Under different conditions it is conceivable that retrieval-induced forgetting may persist over time. For instance, if retrieval practice is exercised frequently and distributed over long time periods, the inhibition effects may be long-lasting. When learning your new mobile phone number, it might take some months and you may not even remember your old number. Recent evidence on the durability of retrieval-induced forgetting comes from a study on relearning by Storm, Bjork and Bjork (2008). Their research showed that items benefited more from relearning if they had previously been forgotten; thus, demonstrating that retrieval-induced forgetting does not lead to permanent loss of items in memory. Rather, it has a beneficial effect on future learning. Yet, the duration of retrieval-induced forgetting remains to be examined in more detail.

Cue-independence

Retrieval-induced forgetting appears to be cue-independent, a property that has been found for varying stimulus material (Anderson & Spellman, 1995; Anderson & Bell, 2001). Cue-independence refers to the tendency of the impairment to generalize to novel test cues not involved in the retrieval practice that induced impairment (Anderson, 2003). Thus, an inhibition or decreased activation of the item *Apple* as a result of retrieval practice on for instance *Fruit-Mango*, is even measurable when memory for *Apple* is tested with another cue than *Fruit-A____*, for example *Food-A____*. Yet, evidence on cue-independence is not totally consistent. A study of Perfect et al. (2004) delivered contrary results, indicating that forgetting may actually be cue-dependant.

Retrieval and interference dependence

The forgetting effect has also been shown to be specific to retrieval. Unlike retrieval practice, other types of practice such as repeated study exposure do not generate forgetting (Anderson & Bell, 2001; Johansson, Aslan, Bäuml, Gäbel, & Mecklinger, 2007). Yet, although retrieval is necessary it is not sufficient for forgetting to occur. The essential factor is interference, which means that the retrieval of a specific item is impeded by strongly interfering competitors. The interference dependence has been demonstrated in several studies, for example in the experiment of Anderson et al. (1994), which showed that retrieval-induced forgetting only occurred if the unpractised competing category exemplars were high in taxonomic frequency. For example, retrieval practice on an untypical exemplar (e.g., *Fruit Gu____* for *Guava*) led to impaired recall of a related typical exemplar (e.g. *Apple*) but not the other way round. The stronger the association between the category and the unpractised competitor, the more impairment was found. This pattern indicates that retrieval-induced forgetting is due to inhibition driven by the need to override interference from competing memories during the selective retrieval of items (Anderson, 2003).

Interference can occur of different reasons and discrepant frequencies seem to be one factor leading to augmented competition between related items. Increased competition among items can also be achieved by the very intention to remember (Macrae & MacLeod, 1999; Storm, Bjork, & Bjork, 2007). Macrae and MacLeod (1999) found that forgetting is even elicited in contexts in which participants are highly motivated to remember the studied material. In the study of Storm et al. (2007), participants were instructed to either remember or forget a previously presented list of items. Consistent with the inhibitory account of retrieval-induced forgetting, the items that were to be remembered and thus interfered most with retrieval practice suffered from more forgetting than the items the participants were told to forget.

Strength independence

Another property of retrieval-induced forgetting is strength independence. Neither retrieval success nor the degree to which successfully retrieved items are strengthened through practice predicts the amount of forgetting observed. Thus, the critical variable is not the strengthening of a competitor but only the strength of the unpractised item (Anderson et al., 1994). This important finding was also demonstrated by Macrae and MacLeod (1999) who found that forgetting was not moderated by the amount of retrieval practice that participants accomplished. The effects of one repetition of each item in retrieval practice versus three and six repetitions were compared and no difference in the amount of inhibition could be detected.

Yet, the authors themselves suggest interpreting these results with care as it is problematic to test differences in inhibition across the retrieval conditions. Moreover, the intervals for retrieval practice varied in time depending on the amount of repetition. Thus, in the one-repetition condition participants had longer time for retrieving each item than in the other two conditions. The problem here is that the participants' silent activity after the retrieval of an item could not be controlled for, which means that they may have been engaging in further retrieval practice on their own.

Theoretical models

Different theories have been developed in order to explain retrieval-induced forgetting. Early models are referred to as strength-dependent competition models of interference or blocking-based accounts (Storm, Bjork, & Bjork, 2008). They argue that the impaired recall of related items is caused by the increased strength of their successfully retrieved competitors, as this strength is assumed to block the access to related items. Three assumptions underlie these models and constituted the rationale behind the original paradigm applied in the experiments of Anderson et al. (1994): the competition assumption, the strength-dependent assumption and the retrieval-based learning assumption. The competition assumption poses that memories associated to the same cue are competing for recall when that cue is presented. According to the strength-dependent assumption, the cued recall of an item decreases as a function of in-creases in the strengths of its competitors' associations to the cue. Finally, the retrieval-based learning assumption implies that the act of retrieval involves a learning process as it leads to subsequent improved recall of the retrieved item.

These kinds of approaches and the strength-dependent assumption in particular have been questioned more recently, as a different approach, the inhibitory control account, seems more adequate to explain retrieval-induced forgetting, especially in the light of the research findings mentioned above. According to the inhibitory control account, retrieval-induced forgetting is caused by inhibition. When specific memories are to be retrieved, interfering, competing memories are inhibited in order to facilitate the retrieval of the relevant memories. As a consequence, the accessibility of competing memories is impaired and the information may be forgotten. Thus, inhibition is conceptualised as a mechanism of executive control being necessary for guiding the selective retrieval of specific memories by impairing competing memories. The features of retrieval-induced forgetting, such as cue-independence, strength independence, retrieval specificity and interference dependence all signal that inhibition of competing items lies behind forgetting, rather than strengthened competitors blocking the

access to associated memories (Anderson, 2003). Nevertheless, the debate on the underlying mechanism of retrieval-induced forgetting is far from over and the inhibitory control account is not endorsed by all researchers (e.g., Perfect et al., 2004).

Moderating and masking factors

Anderson (2003) has outlined several factors that are likely to either moderate or mask retrieval-induced forgetting. Moderating factors influence the magnitude of inhibition that target items suffer from during retrieval practice. By contrast, masking factors alter the behavioural assessment of inhibition during the test phase without modifying the actual amount of inhibition that occurred during retrieval practice. Furthermore, both kinds of factors can be due to the presentation of the study material, the process of retrieval practice or the test procedure. In the following, examples of moderating and masking factors will be presented.

According to Anderson (2003) integration and similarity are two important representational factors that moderate inhibition. Integration refers to the existence of interconnections between items that are associated to the same cue. Semantic similarity (e.g. Lemon, Lime), associative relatedness (e.g. Apple, Tree) or even more elaborate encoding of relations can give rise to interconnections (e.g. interactive imagery, such as imagining how Bill plays the guitar in the classroom, when learning about Bill being a teacher and playing the guitar in his spare time). Also, if the study time per item is prolonged from the usual 4–5 s to 8 s, the likelihood for integration is increased (Anderson & Bell, 2001). Generally, high integration of the competitors with the items to be retrieved prevents the former from retrieval-induced forgetting. Anderson and McCulloch (1999) examined this effect by instructing one group of participants to find inter-relationships among the items during the study phase. The other group performed the experiment according to the common procedure. The results showed that the instruction to integrate the study items countervailed retrieval-induced forgetting. Even more striking was the fact that some participants that were not instructed to find interconnections exhibited reduced retrieval-induced forgetting. A post-experimental questionnaire revealed that those participants had applied the strategy of finding inter-relationships on their own during encoding.

Semantic similarity is a complex moderating factor as it affects inhibition differently depending on whether the similarity exists between targets or between nontargets and targets.

In case of target-target similarity retrieval-induced forgetting is amplified, whereas target-nontarget similarity attenuates the inhibition effect (Anderson, Green, & McCulloch, 2000).

Another critical aspect of the retrieval-practice paradigm is the relation between target items and control items that constitute the baseline used to measure the impairment. If the control items themselves are affected by retrieval practice, a baseline deflation arises that can mask an actual forgetting effect. According to Anderson (2003), there are two sources of baseline deflation: overlapping contextual features and similarity between practised and unpractised categories. If practised items share contextual or semantic features with items of the unpractised categories, retrieval-induced forgetting may generalize to those categories. The studies of Anderson and Spellman (1995) and Anderson and Bell (2001) support this view and emphasize the importance of choosing control items that differ as much as possible from the target items.

Another masking factor is referred to as cue priming (Anderson, 2003). The act of retrieval practice might increase the overall accessibility of the practised category and hence facilitate the recall of its associated members, especially if the category cue and its members are strongly linked to each other.

An important test factor that may exaggerate retrieval-induced forgetting is output interference. Originally, the test phase consisted of a free cued-recall test as it was the case in the experiment of Anderson et al. (1994). The participants were presented with a category cue and asked to freely recall all the exemplars they previously had learned. However, in following experiments this free cued-recall test was replaced by a category-plus-stem cued-recall test, in order to control for output interference. If participants themselves are allowed to choose the order of retrieving the previously studied items, they might name the practised items (P+) first and the others later on. In this case output interference would act as a confounding variable as it itself could explain the impairment of the P− items' recall rate. Hence, it would be hard to draw any conclusions about the effect of retrieval practice.

Inhibition can even be masked by inappropriate testing in the final phase (Anderson, 2003). Studied items can be represented in memory on multiple levels, for instance, words can be encoded with phonological, orthographical or semantic representations. While one type of representation might be inhibited by retrieval practice, other representations of the same items might still be unimpaired. If one is to measure the magnitude of inhibition it has to be ensured that the appropriate test that taps the inhibited representation is applied. Anderson (2003)

theorises that an item can be both semantically and episodically represented in memory. The episodic representation of an item as it appeared in the experiment may consist of distinctive contextual features and also semantic features generally used to represent the item in semantic memory. To the extent that such an episodic representation differs from the general semantic representation of the item, it is possible that the episode is inhibited while the general concept remains unaffected.

Generality

The growing research body on retrieval-induced forgetting suggests that this kind of memory effect occurs with a variety of materials and in a variety of contexts. Besides semantic categories that have been shown to be subject to retrieval-induced forgetting, the effect could even be observed with visuospatial materials (Ciranni & Shimamura, 1999), visual scenes and event narratives in eye-witness memory (Saunders & MacLeod, 2002; MacLeod & Saunders, 2008) and autobiographical memories (Barnier, Hung, & Conway, 2004).

Research on verbal overshadowing proved that describing a recently encountered face leads to impaired recognition of that face (Schooler & Engstler-Schooler, 1990). Studies on fact learning demonstrated that facts about a topic were forgotten when other facts about the topic were recalled. Besides, the impairment was found to generalize to facts that shared concepts with the competing facts (Anderson & Bell, 2001). Bäuml (2002) argued that retrieval-induced forgetting is not only active in episodic memory but extends to semantic memory. He showed that generating further exemplars of previously studied categories from semantic memory caused forgetting of the recently learned exemplars. This impairment of episodic memory was not found if participants were presented with the same novel exemplars to study, but instead instructed to engage in retrieval of novel exemplars from semantic memory. Furthermore, retrieval-induced forgetting appears to be moderated by the participants' affective state during retrieval practice. Bäuml and Kuhbander (2007) showed that an inhibitory effect occurred when the participants were in positive moods but not when a negative mood was induced.

Evidence that retrieval-induced forgetting extends to issues in social cognition comes from Macrae and MacLeod (1999) who instructed their participants to form impressions of two men named John and Bill. In the study phase, participants were presented with index cards displaying traits that characterized the two men. The further experimental procedure followed closely that used by Anderson et al. (1994) with the selective retrieval practice for either John

or Bill ensuing the study phase, followed by a distracter task and a concluding test phase. The findings demonstrated that retrieval-induced forgetting even occurs in the context of a social information-processing task, as participants had greater difficulty recalling unpractised traits of the practised person (e.g. John) than they did recalling unpractised traits of the previously unpractised person (e.g. Bill). A series of experiments by Dunn and Spellman (2003) showed that retrieval-induced forgetting plays a role in stereotype inhibition. A consequence of retrieving individuating traits of a person that participants recently learned about is that stereotypic traits of that person are inhibited. Additionally, inhibition of stereotypic traits was moderated by the participant's belief in the stereotype. The stronger the participant thought the stereotype to be true, the more insulated the stereotypic trait became from inhibition. Taken together, the evidence of research on retrieval-induced forgetting in different contexts and with different materials suggests that the effect is not restricted to episodic retrieval or to taxonomic categories, instead it seems to be a general consequence of inhibitory mechanisms supporting selective retrieval in the face of competing memories (Anderson, 2003).

With the generality of retrieval-induced forgetting in mind, questions about its consequences for other cognitive functions arise. As mentioned above, retrieval inhibition appears to be able to cause distortions in memory and to affect stereotypes, but even to act as an enabler for future learning. Further consequences of forgetting such as its potential effect on thoughts and attitudes remain to be investigated in more detail.

Attitudes

An important part of social cognition is the study of attitudes. We all have attitudes towards things around us, they are evaluations that we hold against the self, individuals, groups and other objects (Rydell & McConnell, 2006). Some of these evaluations are easy, universal and uncomplicated. For example, most people like love and peace, and most people dislike hate and war. When it comes to people, the matter can still be a rather uncomplicated one. We dislike Hitler but think that Ghandi was a great man. Sometimes, there is no universal agreement about the attitude towards a person, but we still can easily express our own opinion. Saying that our old math teacher was a mean person can be an easy claim. This kind of attitudes is usually referred to as explicit attitudes. These are the attitudes that we show to the world. To capture these attitudes in the laboratory is not a too tricky thing, we simply ask.

But what if we don't really want to express our attitudes? Most people have attitudes that they do not like to admit, attitudes that the society we live in has taught us not to have (at least not

out in the open). When asked by a researcher about these attitudes we are less likely to express them. We might even overcompensate and state the complete opposite. Sometimes we are not even aware of having these attitudes.

The attitudes described above are called implicit attitudes. A general definition of implicit constructs is proposed by Greenwald and Banaji (1995); "an implicit C is the introspectively unidentified (or inaccurately identified) trace of past experience that mediates R." (s.5). In the case of implicit attitudes the C is the attitude and the R is the object-evaluative judgement. Although both this definition and the term "implicit" suggest an unconscious nature of the attitudes this does not have to be the case. Fazio and Olson (2003) stress that researchers cannot capture exactly what the participants know about their own attitudes, only what they admit to know about them. Precisely what constitutes implicit attitudes is still a matter of debate, so is how explicit and implicit attitudes differ. What is clear is that the focus of attitude research has shifted from explicit to implicit attitudes (Rydell & McConnell, 2006), and that the field of implicit attitude research today is dynamic and diverse.

To capture implicit attitudes, different types of tests are used. One common implicit attitude test is the evaluative decision task (EDT), a test based on automatic activation of attitudes. The basic principle behind the automatic activation of attitudes is a matter of priming. Presentation of an attitude object as a prime automatically activates the already stored evaluation that the participant associates with the object. This activation facilitates the sorting of an object in the same evaluative cluster as the prime (Fazio, Sanbonmatsu, Powell, & Kardes, 1986).

In the EDT, the participant is initially presented with an emotionally loaded image or word that is shown for a brief period of time and serves as a prime. After the prime has been displayed a new emotional stimulus (the target) is shown. It is now up to the participant to decide if the target is good or bad as fast as he/she can. Two different conditions emerge; either the prime and the following stimulus are of the same valence or of the opposite one. In support of the automatic activation hypothesis, responding time is faster on trials for which the participants' evaluations of the primed attitude objects are congruent with the connotation of the following stimulus than on trials for which they are incongruent (Fazio et al., 1986). This difference in response times is referred to as the congruency effect. The congruency effect has been well documented in several experiments (Fazio et al., 1986; Dovido, Kawakami, Johnson, Johnson, & Howard., 1997; Klauer, Roßnagel, & Musch, 1997). Nevertheless, there are some limitations to the effect. If the interval between the prime and the

target is longer than 300 ms the effect is diminished (Fazio et al., 1986; Klauer et al., 1997). Furthermore, the evaluative association with the stimulus used as a prime must be strong (Fazio et al., 1986).

The EDT has today in large been replaced by an alternative procedure called the implicit attitude test (IAT). Developed by Greenwald, McGhee and Schwartz (1998), the IAT is robust and produces large effect sizes (Karpinski & Hilton, 2001). The IAT assesses implicit attitudes by measuring the automatic associative strength between an attitude object and an evaluative attribute (Greenwald et al., 1998). A stronger association implies a stronger implicit attitude.

IAT is a sorting task like the EDT, but no prime is used and there are four categories instead of two. Two categories correspond to the attitude objects to be measured (e.g. *young* and *elderly*). The other two categories are the evaluative attributes *pleasant* and *unpleasant*. The participants are requested to sort different stimuli into their corresponding category by pressing one of two keys on the keyboard. The same key is used for one attitude object category and one evaluative attribute category. The allocation of category to key is varied so that both attitude objects are combined with the categories of *unpleasant* and *pleasant*. To obtain the overall IAT-score, the difference between the response times in the two category combinations is calculated. For instance, if the response times are shorter for *elderly* and *pleasant* than for *elderly* and *unpleasant*, the implicit attitude towards elderly is assumed to be positive. If the response times are longer for *elderly* and *pleasant* than for *elderly* and *unpleasant*, the implicit attitude towards elderly is assumed to be negative.

In support of the IAT and implicit attitudes as a concept, uncontroversial objects like *flowers* versus *insects* and *instruments* versus *weapons* show a clear advantage for *flowers* and *pleasant* (*insects* and *unpleasant*) and *instruments* and *pleasant* (*weapons* and *unpleasant*) over the opposite (Greenwald et al., 1998). This advantage reflects the explicit attitudes and therefore proofs implicit attitude measures to be sensitive to well-established evaluative discriminations.

Even if an evaluation is not well established in the society at large, it can still be reflected in measures of implicit attitudes. Since there is a long history of conflict between the Japanese and the Chinese, implicit negative attitudes should be revealed against the other group. When Americans from the different ethnic communities were tested, the hypothesis was proven right, given that the participants were immersed in the Asian culture (Greenwald et al., 1998).

These attitudes are not only less socially acceptable than the ones towards instruments and flowers; they are also substantially less negative on explicit measures.

The racial attitudes towards black versus white people are even less socially acceptable than the ones between the Japanese and the Chinese communities. Given that, it is of no surprise that the explicit measures are lower as well, although still with a small favourability for white people (Greenwald et al., 1998). The implicit attitudes though seem to be more positive for white people than black people amongst white participants, and this difference is higher than between the Japanese/Chinese ethnic groups. In contrast to the implicit attitudes between the Chinese and the Japanese, black people do not show the reverse pattern towards white people. Instead, they also revealed an implicit preference for white people over black people, although the discrepancy was smaller than it was for the white participants' result (Nosek, Banaji, & Greenwald, 2002). The implicit attitudes collected from black participants contradict the explicit attitudes which state a stronger preference for black people. This explicit preference is more pronounced than the white participants' in-group bias. Taken the results together, it is clear that implicit measures like the IAT do capture something else than the explicit attitudes, especially when the social desirability not to have those attitudes is high. It is not surprising that implicit attitudes do not correlate with explicit attitudes in situations of social desirability (Greenwald et al., 1998). But even with uncontroversial material like the favourability between insects and flowers, the lack of correlation between explicit and implicit attitudes sustains when examined at an intrapersonal level (Karpinski & Hilton, 2001). Hence, the explicit and implicit attitudes seem to be qualitatively different.

A critique against implicit attitude tests and the IAT in particular, is that they might measure the society's evaluations to a greater extent than personal evaluations. In the classic Greenwald et al. (1998) study, the Chinese/Japanese participants showed a larger negative out-group bias if they were strongly embedded in their culture. This might be due to a higher negativity towards the other ethnic group on a personal level, but it might also simply be a cultural expression. Karpinski and Hilton (2001) conducted an IAT on candy bars versus apples. Although no preference was conveyed in explicit measures, a preference for apples over candy bars was obtained in the IAT. In the experiment, the participants were also offered a candy bar or an apple. Contrary to the results from the IAT, most people picked the candy bar. The discrepancy may be due to cultural influences, as apples are consistently pointed out as a better alternative than candy bars. If implicit attitude measures assess the cultural

attitudes, this could explain the implicit attitudes obtained from black participants against their own race (Nosek et al., 2002), as they live in a culture that favours white persons.

Although there are indications of implicit attitude tests being influenced by the values that surround the participants, they may also be directed against novel objects and created in an experimental setting. Rydell & McConnell (2006) constructed an experiment that tested the nature of implicit attitudes without an obvious cultural bias, as the participants were introduced to an unknown person called Bob. At first he was loaded as a positive object by presenting describing sentences. The attitudes against Bob were, not surprisingly, positive on both explicit and implicit measures (as measured by a Bob versus not-Bob IAT). When relearning new, negative information, only the explicit attitudes switched, the implicit attitudes stayed the same. On the other hand, when exposed to negative subliminal priming, the implicit attitudes changed and the explicit attitudes persisted. Implicit attitudes for categories that might be culturally dependent have been proven sensitive to priming as well. Karpinski and Hilton (2001) created new associations between the attitude objects *young* and *elderly* by pairing the objects with either positive or negative words and having the participants remember the word pairs. When exposed to this rather simple priming the implicit attitudes changed whereas the explicit attitudes were preserved.

If implicit attitudes are altered by mere presentation, why are they still of so much interest? Since they seem to tap different cognitive systems it is important to draw correct conclusions about attitudes in research. In everyday life implicit attitudes influence behaviour in a different way than explicit attitudes do. Whereas explicit attitudes influence verbal behaviour (Rydell & McConnell, 2006) implicit attitudes are reflected in nonverbal behaviour like visual contact (Dovido et al., 1997), frequency of blinking (Dovido et al., 1997) and the physical distance to the attitude object (Rydell & McConnel, 2006). The connection between implicit attitudes and nonverbal behaviour is documented both when the social desirability is high as in racial prejudice (Dovido et al., 1997) and when the implicit attitude is induced on a novel object (Rydell & McConnell, 2006). And, as shown in the Rydell & McConnell (2006) study, these subtle, nonverbal behaviours are changed with the implicit attitudes when exposed to priming.

Retrieval-induced forgetting and attitudes

The effects of retrieval-induced forgetting in the realm of social cognition and attitudes in particular have been investigated by a series of studies conducted by Storm et al. (2005).

Several novel questions were addressed in their research, such as the impact of emotional stimulus material on retrieval-induced forgetting and the role this kind of forgetting plays in maintaining and modifying attitudes. More specifically, they examined whether the retrieval-induced forgetting effect also occurred for emotionally loaded material and if, in this case, it differed for negative and positive traits characterizing a person. Regarding the role of retrieval-induced forgetting in person perception, the question was if the forgetting of positive or negative traits of a given person changes the previously formed impression about that person.

As mentioned above, retrieval-induced forgetting seems *not* to be just a side-effect of the retrieval process but instead occurs for items that of different reasons strongly compete with the items that are to be retrieved from memory. This competition can be enhanced by several conditions, such as the typicality or frequency of a category member or the importance to remember a given item. Accordingly, emotionality could also constitute such a facilitating condition as emotional material seems to be easier to remember than neutral material (Christianson, 1992; McGaugh, 2004) and hence should interfere to a greater extent with other information related to the same cue. Furthermore, differences in remembrance of negative and positive items could be demonstrated in that sense that negative items were better recalled than positive ones and also appeared to require more cognitive processing and attentional resources (Ito, Larsen, Smith, & Cacioppo, 1998; Kihara & Osaka, 2008). Since prior research on impression formation also indicates a negativity bias in the perception of other people (e.g. Amabile & Glazebrook, 1982), it is reasonable to expect that such a negativity bias enhances the retrieval-induced forgetting of negative information.

Storm et al. (2005) postulated two general hypotheses to be tested in their experiment. First, they expected that both negative and positive information would be inhibited, but not to the same extend. Second, they reckoned that retrieval-induced forgetting, to the extent that it impaired access to either positive or negative information about a studied individual, would shift the attitudes hold against that person in the according direction.

In their experiment, Storm et al. (2005) instructed participants to memorise traits associated with four novel persons. Every person was described with ten different traits. For each person, half of the traits were neutral and constituted the nontarget condition, for two persons the remaining target traits were positive and for the other two persons the remaining target traits were negative. In each emotional category one person was used as a control. The participants studied one person at a time. Prior to study, participants were told that they later on were to

play a game with these persons and that knowing the presented traits would be advantageous. After the study phase, they were asked to evaluate the person they had encountered on six scales: likeability, honesty, intelligence, morality, competence, and attractiveness. When the rating was finished the retrieval practice phase was initiated. This phase differed between control and practice conditions. In the practice condition the learned neutral traits were trained with a word stem task, and in the control condition a word stem task with fruits was performed. A new evaluation, identical to the first one, was made before the test phase containing a category-cued-recall task was conducted. During recall, the image and name of the person studied was shown and the participants were requested to write down as many traits as they could remember from the initial study phase. When finished, the next person was to be studied. After the completion of all four persons a final surprise evaluation and recall were obtained. As the final tests did not differ from the earlier obtained recalls and evaluations, they were counted out in the presentation of the results.

The results confirmed a retrieval-induced forgetting for both positive and negative traits. Although a negativity bias was evident, with more negative traits being remembered, no significant difference in inhibition for the two emotional categories could be found. The measured attitudes towards a person were clearly regulated by the valence of the traits ascribed to that person. However, the valence did not alter as a function of retrieval practice. In fact, the evaluative judgements were approximately the same at all assessment occasions and no correlation was found between remembered traits and attitude ratings.

Storm et al. (2005) altered their study by creating more complex persons with both positive and negative traits. Furthermore, just one evaluation about each person was made, right before the test phase, but the results remained the same. In a third experiment, they replaced the target traits with sentences about corresponding behavioural activity. The significances remained the same, but they made one new finding. Probably due to cultural factors, a large negativity bias was revealed for females in the experiment, whereas no such bias was found for the male counterpart. Interestingly, recall of behaviour about females led to inhibition of negative behaviours to a much greater extent than positive behaviours. The inhibitory effect for males on the other hand was slightly larger for positive than negative behaviours.

The findings from the Storm et al. (2005) study suggest that there is indeed an inhibitory effect for emotional information. The negativity bias was confirmed, as negative traits were better recalled than positive or neutral ones. Even though a negativity bias was obtained, it did not lead to significantly differences in inhibition of positive and negative information. Despite

this fact, the results suggest that a stronger negativity bias does correlate with a larger inhibitory effect for negative information. However, the attitudes initially formed did not vary as a result of retrieval-induced forgetting. Storm et al. (2005) reasoned that impressions are stable constructs that do not easily change. Even when the initial information that the attitudes are based upon are forgotten, the impression remains.

The present study

The present study is a development of the study by Storm et al. (2005). Even though Storm's study is well implemented and produced some interesting results, it also contains some open issues that warrant further research. Storm et al. (2005) are investigating the impact that valence has on the inhibitory effect. They use negative and positive information of equal emotional intensity to control for confounding factors. Yet, a moderating effect of emotionality per se is not accounted for without using neutral information as a control. Therefore, it is necessary to include a third emotional category in the experiment, namely neutral traits. Since there is a limited amount of suitable neutral traits, other neutral information can serve as nontargets.

The presentation of one person at a time is meant to increase the recall rate in the Storm et al. (2005) study, but it leads to other complications. To begin with, a task that is equivalent to retrieval practice must be implemented in the intermediate phase to keep the control condition tantamount to the practice condition. Storm et al. (2005) uses a fruit word stem task which may take the same amount of time to complete and tap the same cognitive resources, but still seems off topic. By having the control and practice condition in the same presentation no alternative task is needed since the retrieval practice for the P+ items constitutes the intermediate phase for the control condition as well. Furthermore, when each phase merely contains one person at a time, the participants might not conceptualize the studied persons as categories, although they are encouraged to do so in the cover story. Traits are abstract concepts and hence less natural to apply to the category of a virtual person. The usage of several different persons in the study phase could be one way to aid the formation of categories. Another possibility to facilitate the construction of person categories is to have describing sentences presented prior to the traits in order to make the persons more life-like. The usage of a free cued-recall test in the last phase may promote output interference and should therefore be avoided. With a category-plus-stem cued-recall test it is possible to

control the order of items to be retrieved, thereby ensuring that the practised items are not reported first.

In addition, the Storm et al. (2005) study investigates the relationship between retrieval-induced forgetting and explicit attitudes. Given that retrieval-induced forgetting is a subconscious cognitive function, it is more likely to affect implicit attitudes (Rydell & McConnell, 2006). Although an IAT is a commonly applied and reliable implicit measure, it is clumsy when no well established categories can be used. For novel objects IAT categories are often labelled as *seen before* and *not seen before*. In addition to the persons encountered in the experiment, the same number of not-encountered persons must be tested as a comparison. Thus, it is far more time-consuming than an EDT. On the other hand, the problem with an EDT is that the primes should have strong evaluative connotations, which may not be the case for newly learned objects. Therefore, to measure implicit attitudes, a variant of the EDT is constructed in which the prime is not shown subliminally but remains on the screen during the presentation of the target word.

With the alterations and developments of the Storm et al. (2005) study the aim of this study is to test how emotionality (both intensity and valence) influences retrieval-induced forgetting, and further if the induced forgetting changes the implicit attitudes towards the previously studied persons. Two main hypotheses are postulated:

Hypothesis 1a. The memory part of the experiment will produce an inhibitory effect for traits in the practice condition.

     b. Negative traits will be better remembered than positive and neutral traits due to a negativity bias. Positive traits will be better remembered than neutral traits due to emotional intensity.

     c. There will be a difference in the inhibitory effect depending on the traits' emotionality. Due to greater interference, negative and positive traits will be more inhibited than neutral ones with the strongest inhibition exhibited for negative information.

Hypothesis 2a. The attitude part of the experiment will show a congruency effect for positive and negative persons, with congruent target words being categorised faster than incongruent targets.

     b. To the extent that retrieval-induced forgetting occurs, the congruency effect will be more pronounced for the persons included in the control condition

than for the practiced ones. If the inhibitory effect is larger for negative than positive traits, a corresponding difference between control and practice condition will be found in the EDT.

Method

Participants

A total of 56 students at University of Lund voluntarily participated in a study on memory and attitudes. The students were recruited from different university departments. All participants were native Swedish speakers. Because of computer error, data from three of the participants had to be excluded from analyses. One participant did not follow the instructions and had to be omitted. In addition, the data from three participants with recall rates of 0% in a C− condition were excluded to avoid floor effects. In order to create a counterbalanced material one more participant was randomly left out. Thus, the final sample consisted of 25 women and 23 men with a mean age of 25 years (range = 19−47).

Material

The images of 12 women and 12 men of varying ethnicity were selected from a data base (Tottenham et al., in press). All pictures showed standardised, neutral faces against a white background. The pictures were labelled with commonly used Swedish names (e.g., *Ida*). City of origin, profession and hobby served as neutral information used in retrieval practice (Appendix A). The neutral information was clustered with one city, one profession and one hobby in each set. To facilitate a deeper encoding, sentences preceding each bit of information were generated (Appendix A).

In order to select adequate negative, neutral and positive traits a pilot study was conducted. Ten subjects from an ad-hoc sample were asked to rate the valence and intensity of 150 Swedish traits on a 7-graded scale (Appendix B). 72 traits, 24 in each emotional category, were chosen on basis of the subjects' ratings with consideration to word length and frequency values retrieved from Press97 (Språkbanken, 2003). For each trait a related, describing sentence was constructed (Appendix A). The traits were put together in groups of three, depending on their valence. The sets equated each other regarding emotional intensity, word length and frequency.

For the evaluative decision task 48 Swedish nouns were generated, 24 obviously negative ones and 24 obviously positive ones. The two groups of nouns with different valence were equivalent with regard to emotional intensity, frequency values retrieved from Press97 (Språkbanken, 2003) and word length (Appendix C).

Design

The factors investigated in the present study were Status, Item type and Emotion. Status referred to whether a studied person was included in retrieval practice (practice condition) or not (control condition). The factor of Item type consisted of target and nontarget items. In practice condition, a person's nontarget items were practised, while the target items were not. The factor of Emotion comprised three levels corresponding to the valence of the target words (negative, neutral and positive). As each person to be studied was solely connected to emotional targets of the same valence, the factor of Emotion extended to the person as a category.

To avoid confounding factors the material was counterbalanced between subjects. The counterbalancing was achieved by constructing six different lists, each made up of four different blocks. Each block consisted of six images and names (three male and three female), each constantly allocated to a set of neutral information (nontarget/ +). The blocks also contained two sets of negative (target/−), two sets of neutral (target/−) and two sets of positive traits (target/−). Over the lists and within the blocks, each set of neutral information was connected to all three emotional groups. Thus, all images, names and neutral information were equally common in the negative, neutral and positive condition. Furthermore, all sets of neutral information and all sets of traits were both used as control (C) and as practice (P). As a result, all traits were equally common in the C− and the P− condition and all sets of neutral information were equally common in the C+ and the P+ condition. To exclude primacy and recency effects, the order of presentation of the four blocks was altered over the lists. To ensure that the participants generated the correct words in retrieval practice and the test phase, for every person, the first letter of any word to be learned was unique. Moreover, correct retrieval was facilitated as even within each block, the first two letters of the words were unique.

Procedure

The experiment took place in a sound and light controlled laboratory. Up to three participants were tested at a time. The participants were separated by dividing screens and had no visual contact. First, the participants were asked to read and sign a contract of informed consent comprising the basic principles behind the experiment (Appendix D). Subsequently the participants received a general introduction to the experiment, presented on a computer screen (Appendix E). To increase the participants' motivation, it was emphasized that the experiment tested parts of their social capability. After making sure that the participants had understood the instructions, the experiment began.

The experiment was completely computerised and took approximately one hour to complete. The experimental procedure is shown in Figure 1. The memory part of the experiment consisted of four analogous blocks. Each block was divided into three main phases; a study phase, a selective retrieval practice phase and a test phase.
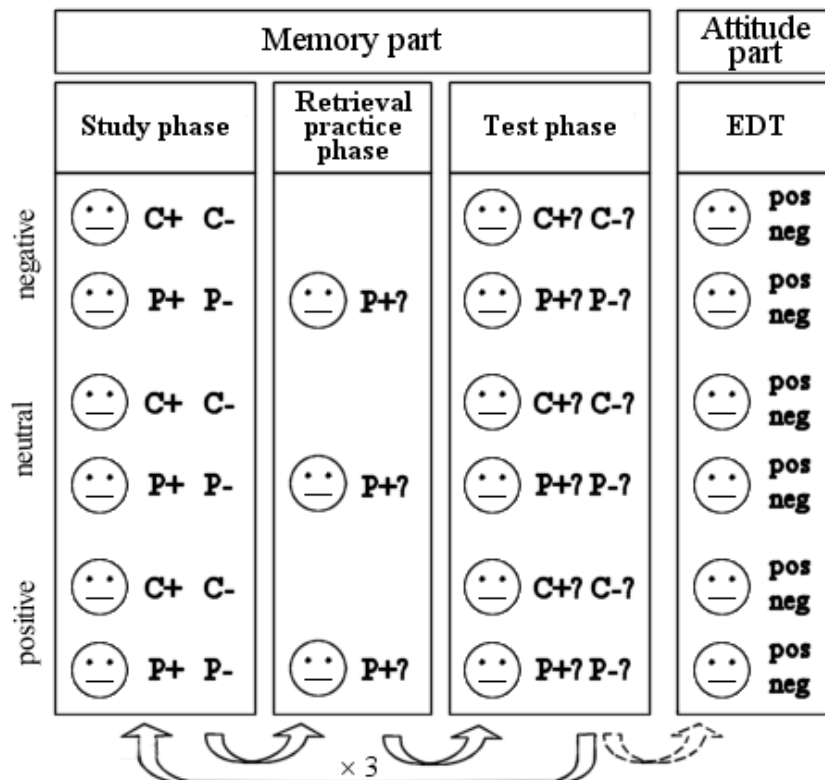

Figure 1. The experimental procedure. C+ = nonpractised neutral information; P+ = practised neutral information; C– = nonpractised traits from nonpracticed persons; P– = nonpractised traits from practised persons; pos = positive target words; neg = negative target words.

After completing the test phase of a block, the next block was initiated. When all four blocks were completed the attitude part of the experiment was conducted in form of an evaluative decision task. Each phase was opened with a written instruction about the upcoming tasks (Appendix F).

The study phase

During the study phase (Figure 1) the participants got acquainted with six different persons, presented as an image and a name. These six persons were all described with six items, three neutral ones concerning their city of origin (e.g. *Borås*), profession (e.g. *vårdbiträde*) and hobby (e.g. *piano*), and three traits. The traits were either positive (e.g. *godhjärtad*), negative (e.g. *grym*) or neutral (e.g. *klumpig*) to give the persons different emotional valence. Each study phase included two positive, two negative and two neutral persons, half of them male, half of them female. Consequently, one block consisted of 36 different items that were to be memorised. These were presented to the participants in a randomly manner, one item at a time. For the participants, the information was shown as follows; an image and a sentence (e.g. *Lotta spiller ofta kaffe vid frukostbordet. Hon är*) simultaneously appeared on the screen. After a 2000 ms delay the word to be learned (e.g. *klumpig*), called the keyword, appeared underneath the sentence in blue print. The delay of the keyword was aimed to deepen the encoding by making sure that the participants read the preceding sentence. The image, name, sentence and keyword remained on the screen for 5000 ms. Afterwards the screen was cleared for 1000 ms before the next image and sentence were shown.

The retrieval practice phase

In the retrieval practice phase (Figure 1) the participants were asked to practice some of the items they had studied. Half of the keywords of half of the persons from the study phase were to be trained, thereby creating a practice and a control condition. The three emotional categories were represented by one person each. All the keywords in the retrieval-practice phase were neutral information. They were presented in a randomly order, three times each in order to strengthen the expected retrieval-induced forgetting effect. The neutral information being practised constituted the P+ condition, whereas the neutral information of the non-practised persons made up the C+ condition. For each person to be practised the participants were shown the person's image and name (e.g. Lotta) together with the first two letters of one of the associated neutral keywords in blue print (e.g. Bo). The participants had 12000 ms to

type the correct keyword on the keyboard. The screen was cleared after this time or in case the participant pressed [enter]. After 1000 ms a new image, name and word stem appeared.

The test phase

During the test phase (Figure 1) the participants were instructed to recall all learned items from the study phase. This was done by presenting each person (e.g. image and *Lotta*) together with the first letter of the studied keywords in blue print (e.g. *K*). The participants had 12000 ms to type the correct keyword on the keyboard. Afterwards, or after the participant pressed [enter], the screen was cleared for 1000 ms before the next image, name and letter were shown. To avoid output interference the target traits (C− and P−) were to be retrieved first, followed by the nontarget, neutral information (C+ and P+). The presentation of items within each item type (target/− vs. nontarget/+) was randomized.

The evaluative decision task

In the EDT (Figure 1), the faces encountered during the previous experiment were used as primes and randomly displayed on the screen at eye level. 1000 ms before the presentation a fixation cross appeared to ready the participants for the primes. A positive or negative target word was shown 300 ms after the faces appeared and remained on the screen for 2000 ms, masking the presented person's eyes. Afterwards the screen was cleared for 500 ms until a new fixation cross appeared. The participants' task was to categorize the target words as positive or negative by pressing a corresponding key (e.g. left arrow for positive and right arrow for negative words) during the time that the word was shown. The allocation of key to emotional category was counterbalanced over participants. As every person was shown twice, once in combination with a positive word, once together with a negative word, two different conditions of interest could occur. The congruent condition was given in case a positively (negatively) loaded face was shown together with a positive (negative) word. The incongruent condition was created by presenting a positive (negative) face together with a negative (positive) word. The third possible combination of items was made up of neutrally loaded faces presented together with positive or negative words.

Debriefing

After the completed experiment the participants went through a verbal debriefing with a researcher (Appendix G). The debriefing aimed at making sure that the participants had executed the experiment in a correct manner. The participants were also asked about memory

strategies used and their apprehension of the different items' memorability. Furthermore, questions were asked to examine how much of the non-explicit systematic parts of the experiment that were apparent to the participants. Finally, the basic principles behind the study were explained. The participants received a candy bar, were thanked for their participation and were dismissed.

Results

The attained data were analysed with repeated measures analyses of variance (ANOVA) and planned pairwise comparisons using paired t-test.

Memory performance
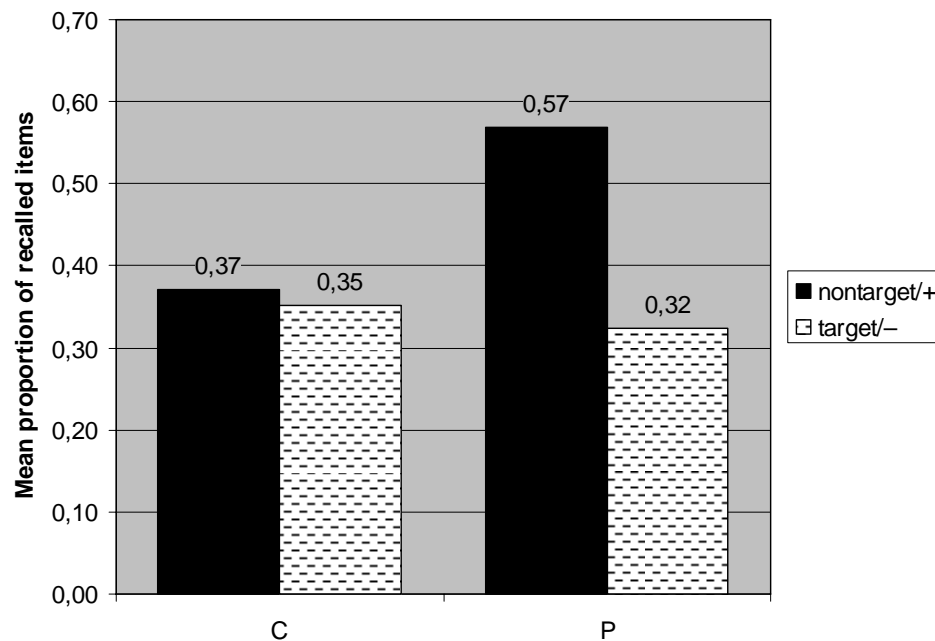
Figure 2. The mean proportion of items recalled in the test phase dependant on item type (nontarget/+, target/−) and Status (C, P). C+ = nonpractised neutral information; P+ = practised neutral information; C− = nonpractised traits from nonpractised persons; P− = nonpractised traits from practised persons.

An initial 2 (Status: C, P) × 2 (Item type: nontarget/+, target/−) repeated measures ANOVA was conducted in order to test if Status and Item type affected the recall rate in the final

memory test phase. The distribution of correctly recalled items over Status and Item type is shown in Figure 2. The analysis demonstrated significant main effects for both Status, $F(1, 47) = 61.688$, $p < .001$, $\eta_p^2 = .568$ and Item type, $F(1, 47) = 60.706$, $p < .001$, $\eta_p^2 = .564$. More importantly, as illustrated in Figure 3, a significant interaction emerged, $F(1, 47) = 112.113$, $p < .001$, $\eta_p^2 = .705$.
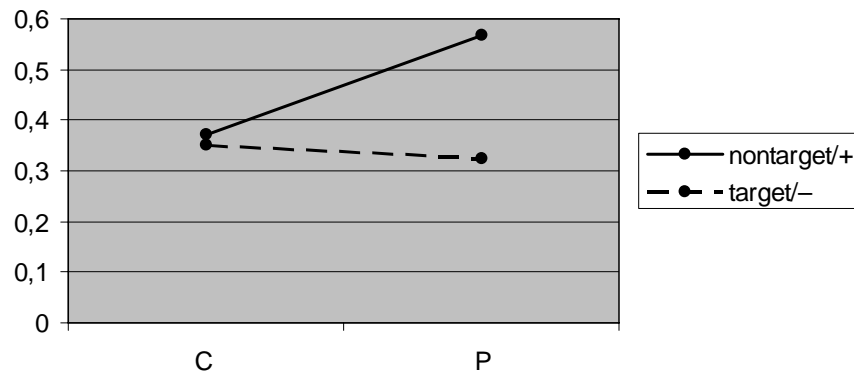
Figure 3. The mean proportion of items recalled in the test phase as a function of item type (nontarget/+, target/−) and Status (C, P). C+ = nonpractised neutral information; P+ = practised neutral information; C− = nonpractised traits from nonpractised persons; P− = nonpractised traits from practised persons.

Further analyses with two-sided paired-samples *t*-tests revealed a significantly higher recall rate for P+ items than for C+ items, $t(47) = 12.604$. $p < .001$, demonstrating the improving effect retrieval practice had on the recall of items that were to be retrieved during the second phase. In contrast, when comparing the recall rate for C− items with that for P− items a marginal retrieval-induced forgetting effect was found, $t(47) = 1.811$, $p = .077$, thus, indicating that retrieval practice did to some extent have a detrimental effect on the recall of target-items. As intended, C+ items were not significantly better recalled than C− items, $t(47) = .855$, $p = .397$.

To assess if traits and neutral information were equally well memorised in general, pairwise two-sided *t*-tests were performed for C+ items and the three different emotional types of C− items. Thus, this analysis examined to what extent memory differed for the distinct types of stimuli irrespective of retrieval practice. Negative C− items were significantly better recalled than C+ items, $t(47) = -2.439$, $p = .019$, thus, corroborating the negativity bias found in previous studies. Both positive and neutral C− items had a lower recall rate than C+ items.

The difference was significant for positive traits, $t(47) = 3.247$, $p = .002$. For neutral traits the difference did not quite reach the significance level, $t(47) = 1.968$, $p = .055$.

To examine if the valence of the traits affected retrieval-induced forgetting a 2 (Status: C–, P–) × 3 (Emotion: negative, neutral, positive) repeated measures ANOVA was conducted. The mean recall rates are presented in Table 1. The results revealed a significant main effect for Emotion, $F(2, 94) = 32.654$, $p < .001$, $\eta_p^2 = .41$, with planned pairwise comparisons showing that negative traits were significantly better recalled than positive traits, $t(47) = 8.866$, $p < .001$, and neutral traits, $t(47) = 5.646$, $p < .001$. The recall rate for positive and neutral traits did not differ, $t(47) = 1.197$, $p = .237$. The main effect for Status, $F(1, 47) = 3.28$, $p = .077$, $\eta_p^2 = .065$ corresponds with the marginally significant retrieval-induced forgetting effect reported above. The interaction effect between Emotion and Status was not significant $F(2, 94) < 1$, ns (= nonsignificant).

Table 1

Means and standard error of means for recall rates in the test phase in the memory part of the experiment

	C–		P–		Total mean	
	M	S.E.M.	M	S.E.M.	M	S.E.M.
Negative traits	.44	.02	.39	.02	.41	.02
Neutral traits	.32	.02	.30	.02	.31	.02
Positive traits	.29	.02	.29	.02	.29	.02
Total mean	.35	.01	.33	.02	.34	.01

Note. C– = nonpracticed items from nonpracticed persons; P– = nonpracticed items from practiced persons

Since the postulated hypotheses predicted a specific direction of the expected effect, namely that the recall rate for P– items would be significantly lower than for C– items, a further analysis with a one-sided t-test was justified. Using one-sided paired-samples t-tests in order to compare the recall rate of C– items and P– items in each of the three different emotional groups of traits, the following results were obtained; $t(47) = 1.745$, $p = .044$ for negative, $t(47) = 1.070$, $p = .145$ for neutral and $t(47) = .136$, $p = .446$ for positive traits. Hence,

retrieval-induced forgetting was reliable for negative traits, but not for neutral and positive traits.

In order to assess whether the retrieval-induced forgetting merely occurred at a lexical level or at a deeper emotional level an additional measure (emotional accuracy) of recall performance was applied. As long as the recalled trait in the final test phase belonged to the same emotional category as the actual word that was to be retrieved, the answer was coded as correct. A 2 (Status: C−, P−) × 3 (Emotion: negative, neutral, positive) repeated measures ANOVA demonstrated a significant main effect for Emotion, $F(2, 94) = 31.894$, $p < .001$, $\eta_p^2 = .404$. By means of planned pairwise comparisons, significant differences were detected between negative and neutral traits, $t(47) = 7.378$, $p < .001$, negative and positive traits, $t(47) = 5.353$, $p < .001$, and neutral and positive traits, $t(47) = −3.014$, $p = .004$. The previously obtained marginally significant effect for Status did not persist, $F(1, 47) = 2.763$, ns, and there was no significant interaction between Status and Emotion $F(2, 94) < 1$, ns. The mean recall rates are shown in Table 2.

Table 2

Mean rates and standard error of means for emotionally correct recalled words in the test phase in the memory part of the experiment

	C−		P−		Total mean	
	M	S.E.M.	M	S.E.M.	M	S.E.M.
Negative traits	.54	.02	.50	.03	.51	.02
Neutral traits	.37	.02	.34	.02	.36	.02
Positive traits	.42	.02	.42	.03	.42	.02
Total mean	.44	.02	.42	.02	.43	.02

Note. C− = nonpractised items from nonpractised persons; P− = nonpractised items from practised persons

When comparing the recall rate for C− items and P− items for each emotional category with a one-sided t-test, the following results were obtained; $t(47) = 1.463$, $p = .075$ for negative, $t(47) = 1.404$, $p = .084$ for neutral and $t(47) = −.063$, $p = .475$ for positive traits. Using the

more liberal measure the previously marginal effect for retrieval-induced forgetting for negative traits was diminished.

Evaluative-decision task performance

The EDT is based on congruency and incongruency between primes and target words. The neutral persons from the retrieval-induced forgetting phase were neither congruent nor incongruent with the emotional nouns used as target words. Therefore, although included in the experiment, the data from the neutral faces condition was left out in further analysis.

Since there was a time limit in the EDT, two types of errors could occur. One type consisted of the wrong key being pressed (e.g., a positive word was sorted as negative, error type 1), the other one occurred when the time limit expired before any key was pressed (error type 2). The mean error rate computed on error type 1 was 2%, with a range between 0% and 15 %. The mean error rate for the two types of errors combined was 5% with a range between 0% and 25 %. The error rate for categorizing positive words did not differ from that for negative words, when tested with a two-sided paired-samples *t*-test, $t(47) = -.148$, *ns*, thus indicating that the two types of words were about equally easy to categorize.

In previous literature (i.e. Greenwald et al., 1998) no time limit was used in the implicit attitude tests and therefore, an upper (3000ms) and lower (300ms) cut-off limit was set in order to handle extreme values. Values above or underneath the cut-off received the same value as the respective limit. Extremely short response times did not occur in the current experiment and the time span was just 2000ms, which prevented from upper extreme values. Accordingly, the received data did not show great variance in comparison to data collected in studies without time limit. Therefore, it was not necessary to determine any cut-off limits. On the other hand, it is impossible to know whether left out responses would be false or correct given enough time. As the combined error rate merely amounted to 5%, and did not differ as a function condition, both types of error trials were excluded from the analysis.

The mean response time for every participant was calculated for all conditions. In order to compensate for the skewness in the distribution of these means the data was log-transformed. This is a commonly used procedure (i.e. Greenwald et al., 1998). An alternative is proposed by Karpinski and Hilton (2001), using medians instead of log-transformed means. In that way, extreme values do not need to be adjusted. In lack of extreme values, the traditional method of log-transformed means was preferred. The log-transformed means of the participants'

response times in the different conditions were examined with a 2 (Status: C, P) × 2

(Emotion: negative, positive) × 2 (Congruency: congruent, incongruent) repeated measures

ANOVA. The log-transformed means for the different conditions are presented in Table 3. A

significant main effect was obtained for Congruency, $F(1, 47) = 5.208$, $p = .027$, $\eta_p^2 = .100$,

with faster response times for congruent than incongruent target words. No significant main

effects were found for Status, $F(1, 47) = 3.456$, ns, or Emotion, $F(1, 47) < 1$, ns. Furthermore,

no interaction effects were recorded for Status and Emotion, $F(1, 47) < 1$, ns, Status and

Congruency, $F(1, 47) < 1$, ns, Emotion and Congruency $F(1, 47) = 3,461$, ns, or Emotion,

Status and Congruency, $F(1, 47) = 1.409$, ns.

Table 3

Log-transformed means of response times and standard error of means in the evaluative decision task

	C		P		Total mean	
	M	S.E.M.	M	S.E.M.	M	S.E.M.
Negative persons	2.839	.012	2.847	.011	2.843	.011
Congruent	2.836	.013	2.847	.013	2.842	0.11
Incongruent	2.842	.015	2.846	.014	2.844	.012
Positive persons	2.831	.011	2.847	.011	2.839	.010
Congruent	2.823	.012	2.829	.011	2.826	.010
Incongruent	2.839	.011	2.864	.014	2.852	.011
Congruent	2.829	.011	2.838	.010	2.834	.010
Incongruent	2.841	.011	2.855	.013	2.848	.011
Total mean	2.835	.011	2.847	.011	2.841	.010

Note. C = nonpractised persons; P = practised persons.

One aim of the study was to examine the effect that retrieval-induced forgetting has on

implicit attitudes. As retrieval-induced forgetting only occurred for negative traits, the faces

of interest in the EDT were the negatively loaded ones. Hence, to explore more directly if retrieval-induced forgetting affected EDT performance, a 2 (Status: C, P) × 2 (Congruency: incongruent, congruent) repeated measures ANOVA was executed exclusively on the data of the 23 participants that exhibited impaired recall of negative traits due to retrieval practice. Thus, participants were only included in the analysis if their recall rate for P– items minus the recall rate for C– items was > 0. The results did not show any significant main effects for Status, $F (1, 22) < 1$, *ns*, or Congruency, $F (1, 22) < 1$, *ns*. The interaction between Status and Congruency was not significant either, $F (1, 22) < 1$, *ns*. Nevertheless, the tendency in the interaction was as postulated, since there was a greater, though not significant difference, $t(22) = .561$, $p = .581$ in mean response times between congruent and incongruent target words for faces from the C condition than for faces from the P condition (Figure 4).
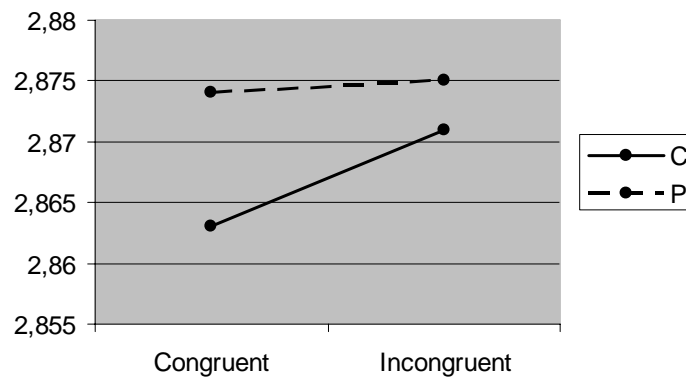
Figure 4. The log-transformed mean response times for negative persons in the EDT, based on the 23 participants that showed retrieval-induced forgetting for negative traits, as a function of Congruency (congruent, incongruent) and Status (C, P). C = nonpractised persons; P = practised persons.

Debriefing

The post-experimental debriefing, conducted in the form of a structured interview, revealed that only few participants had been aware of the design underlying the different phases of the retrieval-induced forgetting task. For instance, most of the participants did not realize that it was always the neutral information that was to be practised in the second phase and that not all persons were included in that phase either. However, some of the participants noted that each word was to be retrieved several times during the practice phase. A couple of participants reported that the persons to be studied were either good or bad.

In addition, the debriefing provided information about the participants' memory strategies and their subjective experience of how recallable the different kinds of items were. In general, participants reported two different types of memory strategies: repetition and integration. When applying repetition, every time a person's picture was presented together with a new item, the participants repeated all items learned about that person so far. The other strategy involved the integration of all information given about a person, for instance by imagining visual scenes or forming associations between items. Yet, some participants reported that the given time was too short to apply this strategy. Participants also commonly reported that persons or items were easier to remember when they could be associated to something personal, for example, a hobby that the participant shared with the presented person. Furthermore, many participants thought the neutral information (e.g. hobbies, profession and city of origin) and negative traits to be easier to be recalled than neutral traits. Yet, all participants perceived the memory part as rather difficult and reported that they remembered very little information altogether. They also named that they in many cases knew which kind of feeling and characteristic that was associated with a person but that they could not remember the exact word.

Regarding the evaluative decision task, some participants experienced it difficult to categorize positive (negative) words with a negative (positive) person presented simultaneously. Most of the participants stated that they tried to ignore the presented faces and concentrated on the words instead.

Discussion

A general inhibitory effect was marginally significant without any consideration taken to the factor of emotion. Hence, Hypothesis 1a (*The memory part of the experiment will produce an inhibitory effect for traits in the practice condition.*) is supported. Retrieval-induced forgetting does occur in the realm of social cognition, even when the information is of strong emotional content. The successful implementation of retrieval practice was confirmed by a significantly higher recall rate for practised items (P+) than for unpractised items. Moreover, the debriefing showed that participants attempted to link the presented information to the relevant persons, suggesting that the persons functioned as categories and the given items were encoded as category members. The results of the EDT showed a corresponding emotional loading of the different images and thus confirmed an accurate attribution of the studied bits of information. Another important prerequisite for retrieval-induced forgetting is competition between the

nontarget and target information. Since this study used different kinds of information for nontargets than targets, it is of outmost importance to control for rivalry. The neutral information in the control condition should have the same or a lower recall rate than the traits in the control condition. As presented in the results, no significant difference in recall rate was found between C+ items and C− items; hence, the induced competition may be considered satisfactory for the experiment as a whole.

The pattern of recall rates reflected a strong negativity bias. The negativity bias verifies the successful construction of negative emotional traits. Furthermore, the first part of Hypothesis 1b (*Negative traits will be better remembered than positive and neutral traits due to a negativity bias.*) is confirmed. Emotional intensity did not seem to influence the recall rate, as positive traits were actually less well recalled than the neutral ones. The fact that the congruency effect in the EDT was as large for positive persons as for negative persons adverts that a lack of increased remembrance of positive traits was not due to a failure in emotional intensity. Thus, the second part of the Hypothesis 1b (*Positive traits will be better remembered than neutral traits due to emotional intensity.*) is unsupported. An explanation for the slightly higher recall of neutral traits is that even the neutral traits were more or less emotionally charged. In comparison with the strongly positive traits, they become more negative and hence, are subject to a negativity bias (Storm et al., 2005).

When examining retrieval-induced forgetting for each emotional condition separately, the inhibitory effect was only reliable for negative traits. This partly proves Hypothesis 1c (*There will be a difference in the inhibitory effect depending on the traits' emotionality. Due to greater interference, negative and positive traits will be more inhibited than neutral ones with the strongest inhibition exhibited for negative information.*) as a stronger inhibitory effect for negative traits was anticipated. Given earlier studies though, an inhibitory effect should be apparent in the other conditions as well (Macrae & MacLeod, 1999; Storm et al., 2005). As mentioned earlier, the unpractised neutral information should have a similar or lower recall rate than the traits to secure a competition between nontargets and targets. Pairwise comparisons between C+ and C− from the different emotional categories demonstrate a significantly better recall rate for unpractised negative traits than unpractised neutral information. For positive and neutral conditions the opposite was true, with a significantly lower recall rate for positive traits and an almost significantly lower recall rate for neutral traits than for neutral information. A possible interpretation of these results is that the interference from competitors necessary for retrieval-induced forgetting was not apparent in

the neutral and positive conditions of the current experiment. Applying these results to Hypothesis 1c, the experiment did not show an inhibitory effect for neutral and positive traits, but cannot disprove an inhibitory effect for those traits either. The experiment did not give any information about how the differences in the inhibitory effect between emotional conditions would be if the presuppositions were satisfactory. The study demonstrated though, that the preconditions for retrieval-induced forgetting were easier met regarding negative traits since competition was easier achieved in that case.

The more liberal emotional accuracy measure was analysed to investigate if the general concept of good and bad was affected by retrieval-induced forgetting to a smaller extent than the actually studied emotional traits (e.g. lexical representations). Since the neutral traits were in fact weaker emotional traits of different valence, neutral could not be seen as a clear-cut general concept and therefore emotional accuracy was not applicable for neutral traits. A notion that was supported by significantly lower recall rates for neutral traits than positive and negative traits when applying the measure of emotional accuracy. Recall rates for positive traits were enhanced when looking at the general concept of good instead of correct target words, but the lack of an inhibition effect remained. Since negative traits were the only ones exhibiting an inhibitory effect at a lexical level, they were also the only ones that could prove a decrease in retrieval-induced forgetting when moving to a conceptual level. Interestingly, the inhibitory effect for negative traits was diminished when using the more generous measure of emotional-accuracy. The effect was still nearly significant though. Caution should be taken in interpreting these results as the validity of the measure of emotional accuracy may be questioned. The participants were not instructed to write a word of accurate valence if they did not know the correct word. Emotional accuracy was calculated on the spontaneous confabulations of right valence made by some participants in addition to the correct traits. As most participants left the words they did not know blank, there was no certainty to them knowing or not knowing the emotional category. Furthermore, the largest part of the measure of emotional accuracy was still made up by the correct traits and hence, the remaining indication of an inhibitory effect for negative traits may in fact be due to retrieval-induced forgetting of target words. The diminishing inhibitory effect for negative traits is therefore merely an indication, though it is an additional puzzle piece taken together with results from the debriefing and the EDT. The debriefing supported the notion of a remaining concept of good and bad for the studied persons as several participants reported knowing the valence associated with previously encountered persons, but failing to remember the exact word.

In support of Hypothesis 2a (*The attitude part of the experiment will show a congruency effect for positive and negative persons, with congruent target words being categorised faster than incongruent targets.*), the modified EDT revealed a significant effect of congruency, with a faster response time for congruent targets and images than incongruent counterparts. This congruency effect suggests that the EDT is an appropriate measure of implicit attitudes in the present experiment. Although the EDT managed to capture implicit attitudes, it did not show a difference in attitudes between persons from control and practice condition. Not even when the 23 participants that demonstrated an inhibitory effect were singled out a significant difference in congruency effect between control and practice condition was apparent. Therefore, it appears that implicit attitudes are not changed by retrieval-induced forgetting and Hypothesis 2b (*To the extent that retrieval-induced forgetting occurs, the congruency effect will be more pronounced for the persons included in the control condition than for the practiced ones. If the inhibitory effect is larger for negative than positive traits, a corresponding difference between control and practice condition will be found in the EDT.*) is unsupported. Nevertheless, reaction time values in the conditions of interest formed a pattern that is in line with the hypothesis. Even though the critical interaction was not significant, the difference in response time between congruent and incongruent target words was greater for prime images from the control condition than from the practice condition. It is conceivable that Hypothesis 2b will receive support in future research employing an experimental manipulation that induces a greater inhibitory effect and a more sensitive measure of implicit attitudes.

Possible moderating and masking factors

The recall performance in the memory part might have been decisively affected by the participants' motivation to fulfil the experiment. As many participants felt they were not doing well during the memory part, their motivation was probably low, especially during the final blocks. This was confirmed by several participants during debriefing. A lack of motivation might not only have affected the overall recall rate, but also the amount of retrieval-induced forgetting, since inhibitory control should be influenced by the level of attention as it is the case for all kinds of cognitive control.

The debriefing also revealed that the encoding of the study material often was supported by the use of different memory strategies. As a great number of participants engaged in interconnecting all six bits of information about a person with each other, the possibility must

be considered that an actual inhibitory effect was masked by integration. On the other hand, the items were presented for 5s which corresponds to the usual time span of 4 – 5 s that has previously been used to avoid integration (Anderson & Bell, 2001). Furthermore, the question remains whether this strategy was applied to a greater extent for positive and neutral traits, thereby accounting for the fact that no inhibitory effect was detected for these kinds of traits as opposed to negative traits. It is conceivable that integration was especially used during encoding of neutral and positive items, as for many participants such information was subjectively harder to remember than negative information.

Another factor that might have been moderating retrieval-induced forgetting in the present study is similarity. In case of target-target similarity, retrieval-induced forgetting could have been amplified, whereas a target-nontarget similarity would have led to an attenuated inhibitory effect. It is conceivable that P+ items (nontargets) consisting of neutral information about a person's profession, city and hobby were more similar to positive and neutral P− items (targets) than to negative P− items (targets); thus, giving rise to target-nontarget similarity which protected positive and neutral traits from forgetting. The fact that the stimulus material in general contained a couple of items with very similar meanings is also important to discuss. To the extent that the C− items were synonyms or similar to the P− items, it is possible that also the former type was affected by inhibition due to a generalisation to connected categories and items (Anderson & Bell, 2001). Thus, it is possible that a baseline deflation lowered the obtained inhibitory effect for negative traits and it may also account for the failure to detect any inhibitory effects for positive and neutral traits. A generalizing inhibitory effect could even be an alternative explanation for the relative lower recall rate of positive and neutral C− items in comparison to C+ items. As mentioned above, even cue priming has been shown to mask inhibition. However, it is unlikely that this factor explains the pattern of retrieval-induced forgetting obtained in the present study, as it should not vary with the different emotional valences.

Issues of validity and ideas for improvement

The retrieval-induced forgetting paradigm applied in the present study is a well-documented procedure that has produced reliable results in multitudinous studies (e.g. Anderson et al., 1994; Anderson & Spellman, 1995; Bäuml & Kuhbandner, 2007; Storm, Bjork & Bjork, 2007). However, the stimulus material used in the present study was constructed from scratch and as the preceding considerations imply, it could be improved in several ways. First, it

would be advantageous to reduce or preferably eliminate synonyms and similarity among the items that are to be learned. Moreover, to ensure that nontarget and target items do not differ in other aspects than the experimentally manipulation, the neutral information, such as profession, city of origin and hobby that served as nontarget items should be replaced by neutral traits if possible. Besides testing each trait in isolation in a pilot study with regards to intensity and valence, the traits should also be tested within the context of the exemplifying sentences. For instance, it is conceivable that the same trait has different emotional implications dependant on the context it is presented in. Thus, a person that is said to be aggressive because he or she unprovoked becomes violent creates a quite different impression than a person that is described as aggressive because he or she often shouts at others.

The evaluative decision task applied in the present study is also based on a well proven procedure. Though, it differs from the original design, since it does not involve priming in a subliminal manner. Furthermore, the participants were not given the possibility to train as is commonly done. Nevertheless, the obtained results indicate that the present variant also functions as it produced a reliable congruency effect. This is rather astonishing as the primes consisted of neutral faces that received their emotionally loading just a short time before the attitude part began. Given that the attitudes measured in the EDT were established during the experiment, confounding variables such as prejudices, stereotypes, and the presented persons' gender and attractiveness could be controlled for by counterbalancing the stimuli over conditions.

The present study was conducted in a highly controlled experimental setting that promotes internal validity. However, this kind of benefit is usually accompanied by drawbacks with regard to external validity. The way of meeting and getting to know other people in a laboratory context as in the present study is likely to differ from real world situations in several aspects. In reality we experience other people with all our senses, thus, receiving much more information about them, which might affect our attitudes. Moreover, the traits that are characterising a person are usually not that obvious; rather, they will become prominent stepwise due to our own and other experiences. Hence, emotional impressions formed in real life might be quite different from that created in a laboratory.

The sample in this study is composed of students that are native Swedish speakers only, which raises the question if the results can be generalised to different populations. However, although the way in which the stimulus material itself is perceived is probably strongly influenced by culture, inhibition is a basal memory function and retrieval-induced forgetting

as its consequence should be present in individuals with a totally different psychosocial or cultural background.

In general, recall performance in the memory part of the experiment is rather low. The highest recall rate is found for practised items and amounts to 57% only, although the participants had practised each item three times. Several participants had to be excluded from statistical analyses because of floor effects. Thus, the results mainly reflect the performance of participants with a good ability to remember. The question arises in how far the results are representative for persons who do not remember things as well. One alternative to increase the general recall performance would be to reduce the amount of items to be learned, for instance by shortening the study phase and adding more blocks. Another possibility is to shorten the interval between study and test phase by reducing the amount of retrieval practice. Since Macrae and MacLeod's (1999) showed that forgetting is not moderated by the amount of retrieval practice, one could consider having the items retrieved just once instead of three times. This would also prevent participants from repeatedly retrieving the same items during the test phase as was the case in the present study. It is also possible that the describing sentences contributed to the difficulty to remember, since they delivered even more information that had to be processed. Yet, Storm et al. (2005) succeeded in producing an inhibitory effect when presenting the study material in the form of sentences. In the present study, the sentences may actually have improved memory for the emotional meaning by deepening the encoding process.

General discussion

The precautions aside, what do the results from the experiment tell us? Stunningly enough, to repeat neutral information about people we meet actually makes us forget the more emotionally loaded and probably more important information. Contrary to what may be expected from pure intuition, it is the most negative and gruesome information that diminishes. This could be a very hopeful detection since a lot of negative information we have about other persons actually are false. In the realm of stereotyping, several groups in our society are subject to negative attitudes that are hard to get around. Could media reporting more everyday goings-on about these groups actually change the public's opinion?

Sadly, attitudes do not seem to change so easily. Even when the reasons for disliking a person have fallen into oblivion, the negative impression of that person may last. This is true for both explicit attitudes (Storm et al., 2005) and implicit attitudes. Implicit attitudes are furthermore

reflected in behaviour (Dovido et al., 1997; Rydell & McConnell, 2006). Although implicit attitudes are expressed in subtle ways as eye-contact and physical distance, they are still apparent for the persons in concern. The persistence of attitudes is not all bad though, sometimes it is advantageous for us to know who is to be trusted. Additionally, the emotional intensity in the current experiment was strong. The negative persons were described as beating up their kids and taking credit for other people's work at the office. It is possible that impressions are subjects to change in the realm of retrieval-induced forgetting if the negative information is of less weight or if the neutral information is more frequently retrieved. However, when we get to know something extremely negative about a person, it might be helpful to remain aware of keeping some caution around that person.

Further research

The question of how far the intensity of the emotional impressions influences our readiness to change our implicit or explicit attitudes remains a topic of future research. Another question that is brought up by the present study is whether positive and negative attitudes may be affected differently by retrieval-induced forgetting. Since forgetting was not induced for positive traits, the present study leaves this question unanswered. Theoretically, it is still possible that positive implicit attitudes are more susceptible to inhibition than negative implicit attitudes. Future research might also address the temporal aspects of retrieval-induced forgetting and its effects, such as the possibility that attitude changes might be achieved in the long run. An interesting further development of the present study would be to investigate the relation between implicit memory tests of retrieval-induced forgetting and changes in implicit attitudes. When it comes to the effect that retrieval practice has on different kinds of emotional stimuli, it is worth to further examine the role of emotional intensity and valence, partly to generate more unambiguous results, partly to deepen the knowledge about the underlying mechanisms of forgetting. For instance, it could be empirically examined if neutral traits actually become more negative in comparison to strongly positive traits. The relationship between emotion and retrieval-induced forgetting needs to be examined in more detail, as such research could deliver further support of inhibition accounts of retrieval-induced forgetting, such as Anderson's (2003) model of executive control.

Acknowledgements

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Block 1

Information	**Describing sentence**

Neutral Information 1
gymnasielärare   X arbetar som
Linköping   X kommer från
handboll   X sysslar på fritiden med

Neutral Information 2
civilingenjör   X arbetar som
Växjö   X kommer från
hemslöjd   X sysslar på fritiden med

Neutral Information 3
ekonom   X arbetar som
Östersund   X kommer från
matlagning   X sysslar på fritiden med

Neutral Information 4
bibliotekarie   X arbetar som
Umeå   X kommer från
piano   X ägnar sig på fritiden åt att spela

Neutral information 5
vårdbiträde   X arbetar som
Lund   X kommer från
fågelskådning   X ägnar sig på fritiden åt

Neutral information 6
vaktmästare   X arbetar som
Simrishamn   X kommer från
paddling   X ägnar sig på fritiden åt

Negative traits 1
brutal   X har flera gånger slagit ner någon som provocerat X. X är
ilsken   X är snabb att skälla ut andra när de gör fel. X är
egoistisk   X bryr sig bara inte om hur andra mår. X är

Negative traits 2
grym   X slår sina barn. X är
lömsk   X pratar förtroligt med kollegor för att sedan kunna rapportera till chefen. X är
avundsjuk   X missunnar sin kompis stipendiet hon fått. X är

Neutral traits 1
tystlåten   X pratar inte mycket under möten. X är
impulsiv   X gör ofta det X känner för. X är
känslig   X tar lätt åt sig av andras kommentarer. X är

Neutral traits 2
kräsen   X äter bara färska grönsaker. X är
risktagande   X spekulerar med sina pengar på börsen. X är
envis   X ger sig sällan, när X väl har bestämt sig. X är

Information	**Describing sentence**

Positive traits 1

hoppfull	X tappar inte modet vid motgångar. X är
begåvad	X lär sig enkelt nya saker. X är
pålitlig	X genomför alltid det som X tar på sig. X är

Positive traits 2

generös	X donerar alltid en del av sin lön till välgörenhet. X är
uppriktig	X är alltid öppenhjärtig mot sina vänner. X är
hjälpsam	X ställer alltid upp när en vän behöver barnpassning. X är

Block 2

Information	**Describing sentence**

Neutral Information 7

socionom	X arbetar som
Malmö	X kommer från
fiske	X sysslar på fritiden med

Neutral Information 8

frisör	X arbetar som
Ystad	X kommer från
segling	X ägnar sig på fritiden åt

Neutral Information 9

brevbärare	X arbetar som
Stockholm	X kommer från
höjdhopp	X sysslar på fritiden med

Neutral Information 10

apotekare	X arbetar som
Göteborg	X kommer från
jonglering	X sysslar på fritiden med

Neutral Information 11

konditor	X arbetar som
Jönköping	X kommer från
fotografering	X ägnar sig på fritiden åt

Neutral Information 12

butiksbiträde	X arbetar som
Falun	X kommer från
dans	X sysslar på fritiden med

Negative traits 3

elak	X säger ofta till sina bekanta sådant som han vet sårar dem mest. X är
arrogant	X lyssnar inte på sina kollegor då han tycker att han kan sitt jobb bäst. X är
bister	X sitter ofta och muttrar framför datorn. X är

Information	**Describing sentence**

Negative traits 4

hatisk	X tycker illa om de flesta X träffar. X är
oärlig	X tar åt sig äran för sådant som andra gjort. X är
tråkig	X pratar alltid om samma saker. X är

Neutral traits 3

nervös	X får lätt darriga händer vid redovisningar. X är
värnlös	X försvarar sig sällan i konflikter. X är
pratsam	X tycker om långa telefonsamtal. X är

Neutral traits 4

klumpig	X spiller ofta kaffe vid frukostbordet. X är
blyg	X pratar inte så ofta med nya människor. X är
övertygande	X brukar kunna få folk på sin sida. X är

Positive traits 3

vänlig	X säger ofta snälla saker till sina arbetskamrater. X är
ambitiös	X gör alltid sitt bästa på jobbet. X är
godhjärtad	X arbetar på ett kök för hemlösa på helgerna. X är

Positive traits 4

hänsynsfull	X ser alltid till att alla röster hörs vid en diskussion. X är
självständig	X tar sitt liv i egna händer. X är
ansvarsfull	X köper oftast rättvisemärkta varor. X är

Block 3

Information	**Describing sentence**

Neutral Information 13

systemutvecklare	X arbetar som
Halmstad	X kommer från
teater	X sysslar på fritiden med

Neutral Information 14

golvläggare	X arbetar som
Härnösand	X kommer från
bordtennis	X sysslar på fritiden med

Neutral Information 15

logoped	X arbetar som
Vänersborg	X kommer från
elgitarr	X sysslar på fritiden med att spela

Neutral Information 16

receptionist	X arbetar som
Norrköping	X kommer från
cykling	X ägnar sig på fritiden åt

Information	**Describing sentence**
Neutral Information 17	
kemist	X arbetar som
Ronneby	X kommer från
dykning	X ägnar sig på fritiden åt
Neutral Information 18	
optiker	X arbetar som
Kalmar	X kommer från
schack	X ägnar sig på fritiden åt
Negative traits 5	
ondskefull	X ger sina kollegor fel information så att de gör dåligt ifrån sig. X är
bitter	X klagar ofta på gamla oförrätter. X är
intolerant	X lyssnar inte på andras åsikter om X själv får som X vill. X är
Negative traits 6	
falsk	X pratar ofta illa om personer som X låtsas vara vän med. X är
argsint	X tappar lätt humöret när folk säger emot X. X är
snål	X bjuder aldrig sina vänner när de är ute. X är
Neutral traits 5	
otålig	X tycker inte om att stå i kö. X är
barnslig	X gillar fortfarande att busringa. X är
kvick	X är bra på att kontra i diskussioner. X är
Neutral traits 6	
tveksam	X tar inte gärna snabba beslut. X är
käck	X tar det mesta med en klackspark. X är
ivrig	X vill gärna påbörja saker direkt. X är
Positive traits 5	
uppmuntrande	X får människor i sin omgivning att må bättre. X är
vis	X har lärt sig mycket av livet. X är
omtänksam	X frågar ofta hur andra mår. X är
Positive traits 6	
entusiastisk	X går med glädje in i nya projekt. X är
modig	X säger emot när chefen beter sig dåligt. X är
gästvänlig	X bjuder ofta hem folk på middag. X är

Block 4

Information	**Describing sentence**
Neutral Information 19	
elektriker	X arbetar som
Västerås	X kommer från
målning	X sysslar på fritiden med

Information	**Describing sentence**

Neutral Information 20
farmakolog	X arbetar som
Uppsala	X kommer från
biljard	X sysslar på fritiden med att spela

Neutral Information 21
trafiklärare	X arbetar som
Borås	X kommer från
motocross	X sysslar på fritiden med

Neutral Information 22
fritidsledare	X arbetar som
Höör	X kommer från
ridning	X ägnar sig på fritiden åt

Neutral Information 23
tandtekniker	X arbetar som
Karlskrona	X kommer från
löpning	X ägnar sig på fritiden åt

Neutral Information 24
Specialpedagog	X arbetar som
Kiruna	X kommer från
Yoga	X ägnar sig på fritiden åt

Negative traits 7
illojal	X byter umgänge så fort det kan ge X fördelar. X är
opålitlig	X säger ofta att X ska fixa saker för att sedan strunta i det. X är
ytlig	X umgås bara med människor som bär märkeskläder. X är

Negative traits 8
aggressiv	X har lätt för att vråla på folk som irriterar X. X är
äcklig	X har dålig kroppshygien. X är
girig	X kan aldrig känna sig nöjd efter en löneförhöjning. X är

Neutral traits 7
fånig	X tramsar ofta i fikarummet. X är
rastlös	X har svårt att sitta still under långa tågresor. X är
oskyldig	X snattade aldrig i tonåren. X är

Neutral traits 8
glömsk	X förlägger ofta sina nycklar. X är
timid	X tar inte gärna plats på sitt jobb. X är
emotionell	X gråter lätt när X ser en gripande film. X är

Positive traits 7
samarbetsvillig	X jobbar bra ihop med andra i team. X är
hygglig	X behandlar alla människor väl. X är
ödmjuk	X har stor respekt för sina kollegors åsikter. X är

Information   **Describing sentence**

Positive traits 8
ljuvlig   X är bra på att göra middagsbjudningar trivsamma. X är
optimistisk   X har en tro på att allt löser sig. X är
humoristisk   X är bra på skämtteckningar. X är

Skattning av egenskaper

Ålder:
Kön:
Modersmål:

Instruktioner

På följande sidor ser du listor med olika adjektiv. För varje adjektiv ska du föreställa dig att det beskriver en person. Hur skulle du skatta personen om du utgår ifrån att adjektivet är kännetecknande för denna och bortser från att människor i realiteten så klart har mer än en enda egenskap?

Till höger om adjektivet finns en sjugradig skala. Gör din skattning genom att kryssa för den siffra som du tycker passar bäst. Är du osäker på adjektivets betydelse, stryk ordet.

Det finns inget rätt eller fel, det är den subjektiva upplevelsen som är viktig. Arbeta snabbt men noggrant.

Exempel

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
Aggressiv	1	2	3	4	5	6	7

Tack för din medverkan!

Corinna Brazel och Karin Ringqvist, psykologprogrammet, termin 9

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
1. Aggressiv	1	2	3	4	5	6	7
2. Aktiv	1	2	3	4	5	6	7
3. Ambitiös	1	2	3	4	5	6	7
4. Ansvarsfull	1	2	3	4	5	6	7
5. Argsint	1	2	3	4	5	6	7
6. Arrogant	1	2	3	4	5	6	7
7. Artig	1	2	3	4	5	6	7
8. Asocial	1	2	3	4	5	6	7
9. Avundsjuk	1	2	3	4	5	6	7
10. Barnslig	1	2	3	4	5	6	7
11. Begåvad	1	2	3	4	5	6	7
12. Behaglig	1	2	3	4	5	6	7
13. Beroende	1	2	3	4	5	6	7
14. Beslutsam	1	2	3	4	5	6	7
15. Bister	1	2	3	4	5	6	7
16. Bitter	1	2	3	4	5	6	7
17. Blyg	1	2	3	4	5	6	7
18. Brutal	1	2	3	4	5	6	7
19. Brysk	1	2	3	4	5	6	7
20. Charmig	1	2	3	4	5	6	7
21. Cynisk	1	2	3	4	5	6	7
22. Djup	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?		Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
23.	Duktig	1	2	3	4	5	6	7
24.	Eftertänksam	1	2	3	4	5	6	7
25.	Egoistisk	1	2	3	4	5	6	7
26.	Elak	1	2	3	4	5	6	7
27.	Emotionell	1	2	3	4	5	6	7
28.	Energisk	1	2	3	4	5	6	7
29.	Entusiastisk	1	2	3	4	5	6	7
30.	Envis	1	2	3	4	5	6	7
31.	Falsk	1	2	3	4	5	6	7
32.	Fantasifull	1	2	3	4	5	6	7
33.	Fridfull	1	2	3	4	5	6	7
34.	Fräsch	1	2	3	4	5	6	7
35.	Fånig	1	2	3	4	5	6	7
36.	Försiktig	1	2	3	4	5	6	7
37.	Galen	1	2	3	4	5	6	7
38.	Generös	1	2	3	4	5	6	7
39.	Girig	1	2	3	4	5	6	7
40.	Glad	1	2	3	4	5	6	7
41.	Glömsk	1	2	3	4	5	6	7
42.	Gnällig	1	2	3	4	5	6	7
43.	Godhjärtad	1	2	3	4	5	6	7
44.	Grym	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
45.	Gullig	1	2	3	4	5	6	7
46.	Gästvänlig	1	2	3	4	5	6	7
47.	Hatisk	1	2	3	4	5	6	7
48.	Hjälpsam	1	2	3	4	5	6	7
49.	Hoppfull	1	2	3	4	5	6	7
50.	Humoristisk	1	2	3	4	5	6	7
51.	Hygglig	1	2	3	4	5	6	7
52.	Hänsynsfull	1	2	3	4	5	6	7
53.	Ignorant	1	2	3	4	5	6	7
54.	Illojal	1	2	3	4	5	6	7
55.	Ilsken	1	2	3	4	5	6	7
56.	Impulsiv	1	2	3	4	5	6	7
57.	Intolerant	1	2	3	4	5	6	7
58.	Ivrig	1	2	3	4	5	6	7
59.	Kallhjärtad	1	2	3	4	5	6	7
60.	Karismatisk	1	2	3	4	5	6	7
61.	Klumpig	1	2	3	4	5	6	7
62.	Kritisk	1	2	3	4	5	6	7
63.	Kräsen	1	2	3	4	5	6	7
64.	Kvick	1	2	3	4	5	6	7
65.	Käck	1	2	3	4	5	6	7
66.	Känslig	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
67.	Ljuvlig	1	2	3	4	5	6	7
68.	Lojal	1	2	3	4	5	6	7
69.	Lugn	1	2	3	4	5	6	7
70.	Löjlig	1	2	3	4	5	6	7
71.	Lömsk	1	2	3	4	5	6	7
72.	Medkännande	1	2	3	4	5	6	7
73.	Menlös	1	2	3	4	5	6	7
74.	Misstänksam	1	2	3	4	5	6	7
75.	Missunnsam	1	2	3	4	5	6	7
76.	Modig	1	2	3	4	5	6	7
77.	Naiv	1	2	3	4	5	6	7
78.	Nervös	1	2	3	4	5	6	7
79.	Noggrann	1	2	3	4	5	6	7
80.	Nyfiken	1	2	3	4	5	6	7
81.	Nyttig	1	2	3	4	5	6	7
82.	Oansvarig	1	2	3	4	5	6	7
83.	Obegåvad	1	2	3	4	5	6	7
84.	Observant	1	2	3	4	5	6	7
85.	Obstinat	1	2	3	4	5	6	7
86.	Ogin	1	2	3	4	5	6	7
87.	Omogen	1	2	3	4	5	6	7
88.	Omtänksam	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
89. Ondskefull	1	2	3	4	5	6	7
90. Optimistisk	1	2	3	4	5	6	7
91. Opålitlig	1	2	3	4	5	6	7
92. Orolig	1	2	3	4	5	6	7
93. Orädd	1	2	3	4	5	6	7
94. Oskyldig	1	2	3	4	5	6	7
95. Otålig	1	2	3	4	5	6	7
96. Oärlig	1	2	3	4	5	6	7
97. Passiv	1	2	3	4	5	6	7
98. Pervers	1	2	3	4	5	6	7
99. Pratsam	1	2	3	4	5	6	7
100. Pålitlig	1	2	3	4	5	6	7
101. Rabiat	1	2	3	4	5	6	7
102. Rastlös	1	2	3	4	5	6	7
103. Rationell	1	2	3	4	5	6	7
104. Respektlös	1	2	3	4	5	6	7
105. Risktagande	1	2	3	4	5	6	7
106. Rolig	1	2	3	4	5	6	7
107. Samarbetsvillig	1	2	3	4	5	6	7
108. Sarkastisk	1	2	3	4	5	6	7
109. Självisk	1	2	3	4	5	6	7
110. Självständig	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?		Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
111.	Självsäker	1	2	3	4	5	6	7
112.	Slarvig	1	2	3	4	5	6	7
113.	Smaklös	1	2	3	4	5	6	7
114.	Smart	1	2	3	4	5	6	7
115.	Snobbig	1	2	3	4	5	6	7
116.	Snål	1	2	3	4	5	6	7
117.	Snäll	1	2	3	4	5	6	7
118.	Social	1	2	3	4	5	6	7
119.	Stolt	1	2	3	4	5	6	7
120.	Svag	1	2	3	4	5	6	7
121.	Säker	1	2	3	4	5	6	7
122.	Taktfull	1	2	3	4	5	6	7
123.	Taktlös	1	2	3	4	5	6	7
124.	Timid	1	2	3	4	5	6	7
125.	Tokig	1	2	3	4	5	6	7
126.	Tolerant	1	2	3	4	5	6	7
127.	Trevlig	1	2	3	4	5	6	7
128.	Tråkig	1	2	3	4	5	6	7
129.	Tveksam	1	2	3	4	5	6	7
130.	Tystlåten	1	2	3	4	5	6	7
131.	Uppmuntrande	1	2	3	4	5	6	7
132.	Uppriktig	1	2	3	4	5	6	7

Hur skulle du skatta en person som beskrivs med följande egenskap?	Mycket Negativt	Negativt	Något negativt	Neutralt	Något positivt	Positivt	Mycket positivt
133. Uthållig	1	2	3	4	5	6	7
134. Vek	1	2	3	4	5	6	7
135. Velig	1	2	3	4	5	6	7
136. Vemodig	1	2	3	4	5	6	7
137. Vidsynt	1	2	3	4	5	6	7
138. Vis	1	2	3	4	5	6	7
139. Vitsig	1	2	3	4	5	6	7
140. Vulgär	1	2	3	4	5	6	7
141. Vänlig	1	2	3	4	5	6	7
142. Värnlös	1	2	3	4	5	6	7
143. Ytlig	1	2	3	4	5	6	7
144. Äcklig	1	2	3	4	5	6	7
145. Ängslig	1	2	3	4	5	6	7
146. Ärlig	1	2	3	4	5	6	7
147. Äventyrslysten	1	2	3	4	5	6	7
148. Ödmjuk	1	2	3	4	5	6	7
149. Öppen	1	2	3	4	5	6	7
150. Övertygande	1	2	3	4	5	6	7

Positive words	**Negative words**
empati	blodbad
fred	krig
eufori	kris
glädje	smärta
lycka	mardröm
njutning	svält
romantik	dråp
ömhet	mördare
frid	slakt
godhet	terror
idyll	vanvett
fägring	ångest
närhet	bödel
frihet	cancer
ideal	skada
fröjd	sorg
harmoni	tragedi
välbehag	slaveri
solsken	plåga
passion	helvete
charm	skräck
oas	maktlös
paradis	förfall
kärlek	våld

Department of Psychology
Mikael Johansson, PhD
Projektansvarig

INFORMATION TILL FORSKNINGSPERSON

Tillfrågande om deltagande
Du tillfrågas härmed om Du vill deltaga i denna studie som inkluderar datoriserade beteendetest.

Bakgrund och syfte
Det generella syftet med undersökningen är att öka förståelsen för grundläggande minnesfunktioner. Avsikten är att kartlägga hur vi lagrar och plockar fram information om nya individer ur minnet samt att förklara varför vi ibland glömmer informationen.

Studiens genomförande och risker
Experimentet består av två huvuddelar. I en del kommer ett antal stimuli (t ex ord, bilder) att presenteras och Din uppgift är att försöka lägga dessa på minnet och i en andra del kommer Din minnesprestation för det inlärda materialet att mätas.

Experimentet är helt datoriserat, vilket innebär att Du kommer att presenteras för olika typer av stimuli på en datorskärm och att alla Dina bedömningar samlas in för lagring via knapptryckningar.

Undersökningstiden är c:a 1 timme.

Hantering av data
Persondata från studien kommer att lagras i ett register och databehandlas. Dina uppgifter är sekretesskyddade och ingen obehörig har tillgång till registret. Då data från studien publiceras kommer enskilda individer inte att kunna identifieras. Hanteringen av Dina uppgifter regleras av Personuppgiftslagen (SFS1998:204). Se bifogad bilaga med allmän information om behandling av personuppgifter i forskningssyfte vid Lunds universitet.

Sekretess
Vi behandlar resultaten av studien konfidentiellt.

Frivillighet
Du deltar helt frivilligt och kan när som helst avbryta Din medverkan i studien utan att behöva ange någon anledning.

Ytterligare information
Förutom denna skriftliga information kommer Du att bli muntligen informerad före
undersökningen. Då får Du också möjlighet att ställa frågor. Du är också välkommen att ringa
någon av följande personer för att få ytterligare information.

Mikael Johansson, projektansvarig
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Tel: 046 – 222 36 39

Corinna Brazel   *Karin Ringqvist*
Student, termin 10   Student, termin 10
Psykologprogrammet   Psykologprogrammet
Institutionen för psykologi   Institutionen för psykologi
Tel: 0705-463174   Tel: 0702-171564

Jag har muntligen informerats om studien och tagit del av den skriftliga informationen. Jag är
medveten om att mitt deltagande i studien är fullt frivilligt och att jag när som helst och utan
närmare förklaring kan avbryta mitt deltagande.

_____   _____
Datum   Datum

_____   _____
Deltagarens signatur   Studieansvarigs signatur

_____   _____
Deltagarens namnförtydligande   Studieansvarigs namnförtydligande

General introduction

Välkommen!

Den här uppgiften handlar om hur bra vi är på att minnas personer i vår omgivning.

Hur uppfattar just du människor du möter?

Tryck mellanslag...

I experimentet kommer du att presenteras för ett antal personer som visas på bild på skärmen. Du får också lite bakgrundsinformation om de du möter och du ska försöka lägga denna information på minnet inför ett avslutande minnestest.

Experimentet består av 4 block och varje block involverar 3 delar: instudering, minnesövning och avslutande minnestest.

Tryck mellanslag...

Instudering

Här kommer du att få bekanta dig med några olika personer. Det kommer att presenteras sex personer i varje block, tre män och tre kvinnor. Om varje person kommer sex bitar av information att presenteras. Informationen om de olika personerna kommer att presenteras blandat, då vi i vardagen sällan får reda på allt om en person på en gång.

Det är viktigt att du försöker minnas den information du får om varje människa du möter. Skapa dig en hel bild av varje person genom att koppla informationen till det ansikte som visas.

Tryck mellanslag ...

Minnesövning

Här får du en möjlighet att öva dig på att plocka fram en del av den information du har lärt dig om de personer som du precis har mött.

Som ledtråd får du de två första bokstäverna i nyckelordet.

Tryck mellanslag...

Avslutande minnestest

Här ska du försöka minnas samtlig information som du lärt dig om de personer du nyligen mött.

Denna gång får du enbart den första bokstaven som ledtråd.

Tryck mellanslag ...

Vi pausar nu innan experimentet börjar. Säg till försöksledaren att du är klar med introduktionen.

Memory part

Instructions for Study phase

Instudering

Nu ska du lära dig om olika personer.

Bilder visas på de personer som du nu ska bekanta dig med. Under varje bild följer korta beskrivningar av denna person. Varje beskrivning avslutas med ett nyckelord som visas i blå färg. Lägg bilderna och de tillhörande nyckelorden på minnet.

Tryck mellanslag för att fortsätta...

Instructions for Retrieval practice phase

Minnesövning

Nu får du en möjlighet att öva dig på att plocka fram en del av den information du har lärt dig om de personer som du precis har mött.

Som ledtråd får du de två första bokstäverna i nyckelordet.

Skriv ner ordet på tangentbordet och avsluta med att trycka på ENTER. Arbeta snabbt men noggrannt.

Tryck mellanslag för att fortsätta...

Instructions for Test phase

Minnestest

Nu ska du återigen försöka minnas vad du har lärt dig om personerna, som du nyligen har mött.

Denna gång får du enbart den första bokstaven som ledtråd.

Skriv ner ordet på tangentbordet och avsluta med att trycka på ENTER. Arbeta snabbt, men noggrant.

Tryck mellanslag för att fortsätta...

Attitude part

Instructions for EDT

Innan experimentet avslutas kommer nu ett kort reaktionstidstest.
De personer som du fått lära känna under experimentet kommer att presentera olika ord för dig.
Dessa ord är antingen positiva eller negativa. Din uppgift är att så snabbt du kan sortera dem i rätt kategori.

Positiva ord (Negativa ord): tryck på blå knapp (Vänsterpil, vänster pekfinger)

Negativa ord (Positiva ord): tryck på gul knapp (Högerpil, höger pekfinger)

Tryck mellanslag för att fortsätta...

Debriefing

1. Hur tror du att det gick?
2. Vad tror du experimentet handlade om?
3. Använde du någon speciell minnesstrategi?
4. Läste du meningarna hela tiden?
5. Var något mer lätt/svårt att minnas?
6. Såg du något system?
7. Har du några tankar angående den avslutande uppgiften?