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Process-Dissociation Procedure: Separating Implicit and Explicit Influences of Memory for Emotional Material

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Abstract

We investigated the role of implicit and explicit memory in the processing of emotional information versus neutral information. By following the process-dissociation procedure, devised by Jacoby (1991), we measured the influence of conscious and nonconscious memory utilizing a stem-completion task. Jacoby's process-dissociation enabled us to dissociate the influences of implicit and explicit memory for emotional words and neutral words. We found no significant difference between emotional and neutral words when measuring conscious and nonconscious memory. An Attention effect was replicated where there was a great effect on conscious memory in full attention as compared to divided attention.

The purpose of our study is to further our understanding on a series of important issues in cognitive psychology. Our question might be phrased, "How does one separate the effects of conscious and nonconscious processes when measuring recollection?" Recent studies in cognitive psychology have focused on questions like this by utilizing indirect memory tests (Graf & Mandler, 1984; Holender, 1986; Reingold & Merikle, 1990). Investigators are continuously attempting to understand what cognitive variables play a role in how information is processed.

In order to investigate human cognitive processes, the model that we used has been defined as the information-processing analysis. The fundamental view of the information-processing approach is that human beings are usefully conceptualized as information processors. Information enters into our system, is acted upon, and produces or influences behavior. That is, human behavior is, in part, a result of multiple, complex, interacting processes.

The information process analysis seeks to break down complex cognitive processes into subprocesses or constituent parts. The general model seeks to describe the flow of information through the system being modified by the stages in processing. In general, the processes are conceptualized as three distinct stages: (a) information enters the system, (b) information is stored, and (c) information is retrieved. Information enters the system via environmental or internal stimulation. Attentional

processes play a role in selecting what is passed on. Once this information is admitted to the system, it is encoded and subsequently enters memory. The final stage of the process is memory retrieval. Retrieval reflects both accessing memory and retrieval for use in directing behavior. Much cognitive research focuses on accessing those memories that have been stored. In particular, our study focuses on how emotional material is received, stored, and retrieved perhaps differently than neutral material. We believe that emotional information may have different effects on the processing system as it may be more salient than neutral information.

Emotion

One of the primary purposes of focusing our study on the effects of emotional words is due to its practical implications. The processing of emotional information is dealt with on a daily basis. Whether the emotional stimuli are acquired from environmental or internal cues, the emotions are often the result of unpredictable and unanticipated events. One's emotional reactions to these unplanned events are usually based on previous experiences in dealing with affective situations. When an emotion is activated, a collection of memories for that specific emotion will also be activated (Bower, 1992).

Much cognitive research concentrates on the role of cognitive processes when dealing with emotional information

(e.g., Bower, 1981; Lazarus, Kanner, & Folkman, 1980; Zajonc, 1984). Lazarus et al. (1980) have proposed a theory of emotion based on cognitive appraisal. This theory consists of appraisal, action impulses, and systematic somatic reactions which differ for each emotion. Lang et al. (1980) have presented a bio-informational theory which integrates cognitive psychology and psychophysiology. Lang's theory identifies semantic, meaning, and response propositions as the basic structure of the emotion system. Propositions refer to non-verbal relationships between concepts.

Bower (1981) has proposed that memory is organized as links in the brain within an associative network. According to Bower, emotions are memory nodes that are activated when affective experiences or events occur. This theory places emotions in conjunction with cognitive variables. Often, emotion and cognition have been regarded as separate entities. However, Bower and Lang propose that there is an interplay between emotion and cognition. We are in agreement with this premise that emotion and cognition operate in conjunction.

Role of Implicit and Explicit Memory in Cognition

A topic in cognitive psychology that is the focus of much research is the dissociation between implicit and explicit memory. Most memory research has focused on the explicit or conscious memory which can be measured or indexed in standard

tests of recognition and recall. Explicit memories are memories of past experiences which can be consciously recollected. However, current studies have indicated an increased interest in the implicit or nonconscious memories. Implicit memories are most often revealed by tasks that require no conscious recollection of past experiences (Schacter, 1987).

Studies of both implicit and explicit memory date back to the seventeenth century, but it is widely accepted that while studying memory, early scholars including Aristotle and Plato were concerned with explicit memory alone. From the seventeenth century to the present, psychologists, philosophers, and psychiatrists have discussed instances in which there was no conscious memory for recent events, but these experiences were indirectly expressed. The occurrence of implicit and explicit memory was reported, but it was not until 1924 that William McDougall defined this phenomena as implicit and explicit memory. For convenience purposes, Schacter (1987) used the term "implicit memory phenomena" to refer to the observations of past researchers.

One of the major contributors to directing attention to the study of the unconscious is Freud. Freud argued that unconscious influences of prior experiences profoundly affect behavior without one's knowledge. Freud's psychoanalytic theory states that unconscious memories are often exposed indirectly and can be measured through projective or indirect tasks. The

psychoanalytic theory focused on implicit memory, but it did not methodologically attempt to separate it from explicit memory.

As noted, to measure explicit memory, direct tests are employed and are often in the form of recognition and recall. While direct tests ask subjects to report on their memories, indirect tests do not require subjects to remember. For indirect tasks, subjects engage in a procedure which indirectly reflects memories for a past event; conscious recollection of the past experience is not required. The most common form of indirect memory tests are word stem and fragment completion tasks (Graf & Mandler, 1984; Jacoby & Witherspoon, 1982). When subjects complete a word stem for an indirect test, the directions for the task usually are to complete the stem with the first word that comes to mind. If subjects are not told to remember a prior word or are not told to think of a specific word, then they will fill in the stem with a word that automatically comes to mind. For a test to be labeled an indirect test, memory processes associated with it must be automatic or nonconscious.

Excluding research from the past few years, most cognitive studies did not attempt to dissociate conscious and nonconscious memory. Regarding early research, Schacter (1987) points out that "the most popular idea was that implicit memory phenomena were produced by memory traces that are too 'weak' to exceed the threshold of strength or activation needed for explicit memory (504)." Our study, however, does attempt to dissociate implicit

and explicit memory. We argue, in agreement with Jacoby (1991), that implicit and explicit memories are separate entities both of which affect behavior.

Some researchers propose that the dissociation of implicit and explicit memory is possible due to their connections with anatomically distinct memory systems (Squire, 1987; Squire & Zola-Morgan, 1988; Tulving, 1985; Weiskrantz, 1989). Support for this postulation is derived from studies of patients with brain damage. Experiments have shown that an amnesic patient's performance on stem-completion tasks is near normal, but performance on direct tests of memory is severely impaired (Graf, Sqire, Mandler, 1984; Warrington & Weiskrantz, 1974). These studies indicate that the amnesia adversely affects memory for conscious recollection but does not affect other forms of memory (i.e., unconscious).

According to Squire (1986) dissociations between implicit and explicit memory can be made due to different neural structures which are responsible for the two types of memory. He argues that two systems of memory, procedural and declarative, underlie the dissociation. Squire proposes that procedural memory is responsible for priming, conditioning, and motor skills; whereas, declarative memory underlies conscious, explicit tasks. Squire believes that the explanation for amnesiacs' poor performance on explicit tests is due to a disruption to their declarative memory system. The point here is that the evidence

which suggests neuroanatomically distinct systems as substrates for explicit and implicit memory is strong evidence for the useful distinction between the two.

Another theory has also been proposed to explain the dissociation between implicit and explicit memory. This theory, labeled as the "transfer-appropriate procedures approach" (Morris, Bransford, & Franks, 1977; Roediger, Weldon & Challis, 1989), separates implicit and explicit memory due to different processes involved during learning and test. In standard explicit tests, the task reflects meaning and can be referred to as <u>conceptually-driven tests</u> (Jacoby, 1983). Conversely, implicit tests reflect perceptual processing and are referred to as <u>data-driven tests</u>. Processing theory states that if tasks at the time of test are similar to operation at the time of learning, then performance on test will increase. Different operations are required for retrieval for implicit and explicit tests, and consequently, different forms of information are accessed. Since different processes are involved at retrieval, the type of processing during learning can directly affect performance.

According to the information-processing approach, emotional words will be more affected by explicit memory than implicit memory. The theory of data-driven and conceptually-driven information supports this hypothesis since emotional words can be referred to as conceptually-driven information. When an

emotional word is read, a more complex process is involved in understanding the word compared to the process for understanding a neutral word. It is not just data (strings of letters) that operate as stimuli. Previous experience and situations involving the emotional word will be triggered when processing the word. If emotional words are considered conceptually-driven information and conceptually driven information is believed to be controlled by explicit processes, then one can conclude that emotional words will be greatly controlled by explicit processes.

Emotion Theory and the Nonconscious Memory

Prior research on implicit and explicit memory has often utilized verbal tasks including free recall, word-fragment completion, and lexical decision (e.g., Jacoby, 1983; Smith & Branscombe, 1988; Weldon & Roediger, 1987). The test words in this previous research typically have been neutral words. One of the fundamental questions in our experiment is whether emotional words will affect implicit memory differently than neutral words?

We hypothesize that emotional words will be processed differently than neutral words. Our position regarding emotional words and memory is based on a fundamental principle in learning theory involving attention: If information is interesting or affectively arousing, then we pay more attention to it. Compared to neutral words, aversive emotional words will be processed at a higher level and will remain in conscious memory longer. This

lingering of emotional words in conscious memory results in a greater likelihood of encoding and being placed in memory.

In contrast with that suggestion, some studies demonstrate implicit memory controlling emotions. Bargh & Pietromonanco's (1982) findings place nonconscious memory as controlling subjects' judgements of people after reading aversive emotional words. They reported that when subjects were subliminally presented hostile words, they later judged a picture of a person with a substantial number of more negative qualities. Likewise, Bornstein, Leone, and Galley (1987) demonstrated that aversive subliminal presentations affected subject's behavior toward the person in the picture. Each of these empirical studies involving subliminal exposure illustrates the role of implicit memory on behavior. These findings contrast with our hypothesis which states that explicit memory will have a greater effect on emotional words. However, note that in both of these studies the conscious memory system was not present at the time of learning. If hostile words were presented subliminally (i.e. unconsciously), then the conscious system played no role in learning. In our study, we dissociated conscious and nonconscious memory when both are present at learning and test. When the words were presented for study in the two previous tests, the words entered the memory system through subliminal processes (i.e., nonconscious). In our experiment, when the

words were presented for study, conscious and nonconscious memories were both in operation. In Bargh and Pietromonanco's (1982) study, the influence of conscious memory could not be tested because conscious memory was not present at the time of study. In contrast, our study measured the influences of both conscious and nonconscious memory because both were present at time of study.

We suggest that explicit memory processes will play a more dominant role in the processing of emotional words. If subjects ruminate, that is process consciously, aversive emotional words, this high level of processing will be evident in tests of direct memory.

Jacoby and Process-Dissociation Procedure

How is one to measure the separate contributions of implicit and explicit memory when performing a task? Jacoby (1991; Jacoby & Kelley, 1992; Jacoby, Toth, & Yonelinas, in press) has developed a process-dissociation procedure to separate the contributions of conscious and automatic uses of memory within a task. We also used this methodology in our work.

When using a direct test of memory, conscious influences of memory are measured. Jacoby et al. (in press) argue that performance on direct tests may also be influenced by automatic processes causing contamination of the supposed measure of

controlled processes. The automatic influences sum with the conscious influences resulting in an increased probability of correct guessing. This "informed guessing" would confound the measurement of truly controlled processes.

To assess this nonconscious influence, Jacoby et al. (in press) suggest measuring recollection by placing two forms of responding in opposition. Jacoby defines recollection as the difference between performance when one is <u>trying to</u> engage in a task and performance when one is <u>trying not to</u> engage in that task. If a subject is just as likely to do something when trying to do it as when trying not to do it, then the subject has no conscious control. The use of stem-completion tasks can illustrate this assumption. In Jacoby (in press; Jacoby & Kelley, 1992), subjects were instructed to complete stems with words that were <u>not</u> presented earlier. Assuming that subjects followed these instructions, automatic influences of memory would cause the probability of completing the stems with old recently presented words to be somewhat higher than the probability of completing the stems with new words. However, recollection opposes this effect whereby causing subjects to exclude previously presented words. If recollection was perfect, subjects would always complete the stems of the "inclusion condition" with old words and always completing the stems of the "exclusion condition" with new words.

Jacoby (1991) proposes a set of simple equations to estimate the separate contributions of implicit and explicit memory. The following set of equations are presented and explained similar to Jacoby's (in press; Jacoby & Kelley, 1992) explanation. The probability of responding with a previous word in the inclusion condition is defined as the probability of recollection (R) plus the probability of the word automatically coming to mind (A) when there is a failure of recollection A (1-R):

$$\text{Inclusion} = R + A\ (1-R)$$

In the exclusion condition, a studied word will be produced when it automatically comes to mind and there is a failure to recollect that it was presented earlier:

$$\text{Exclusion} = A\ (1-R)$$

The probability of recollection is defined as the probability of responding with a previous word in the inclusion condition minus the probability of responding with a previous word in the exclusion condition:

$$R = \text{Inclusion} - \text{Exclusion}$$

Automatic influences can be estimated once recollection has been obtained:

$$A = \text{Exclusion}\ /\ (1-R)$$

When estimating the effects of automatic influences in the previous equation, it is important to note that automatic or nonconscious memory reflects the effects of automatic influences

of memory (M) and the baseline rate for completing a stem with a word (B):

$$A = M + B$$

It is important to demonstrate that A is greater then B. In the inclusion condition, conscious and nonconscious influences act in unison. Contrarily, the exclusion condition places conscious memory and nonconscious memory in opposition. If the frequency of completing a stem with a prior word in the exclusion condition is higher than baseline, then one can assume that nonconscious, implicit influences exist.

Jacoby (in press) used the process-dissociation procedure to identify the variables that produce dissociations between implicit and explicit memory. If indeed conscious and nonconscious processes are independent, it should be possible to identify variables which will influence one process but leave the other process unchanged.

In Jacoby's (in press) experiment, one such manipulation was attention to experimental stimuli at time of study. Under the divided attention condition, while subjects visually studied a word list, they also listened to a string of digits and indicated when they detected the target sequence--any three odd numbered digits in a row. In this condition, only limited attention to the word list was possible. The task for both full and divided attention conditions was a stem-completion task.

The results of the study indicated that under the divided attention condition, the probability of conscious recollection was reduced from .25 to .00; whereas, automatic, unconscious influences were unchanged (.47 vs. .46). The probability of recollection was truly zero for the divided attention condition. We used this attention dividing manipulation in our study to further our understanding of the processing of emotional stimuli.

Using the Process-Dissociation Procedure with Emotional Words

By using Jacoby's (1991) process-dissociation procedure, we chose to examine the role of automatic and conscious memory with emotional words. Jacoby's procedure provided a methodology which allowed us to measure the influence of conscious and nonconscious processes. Using Jacoby's (in press) methodology, we extended his work to include emotional words along with neutral words. One of the most exciting aspects of this research is that it allows us to test competing theoretical notions concerning the role of conscious versus nonconscious processes for emotional stimuli.

When developing a hypothesis for this experiment, there were two basic models which we followed: the information-process theory or the psychodynamic theory. The information-process approach suggests the usefulness of conceptualizing human beings as operating as computers processing information. According to

this approach, if information is processed longer or more elaborately, then this information will have had a higher likelihood of entering memory. With our assumption that emotional words are more salient than neutral words, the emotional words will be processed longer in conscious memory than neutral words. Because of the high level of conscious processing at the time of exposure, conscious influences will have a greater effect at time of test. Thus, if following the information processing approach, one would hypothesize that conscious memory has a greater influence on tasks involving emotional words. The information-processing approach supports the theory of conceptually-driven versus data-driven behavior. As previously noted, emotional words are conceptually driven thus requiring explicit processes. The information-processing approach and the theory of conceptually-driven information both suggest that explicit memory will have a great influence on emotional words.

In contrast, if Freud's psychodynamic model is correct, our predictions would be different. Freud would agree that emotional words are more salient compared to neutral words; however, following the psychoanalytic theory, the interpretation and prediction of results would be different. One of the principal concepts of Freud's theory is that emotions are powerfully involved with the unconscious. Freud believed that people often suppress emotions to an unconscious level, but these emotions can

affect one's behavior. Like the child who was sexually abused but has no conscious memory for the event, this abuse may have an adverse effect on later relationships or sexual performance. In this sense, unconscious feelings affect behavior. In summary, according to Freud's psychodynamic model, one would argue that emotional words would have a powerful effect upon nonconscious memory.

Experimental Design and Hypotheses

We investigated the role of emotional information on implicit and explicit components of memory using Jacoby's process-dissociation methodology. We used a 2 x 2 experimental design with the first independent variable being the between subjects factor of Attentional Focus (full vs. divided), and the second independent variable being the within subjects variable of Emotion (emotional vs. neutral words).

Our design allowed us to contrast predictions from the information-processing approach versus a psychoanalytic view of the processing of emotional material. The experimental hypotheses examined in the study were:

1. Effect of Emotion would differ as a function of the dependent variables tested. The information- processing approach expected little influence on the probability of unconscious recall but a major influence on the

probability of conscious recall.

2. This above hypothesis would interact with Attentional Focus. The information-processing approach says there would be a greater effect on conscious memory in full attention and less effect on divided attention. The psychodynamic view predicted no difference on unconscious memory as a function of attention.
3. We expected to replicate the findings of Jacoby with neutral words, and they will allowed us to examine the direction of the influence of emotional words from the neutral control.

Methods

Subjects and Design

One hundred men and women enrolled in undergraduate psychology courses at Louisiana State University participated in the study in return for extra-credit. A 2 x 2 experimental design was used with the independent variables being Attention (full vs. divided) and Emotion (emotional or neutral). The first variable, Attention, was a between subjects factor, and the second variable, Word Category was a within subjects factor. Subjects were randomly placed in one of the two between subjects test conditions resulting in 50 subjects for each attention condition.

Materials

A pool of 40 emotional and 40 nonemotional words were used and were matched on word length, number of possible completions of the stems, and word familiarity by Jackson (personal communication, May 1, 1993).

The pool of 80 words were divided into four groups (A, B, C, and D) of 20 words each--10 emotional and 10 nonemotional words. Each of the four word sets was also balanced according to word length, familiarity, and possible number of stem completions. The four sets were arranged in six possible pairs (AB, AC, AD, BC, BD, and CD). These pairs represented the words used in the study condition and thus were considered "old words." The remaining two lists were those used to determine baseline. If a subject received lists AB in the study condition, then lists CD determined baseline. The pairs of lists were rotated across all experimental conditions to insure that our results were not determined by one particular set of words.

There were two word stem lists for each subject to complete during the test phase, i.e., one for the inclusion and one for the exclusion condition. Each test list contained 50 word stems--20 for the emotional words, 20 for the nonemotional words, 5 for beginning buffer words, and 5 for end buffer words. The test list was typed in two columns on sheets of paper. Within each test list, one half of the words were old, studied words and one

half were new words for determining the baseline rate of the words. The terms "inclusion" and "exclusion" were printed at the top of the columns as to instruct subjects to complete the stem with either the previously presented words or with new words. Since each subject completed both the inclusion and exclusion lists, 50 subjects received the inclusion stems first, and 50 subjects received the exclusion stems first. Also, within each list pair, the two lists were alternated between inclusion condition and exclusion condition. For example, consider subjects with pair AB as the studied lists, for one half of subjects list A was the inclusion condition and list B was the exclusion condition; for the other half of subjects list A was the exclusion condition and list B was the inclusion condition. This design prevented confounding of results due to the specific words in the two lists.

The listening task for the divided attention condition was one developed by Craik (1982). A tape-recorded list of digits was played and subjects were instructed to detect target sequences of three odd numbers in a row. Digits were in random order; however, a minimum of one and a maximum of five numbers were presented between target sequences. Numbers were recorded at a 1.5 second rate.

Procedure

When subjects came to the laboratory, they first read and signed informed consent forms which gave basic instructions concerning the study. All subjects initially engaged in a study task. In the study phase, words appeared in lower case letters in the middle of the computer screen. Each word was presented for 1.5 seconds followed by .5 seconds of a blank screen. Subjects in the divided attention condition performed a visual/study task as well as a listening task. When a target sequence in the audition task was detected, subjects responded by placing an "x" on a "Target Sequence" answer sheet.

In the test phase, subjects were given separate pieces of paper with word stems listed in the columns. Subjects were asked to complete the stem for the inclusion condition with an old word and a new word for the exclusion condition. Proper names and plurals were not accepted as completions for the stems. The stems consisted of three letters followed by the correct number of blanks to complete the word. All subjects received both word lists. One half of the subjects received the inclusion word stems first, and the other half received the exclusion stems first to prevent order confounding.

Results

The analysis strategy that we followed was to examine each

of our dependent variables with SAS's General Linear Model analysis of variance using the Multiple Analysis of Variance procedure where appropriate. In our analyses Emotion (emotional vs. neutral words) and Condition (full vs. divided attention) and others, where appropriate, served as independent variables. Contrast between means was used to examine where differences lie when evaluating significant interactions. Finally, we intercorrelated our various dependent variables.

Consider the first dependent variable of hit rate. Hit rate is defined as the probability of completing a word stem with a studied word. Hit rate, or completing a stem with an old word, should be distinguished from completion of a stem with a correct response. In the exclusion condition, a "hit" is actually an incorrect response to the directions. In the 2 x 2 GLM analysis of hit rate, the analyses were conceptualized as a MANOVA with four dependent variables. These variables were inclusion emotional old words (IEO), inclusion neutral old words (INO), exclusion emotional old words (EEO), and exclusion neutral old words (ENO). The independent variables were Task (inclusion vs. exclusion), Emotion (emotional vs. neutral words), and Condition (full vs. divided). The GLM analysis revealed that there was a main effect for Task ($\underline{F}(1, 98) = 49.30$, $\underline{p} < .0001$) indicating that there were more correct word completions under inclusion ($\underline{M} = .43$) then exclusion ($\underline{M} = .29$) instructions. Table 1 shows this

data. There also was a significant main effect for Emotion

Insert Table 1 about here

($F(1,98) = 5.088$, $p < .026$) with neutral word stems being more accurately filled in than emotional ($M = .37$ vs. $M = .34$). There also was a significant effect of condition ($F(4,95) = 7.59$, $p < .0001$) in which full yielded more correct completions ($M = .38$) then divided ($M = .33$) attention. Finally, there was a significant ($F(1,98) = 21.02$, $p < .0001$) Condition by Task interaction. Figure 1 shows the data for that interaction.

Insert Figure 1 about here

Comparisons among the means reveal that under full attention the inclusion task ($M = .50$) was significantly higher then the exclusion task ($M = .27$). Under divided attention, however, inclusion hit rates ($M = .36$) were not significantly higher than exclusion hit rates ($M = .31$).

The second dependent variable that was examined was recollection. Recollection is defined as the probability of completing a stem with an old word when one is <u>trying to</u> engage in the task minus the probability of completing a stem with an old word when one is <u>trying not to</u> engage in the task (i.e., R =

inclusion - exclusion). In our analysis of recollection, we had two independent variables which were Condition (full vs. divided attention) and Emotion (emotional vs. neutral words). Since emotion was a within subjects variable, we used a MANOVA analysis. The two dependent variables were the probability of recollection of emotional words and the probability of recollection of neutral words. There was a main effect for Condition ($\underline{F}(1, 98) = 21.03$, $\underline{p} < .0001$) with word stems under full attention ($\underline{M} = .23$) having a higher completion rate compared to words under divided attention ($\underline{M} = .05$). These data can be seen in Table 2. There was no effect of emotion on recollection.

Insert Table 2 about here

Recollection of emotional words ($\underline{M} = .15$) was essentially the same as recollection for neutral words ($\underline{M} = .14$).

Consider the third dependent variable of automatic influences of memory. Using a MANOVA, the dependent variables were the automatic influences of memory on emotional words and the automatic influences of memory on neutral words. The between subjects independent variable here was Condition (full vs. divided attention). The within subjects variable was Emotion (emotional vs. neutral words), causing us to use a MANOVA analysis. When the independent variable of Emotion was analyzed,

data indicated that the effect of emotional versus neutral words on nonconscious memory was at the .07 level of significance. These results were in the opposite direction then hypothesized. Automatic influences of neutral words (M = .33) was higher then the automatic influence of emotional words (M = .29) ($F(1, 98)$ = 3.315, p < .072). These findings indicate that, although not reaching an accepted level of statistical significance, the effect of automatic memory on neutral words appears to be higher than the effect on emotional words. The second independent variable, Condition, showed to have no effect on automatic memory, with the mean for full attention versus divided attention (M = .32 and M = .30), respectively. In contrast with recollection, subject's attention condition played no role in automatic memory. Dividing attention reduced recollection to zero but left automatic influences invariant. This process dissociation was essential to indicate that automatic and conscious influences of memory differentially contribute to performance. The procedure indicated that the type of word (i.e., emotional vs. neutral) played no role in memory type; however, collapsed across the emotion of the words, our findings confirm the effectiveness of the process dissociation procedure. Table 3 shows the mean scores for inclusion condition, exclusion condition, probability of recollection, and probability of automatic influences.

Insert Table 3 about here

A Pearson correlation analysis revealed data which were expected as a result of our computational procedure. Significant correlations can be explained because some variables were used to compute others.

Finally, the fourth dependent variable analyzed was baserate. Baserate is defined as the probability of completing a stem with a word without prior exposure or conditioning to the word. Completion rates for baseline words under full attention in the inclusion condition were $\underline{M}$ = .28 and $\underline{M}$ = .28 for emotional and neutral words, respectively. Under divided attention in the inclusion condition, baseline rates were $\underline{M}$ = .31 for emotional and $\underline{M}$ = .27 for neutral words. The corresponding probabilities for the exclusion condition under full attention were $\underline{M}$ = .20 and $\underline{M}$ = .26 for emotional and neutral words. For divided attention under the exclusion condition, probabilities were $\underline{M}$ = .22 and $\underline{M}$ = .28 for emotional and neutral words. Table 4 shows this data.

Insert Table 4 about here

An analysis of baseline rates across Task conditions (i.e., inclusion and exclusion) showed to be significant with the mean

score for inclusion being .29 and the mean for exclusion being .24. This difference, which appears to be based on chance, suggested that analyses should be run using the exclusion baseline scores and should not be collapsed across tasks. In the process dissociation procedure it is essential for data from the exclusion condition to be above baseline to indicate the presence of nonconscious memory; therefore, the exclusion baseline condition was chosen since analyses were between baseline rates and the exclusion rates. Analyses indicate that the probability of completing a stem in the exclusion condition under divided attention (M = .31) was significantly higher then baseline (M = .24, $F(1, 98) = 7.471$, $p < .0074$).

Discussion

When just considering basic hit rate, the type of word influenced responding. Neutral words had a higher completion rate than did emotional words. This finding does not support Bower's (1992) theory that emotional words should have a higher level of processing than neutral words due to their saliency. When one ruminates over an emotional word, a higher response rate of emotional words would be expected; this theory was not supported by our data.

The Condition by Task interaction for hit rate reveals that by dividing attention, we successfully decreased word response

rate. Under full attention, hit rate for exclusion is much lower than inclusion as expected. For divided attention, hit rate is not significantly different for inclusion versus exclusion indicating that the divided task had its desired effect. Subjects were not able to complete word stems accurately when distracted.

By following the process dissociation procedure, we have separated the effects of conscious and nonconscious memory on direct and indirect memory tests. The findings indicated that exclusion data were significantly higher than baseline. This difference suggests that the presence of nonconscious memory influenced the results. Since recollection and automatic memory can be distinguished, their influences can be measured separately. Prior research using direct tests of memory have not taken this automatic influence of memory into account. Direct memory tests, designed to measure conscious memory, are therefore contaminated with nonconscious influences.

One of our hypotheses was to test emotion as a function of memory type, conscious versus nonconscious. As previously stated, the overall effect of emotion did not reach significance, but raw scores indicate that neutral words (M = .37) have a higher completion rate then emotional words (M = .34). Before automatic influences of memory and recollection were computed, there was a main effect of emotion on hit rate. However, once

computations of conscious and nonconscious memory were executed, emotional differences in memory were not significant. A significant difference was not found when measuring automatic influences of memory for emotional and neutral words. At a .07 significance level, mean scores were in the opposite direction than hypothesized by a psychodynamic view that emotion often operates at a nonconscious level. Automatic influences of neutral words ($\underline{M}$ = .33) actually were higher than automatic influences of emotional words ($\underline{M}$ = .29). We hypothesized that due to the saliency and higher cognitive processing of emotional words, they would have a higher automatic effect compared to neutral words. Since the word types were not significantly different, this poses a problem for current theories of emotion. The psychoanalytic and information processing theory would both predict increased performance for emotional words. Emotional words are more salient and involve more "links" and memories than do neutral. Our procedure is able to distinguish memory types for neutral words, so we can be confident that our procedure is effective. Three explanations seem likely for not finding a difference between emotional and neutral words.

The first explanation is that our procedure may not be effective or sensitive when analyzing emotional and neutral words. It may be that conscious and nonconscious from this perspective does not correspond to conscious and nonconscious as

used in emotion theory. Perhaps nonconscious in emotion theory refers to a different conceptual apparatus or cognitive process.

The second explanation is that emotion theories are incorrect. It may be that emotion simply is not a relevant variable in the conscious and nonconscious memory systems. Only further research will tell.

The third explanation for finding no difference between emotional and neutral words when examining conscious and nonconscious memory is that possibly our procedure does not accurately represent emotion. The emotion that we studied by using negative emotional words may be rather weak compared to actual situations. With our use of emotion, it may not be possible to dissociate conscious and nonconscious because words would be considered weak stimuli. With actual emotional situations where stimuli would be stronger, perhaps a dissociation could be made. Further research should be done in this area to determine if current theories concerning the saliency of emotional words are valid by possibly using different methods.

Our dissociation of conscious and nonconscious memories raises questions involving the use of direct memory tests. Due to their contamination with nonconscious memory when actually measuring conscious memory, one must question the validity of the results and conclusions drawn. Also, the lack of a significant

difference between emotional and neutral words also questions the accuracy of current emotion theories.

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Table 1

Probability of Responding with an Old Word

	Divided	Full	X
Inclusion			
Emotional	.34	.48	.41
Neutral	.37	.51	.44
Exclusion			
Emotional	.30	.23	.27
Neutral	.31	.30	.31

Table 2

Probability of recollection and automatic influences

	Divided	Full
Recollection		
Emotional	.04	.25
Neutral	.06	.21
Automatic		
Emotional	.29	.29
Neutral	.31	.35

Table 3

Hit rate and probabilities of recollection

and automatic influences

	Inclusion	Exclusion	R	A
Full				
Em	.48	.23	.25	.29
Neu	.51	.30	.21	.35
Div				
Em	.34	.30	.04	.29
Neu	.37	.31	.06	.31

Table 4

Baseline rates

	Divided	Full	X
Inclusion			
Emotional	.31	.28	.30
Neutral	.27	.28	.28
Exclusion			
Emotional	.22	.20	.21
Neutral	.28	.26	.27

Figure 1. Condition by Task Interaction for Hit Rate