



Universidad Autónoma
de Madrid

Biblos-e Archivo
Repositorio Institucional UAM

Repositorio Institucional de la Universidad Autónoma de Madrid
<https://repositorio.uam.es>

Esta es la **versión de autor** del artículo publicado en:
This is an **author produced version** of a paper published in:

Memory 10.3 (2002): 161 – 177

DOI: <https://doi.org/10.1080/09658210143000308>

Copyright: © 2002 Psychology Press Ltd

El acceso a la versión del editor puede requerir la suscripción del recurso
Access to the published version may require subscription

Effects of Divided Attention and Word Concreteness on Correct Recall and False Memory
Reports

M. Nieves Pérez-Mata¹, J. Don Read², and Margarita Diges¹

¹Universidad Autónoma de Madrid and ²University of Victoria

Running Head: DIVIDED ATTENTION AND FALSE MEMORIES

Contact address:

J. Don Read

Department of Psychology

University of Victoria

P. O. Box 3050

Victoria, B.C., V8W 3P5

Tel: 250-472-4490; Fax: 250-721-8929

E-mail: jdread@uvic.ca

Abstract

Lists of thematically related words were presented to participants with or without a concurrent task. In Experiments 1 and 2, respectively, English or Spanish word lists were either low or high in concreteness (concrete vs. abstract words) and were presented, respectively, auditorily or visually for study. The addition of a concurrent visual or auditory task, respectively, substantially reduced correct recall and doubled the frequency of false memory reports (nonstudied critical or theme words). Divided attention was interpreted as having reduced the opportunity for participants to monitor successfully their elicitations of critical associates. Comparisons of concrete and abstract lists revealed significantly more recalls of false memories for abstract than concrete word lists. Comparisons between two levels of attention, two levels of word concreteness, and two presentation modalities failed to support the "more is less" effect by which enhanced correct recall is accompanied by increased frequencies of false memories.

Effects of Divided Attention and Word Concreteness on Correct Recall and False Memory

Reports

According to Bruce and Winograd's (1998) historical review, the rediscovery of Deese's (1959) work with thematic word lists was stimulated by a burgeoning interest in memory distortion and false memories in theoretical and applied contexts (see, for example, Freyd & Gleaves, 1996; Gallo, Roberts, & Seamon, 1997; Lindsay & Read, 1994; Payne, Elie, Blackwell, & Neuschatz, 1996; Read, 1996; Roediger & McDermott, 1995). Numerous demonstrations now exist of the ease with which research participants can be induced to recall or recognize a nonpresented word following the presentation of a list of thematically related words (see Roediger, McDermott, & Robinson, 1998, for a thorough description of the range of variables studied). It is evident that participants in these studies were frequently convinced that a nonstudied word had been presented within the list because their descriptions and judgments of recollective experiences of it often resembled the experiences they had and judgments they made of presented list items (e.g., Garc a-Bajos & Migueles, 1997; Mather, Henkel, & Johnson, 1997; Payne et al., 1996; Read, 1996; Roediger et al., 1998). To date, the focus of all research has been upon the so-called "critical" or theme word because lists were constructed from associative responses given to this word and because, of all intrusions made, it is the most frequent. However, it is not uncommon that other nonpresented words are recalled and the majority of these are related to the theme of the list (e.g., Deese, 1959, Read, 1996; Roediger & McDermott, 1995; Smith & Hunt, 1998).

The production of false memories in the Deese paradigm likely involves both conscious and nonconscious processes during study and test (cf. Bennett, 1996; Lampinen, Neuschatz, & Payne, 1997; Mather et al., 1997; McDermott & Watson, in press; Payne, 2001; Roediger et al., 1998). With respect to conscious processes, McDermott (1996) and Payne and Elie (1998) have shown that the likelihood of a false positive on a retrieval test decreases as the number of study-test or list presentation trials increases (at least for young adults, cf. Kensington & Schacter, 1999), a result that strongly suggests participants become more likely to detect and withhold their intrusion errors on subsequent test trials. Similarly, when Gallo et al. (1997) instructed participants about the thematic nature of list construction and the common errors made at test, the frequency of false memories decreased, thus demonstrating some voluntary control by participants over the production and/or acceptance of highly associated words. Additionally, when Watson, McDermott, and Balota (2000; cited in McDermott & Watson, in press) combined both of these variables, false memories were further reduced in frequency. However, because these manipulations never completely eliminated the critical word intrusions, unconscious or automatic processes are also implicated (Gallo et al., 1997; Lampinen et al., 1997; McDermott & Roediger, 1998). Indeed, in some studies, warnings were completely unsuccessful in reducing the rate of false memories (e.g., Neuschatz, Payne, Lampinen, & Toggia, 2001). Similarly, Lampinen, Neuschatz, and Payne (1999) also demonstrated robust false memory effects when demand characteristics had been substantially reduced. More provocatively, Seamon, Luo, and Gallo (1998) demonstrated that following very short exposure durations (20 ms), participants were unable to discriminate studied from unstudied words on a recognition test but they

nonetheless falsely recognized critical nonpresented words. In short, because correct recognition of list items was unnecessary for the occurrence of the false memory effect, Seamon et al. argued that this effect may be based upon the nonconscious activation of semantic concepts. These results, however, do not require that participants' remembering of the themes of semantically related word lists is similarly nonconscious.

In the face of the effect's robustness, the explanations suggested for the recall or recognition of nonpresented words have usually emphasized nonconscious or automatic processes such as the activation of semantic associates to a presented word [as in, for example, "implicit associative responses" first suggested by Underwood (1965) or more general semantic activation as described by Roediger and McDermott (1995), McDermott & Watson (in press), Seamon et al. (1998), and Smith & Hunt (1998)]. According to Underwood, associated words are elicited or brought to mind during encoding by the stimulus materials and, as a result, may subsequently be available at the time of recall or recognition. McDermott and Watson's (in press) description of semantic activation suggests a less specific kind of activity by which semantically related words are primed to the point of recall and may or may not be elicited during study (and retrieval). However, by any model, what is critical for the observation of false memories is what participants do with these activated and/or elicited items. Participants may encode the items' self-generated status during study and then choose not to recall them at test, as observed recently by Br  dard (2000) and Multhaup and Conner (1999). Or, they may be unable to discriminate between the sources of presented and elicited items at test and erroneously recall some nonpresented items as list members. Theoretical accounts of these latter confusions have

generally been one of two types (but see Payne et al., 1996; Roediger et al., 1998, for additional perspectives): one that emphasizes the overlap between the encoded qualitative characteristics of elicited and presented words (e.g., Hicks & Marsh, 1998; Mather et al., 1997; Norman & Schacter, 1997), and the other that emphasizes the activation and abstraction processes during study that yield both verbatim and gist traces in memory (Brainerd, Reyna, & Kneer, 1995; Reyna, 1998). Specifically, the intrusion of the critical nonpresented word in recall or its false recognition on a recognition test is taken as evidence of gist extraction during study and of cueing of gist at test. Recollection of list items, on the other hand, is assumed to be based on successfully cued verbatim knowledge. Respectively, these two positions have been referred to as the Source/reality Monitoring Framework (Johnson, Hashtroudi, & Lindsay, 1993) and Fuzzy Trace Theory.

Although the present research is not directed at distinguishing between these accounts, neither model precludes the possibility that during list presentation and retrieval participants may become aware of their own generation of other words and/or the thematic structure of a list (cf. Br  dard, 2000; Stadler, Roediger & McDermott, 1999). Awareness of one neither necessitates nor precludes awareness of the other. Indeed, a primary assumption underlying the current research is that studied items do elicit other associated words, and that these elicitations may or may not be consciously detected during study (cf. Br  dard, 2000; Gardiner, Ramponi, & Richardson-Klavehn, 1998; Mather et al., 1997; McDermott & Watson, in press). With or without such conscious detection, the elicited words may become distinctive, at least temporarily, by virtue of their self-generated compared to list-presented status (see also Toglia,

Neuschatz & Goodwin, 1999) and these differences may be used by participants to discriminate between presented and generated words at test. In recent work by Bruce, Phillips-Grant, Conrad and Bona (2000), Hicks and Marsh (1999), Hunt and Smith (1998), Israel and Schacter (1997), Payne (2001), Schacter, Israel, and Racine (1998), and Watson, McDermott et al. (2000; cited in McDermott & Watson, in press), procedures that increased the distinctiveness of the list items (e.g., visual vs. auditory presentation, accompanying words with context colors, pictures, or increasing the number of study presentations) decreased the frequency of false memories presumably because participants had knowledge that could be used to distinguish more easily the critical items from the list words. Use of such knowledge about the source of a memory or the phenomenological characteristics that may signal presented or nonpresented items is a heuristic based on item distinctiveness and has been credited with the reduction of false memories in several studies (e.g., Schacter et al., 1998). On the other hand, some procedures serve to decrease the discriminability of presented and generated items. For example, in work by Roediger and McDermott (1995) and Payne et al. (1996) the impact of additional recall tests (without intervening list presentation) prior to a recognition test generally increased the probability of a critical word intrusion.

It is also plausible (and seems implied by Roediger & McDermott, 1995, to be the normal course of affairs) that explicit recognition or understanding of the list structure need not follow elicitation of the critical nonpresented word (Stadler et al., 1999). Although detection of a list theme for many Deese-Roediger-McDermott lists seems simple enough in hindsight, the maintenance or "monitoring" of such awareness in memory until an opportunity for recall is

presented would require attentional resources (cf. Seamon et al., 1998). Similarly, detection and marking or "monitoring" (cf. McDermott & Watson, in press) of elicited items as self-generated should also require attentional resources. If attention is divided, it follows that there would be greater difficulty in monitoring or maintaining in memory the unique qualities of elicited items.

There have been few studies completed in which attention was divided during list presentation. Seamon et al. (1998) reported a reduction in false alarms to critical lures following very brief (20 or 250 msec) exposure durations of list items and in the presence of a memory load. With a longer duration of 2 sec., memory load had no effect on false recognitions. Similarly, Payne, Lampinen, and Cordero (1996, cited in Roediger et al., 1998) reported two experiments in which divided attention decreased the false memory effect. These results were taken by Roediger et al. (1998) as support for the view that the opportunities for associative elicitation had been reduced by dividing attention during study. By this argument it is reasonable to anticipate that increasing the presentation rate would have an effect similar to that of reducing attention and, one would further anticipate that the faster the rate of presentation, the fewer the opportunities for associative elicitation, and in turn, fewer critical words recalled. However, the results of studies that have varied presentation rates (Roediger, Robinson, & Balota, 2000, cited in McDermott & Watson, in press; Seamon et al., 1998; Toggia & Neuschatz, 1996) have been equivocal with some demonstrating fewer false recalls (or false alarms on recognition tests) and some reporting more false recalls (or false alarms) with faster presentation rates. Seamon et al. (1998; Exp. 1) reported that whereas presentation rate affected hits, false alarms to critical lures were affected by both memory load and presentation rate.

We suggest that what may mediate differential recall of critical words and other associates following different presentation rates is whether a given rate allows the learner to monitor and encode the characteristics of elicited and presented words during study. Fortunately, at an empirical level, McDermott and Watson seem to have resolved the contradictory outcomes of presentation rate on recall of critical words: with very rapid presentation rates (up to 1000 msec per word) the effect of increasing the rate is an increase in false recalls; however, from 1000 to 5000 msec, the effect is a reduction in false memories. Coincidentally, in line with our thinking, McDermott and Watson also suggested that at relatively slow rates (1 to 5 sec) participants had the resources to monitor and maintain in memory the differences between presented and elicited items.

The present experiments were designed to assess monitoring more directly by manipulating level of attention. Like McDermott and Watson, we anticipated that dividing a participants' attention during study (when items are presented at a relatively slow rate of 2- 3 sec per item) would increase the false recall rate because with divided, as compared to full attention, there is a reduced likelihood of encoding the item-specific, perceptual, and cognitive activities that accompanied the generation of critical words. This reduction in relevant encoded information would then render discrimination of presented and nonpresented items more difficult at test and these differences in the amount of encoded information may be indexed by Remember/Know judgments for recalled items. Relatedly, from a slightly different perspective, Jacoby's (1996) process-dissociation procedure has demonstrated that dividing attention during study reduces recollective influences on recall of word pairs. In turn, we predicted that the

availability of recollective information about list items and elicited words in an immediate recall test is likely to be greater following full than divided attention. Accordingly, Remember/Know judgments (cf. Gardiner, et al., 1998; Tulving, 1985) were made by participants to each recalled word.

Researchers have noted the differential success with which a variety of DRM lists produce false memories (Roediger et al., 1998; Stadler et al., 1999). On the assumption that these differences are related to the particular kinds of semantic and conceptual processing that occur during list presentation, some researchers have encouraged different types of processing through variations in instructions. In earlier work these instructional manipulations in earlier studies have had little or no effect on false memory rates (e.g., Newstead & Newstead, 1998; Read, 1996; Toglia & Neuschatz, 1996). In more recent work, significant effects have been obtained (Anastasi et al., 2000; Thapar & McDermott, in press). On the strength of larger false memory effects for pictorial than verbal stimuli, Toglia (1998) hypothesized that the variations in the false recall rate across lists may be related to list characteristics of the lists themselves, for example, word concreteness. Subsequently, Toglia did, in fact, obtain larger false memory effects for lists of concrete than of abstract words. However, a contrary pattern of results for concrete and abstract lists was obtained by Praterelli, Bowers, and Tiedt (1998) and by Israel and Schacter (1997) whose picture lists produced fewer false memories than word lists, a finding consistent with the distinctiveness heuristic (Schacter et al., 1999).

Explanations of the effects of word concreteness in recall have focused on either processing or structural accounts (cf. Gee, Nelson & Krawczyk, 1999). The processing accounts

emphasize the kinds of differential encodings that result from the processing of concrete compared to abstract words. For example, Paivio (1991; Paivio, Khan, & Begg, 2000) argues that concrete words benefit at retrieval by virtue of access to one or both verbal and pictorial codes. Marschark and colleagues, on the other hand, (e.g., Marschark & Surian, 1992) argue that imaginal processing of concrete words provides an advantage over abstract words because imaginal processing yields more distinctiveness or item-discriminating information at test. In contrast, structural theories emphasize the hypothetical nature of the network of representations and interconnections of concrete and abstract items within semantic memory. Unlike the processing accounts, however, structural perspectives have generated contradictory hypotheses concerning the richness of the network of representations of both concrete and abstract words (see Gee et al., 1999). Whereas all theoretical perspectives account for the poorer correct recall of abstract than concrete list items, it is not at all clear whether all would predict reduced effects of concreteness on false memories (cf. Toggia, 1998). Our expectation followed that of Praterelli et. al's (1998) structural position in which it is argued that abstract words usually have a more generic (less distinctive) character than do concrete words (which often refer to highly specific category exemplars or more precise meanings). We hypothesized that abstract word lists more easily elicit associates, critical words, or list themes (or gist) that well capture semantic relationships between list items (connectivity) and therefore false recalls of critical items should be more frequent from abstract than concrete word lists. It has, for example, been well demonstrated on recognition tests that participants more frequently make false alarms to abstract

than concrete word lists (see Hirshman & Arndt, 1997; Paivio, 1991). To shed light on these differences, we also varied word concreteness in both experiments.

From any theoretical perspective, the availability of item-discriminating features at the time of test should be related to the temporal and cueing characteristics of the retrieval test (cf. Payne, 2001; Thapar & McDermott, in press). For example, a delay between encoding and recall is likely to reduce the availability of item-specific information. For this reason, the use of a delayed aggregate recognition test (see for example, Norman & Schacter, 1997; Robinson & Roediger, 1997; Seamon et al., 1998) that follows the presentation of multiple lists may frequently mask what item-discriminating information is available to the participants shortly after the presentation of each list and, as a consequence, may substantially increase the likelihood of confusions between presented and elicited words (cf. Brúdart, 2000; McDermott & Watson, in press). In short, with delayed tests the distinctiveness heuristic is less likely to be successful. However, when a recall test closely follows each presentation list, the distinctive features of list items, of cognitions relevant to presentation or word generation, and/or of list-specific or relational information (such as the gist of the list) should be maximally available for the discrimination of source at test (cf. McDermott & Roediger, 1998). For these reasons, the experimental design called for recall of each list immediately after its presentation.

The present research focused on manipulations of attention and of word list concreteness. In addition, although not manipulated factorially, Experiments 1 and 2, respectively, employed auditory and visual presentation modes, respectively. The use of Spanish word lists in Experiment 2 was appropriate to the population of participants available to the first author and

also provided an opportunity to assess the generality of the false memory effect with another language (cf. Garc a-Bajos & Migueles, 1997).

Fortuitously, several of the manipulated variables provided for tests of the "more is less" effect reported by Toglia et al. (1999). These researchers observed that certain variables (e.g., depth of processing instructional manipulations, blocked list presentation) that serve to promote better recall of list items paradoxically also increase the rate of false memories. On the basis of the kinds of semantic and conceptual processing thought to be facilitated by these variables, Toglia et al. advanced the "more is less" hypothesis; that is, increased correct recall (or recognition) is accompanied by increased false recall (or recognition) of nonpresented critical words. The authors attributed this effect to increased semantic processing that, presumably, had occurred in those conditions with higher recall and it was this processing that was thought to have increased the elicitation of critical list words. However, because full attention, concrete word lists, and visual presentation have been shown to increase correct recall while divided attention, abstract lists, and auditory presentation have been associated with increased (not decreased) false memories, the generality of the "more is less" effect could be assessed by the present research.

Finally, another variable was included in the two experiments but, by virtue of its lack of an effect upon performance, its discussion here is restricted. Specifically, if participants do encode information about the characteristics of self-generated critical words and this knowledge is available at test, explicit cueing by the critical word prior to a recall attempt could serve to highlight this knowledge and improve the discrimination of critical words from other list

members, relative to a noncued control condition, and to a condition in which another nonpresented and noncritical list associate is provided as a cue. We hypothesized that by calling attention to the critical word at the beginning of the test, participants would be most likely to recall its perceptual and phenomenological characteristics and, as a result of their evaluation, less likely to recall the critical item on the test itself. This retrieval manipulation was based, in part, upon a faintly analogous procedure used by Brainerd et al. (1995) with a continuous study-test paradigm whereby presentation of a related associate word reduced the likelihood of a subsequent false recognition of the critical word (see Wallace, Malone, Swiergosz & Amberg, 2000, for contrary results). However, in the two experiments reported here, the effects of presenting the critical word as a cue proved to be numerically and directionally inconsistent, and statistically unreliable across experiments. The addition of another list associate as a cue prior to recall did reliably increase the numbers of false recalls of the critical word, but this outcome is consistent with the known effects of list length (number of semantic associates to a critical item) upon false recalls and is well documented by other researchers (Robinson & Roediger, 1997; Roediger et al., 1998). In the interests of brevity and simplicity, further discussion of this retrieval manipulation is not presented.

Experiment 1

Participants A total of 127 University of Lethbridge introductory psychology students participated in return for course credit. The data from three participants were excluded because of their failure to follow instructions. Data were collected in group settings with group sizes that ranged from 2 to 10.

Design. A 2 X 2 mixed factorial design incorporated a between-participant variable of level of attention (full vs. divided) and a within-participants variable of word concreteness (concrete vs. abstract). A Greco-Latin Square was used to counterbalance the presentation order of the study lists within experimental conditions (and provided for the within-subjects cue manipulation at retrieval described above). Participants were assigned to conditions on the basis of a quasi-random sequence that filled conditions at approximately the same rate.

Materials. Four 12-item lists from Roediger and McDermott (1995) were recorded on tape for auditory presentation at a 2 sec. rate. Ordering of the words within each list was held constant and in order of decreasing association with the critical nonpresented word, as in Roediger and McDermott. The nonpresented critical words for the two concrete and abstract lists were, respectively, sleep and anger, bread and mountain. The original Roediger and McDermott versions of these lists were modified slightly to produce lists that we considered more homogeneously abstract or concrete (see Appendix). Although not all list words are available in published norms, comparisons of the words for which data are available (MRC Psycholinguistic Database) revealed that the two low-concreteness lists had significantly lower concreteness ratings ($\bar{M} = 351$) than the two high-concreteness ($\bar{M} = 568$) lists, $t(27) = 7.98$, $p < .01$. Further, in a comparison between the low-concreteness list with the highest mean concreteness rating (sleep) and the high-concreteness list with the lowest mean concreteness rating (mountain) a significant difference was obtained, $t(10) = 2.74$, $p < .01$. On the other hand, mean word frequencies obtained from both the Thorndike-Lorge and Kucera-Francis norms were equivalent between the low- and high-concreteness sets of words, t 's (n 's $= 40$) $= 0.33$, $p > .05$. Taken

together, these results demonstrate that the low and high concreteness lists differed significantly in rated concreteness, but not in word frequency.

Procedure. To manipulate level of attention, participants either heard each list alone (Full Attention) or while they simultaneously monitored a video clip for camera perspective changes (Divided Attention). The video clips averaged 45 seconds in length, and contained between 14 and 16 camera perspective changes: camera shifts to different characters, scenes, actions, angles, and depth of field. The clips were selected from movies or television series solely on the basis of frequency of perspective changes (although we did avoid graphic or atypical events). Participants recorded each perspective change by pressing the equal sign on a simple hand calculator. Each press incremented the sum and allowed participants to continue monitoring the video clip without having to view the calculator. Following each video, participants recorded the number of camera changes and, to increase motivation in the task, feedback was provided as to the correct number of changes in each clip. Whereas Divided Attention participants judged perspective changes while the word lists were presented on audio tape, Full Attention subjects first heard the list items and then immediately judged camera perspectives. Following each video, participants answered a series of open and closed questions concerning details in the clip. To equate the length of the time between study list and recall across conditions to 120 sec, Full Attention participants received only 75 sec to complete the questions whereas Divided Attention participants received 120 sec. A period of 90 sec was then allowed for written recall of the list items.

Prior to the presentation of the four lists, participants received instructions and practice in the video monitoring, list presentation, and recall procedures with two additional Deese-Roediger-McDermott (DRM) lists (high and music) and, separately, two additional videos. The order of the practice lists was counterbalanced and were presented with instructions identical to those subsequently received for the experimental lists. The level of attention variable was not manipulated during the practice list presentations.

Following recall of each list, all participants made a Remember/Know judgment about each word they had recorded. The instructions followed those of Read (1996), with the participants indicating whether they remembered (R) the event of hearing the word or, instead, simply knew (K) that it had been presented in the lists.

Finally, following recall of all lists, participants' abilities were assessed with two measures that, on a priori grounds, might be expected to be related to false memory production: verbal ability (speeded vocabulary test) and field independence. Both tests were based upon similar materials in the literature but were constructed to meet our specific purposes in terms of time and difficulty. Suffice it to say that neither of these predicted critical or noncritical intrusion errors and, for that reason, are discussed no further.

Results and Discussion

Because there was neither a main effect of the presentation order variable nor interactions of it with any other variable ($F_s < 1$) the data were collapsed across presentation orders to perform 2 (Attention Level: Full vs. Divided) X 2 (List Type: Concrete vs. Abstract) mixed-factors ANOVAs on the various dependent measures: correct recall of list items, recall of

nonpresented words (critical and other intrusions), and R/K judgments. The numbers of camera shifts recorded by participants in the Full and Divided Attention conditions did not differ, $F < 1$. The alpha level for all analyses and post hoc tests (Student's t and Wilcoxon's T) was set at $p < .05$.

 Insert Table 1 about here

Correct recall of list items. The mean proportions of list items recalled in each condition are given in Table 1 as a function of attention level and list type. As expected, significantly more list items were recalled in the Full ($M = .605$, $SD = .12$) than Divided Attention condition ($M = .376$, $SD = .11$), $F(1,122) = 177.85$, $MSe = .018$, a finding consistent with the recognition results of Seamon et al. (1998). As also anticipated, there was a main effect of list type with more list items recalled from concrete ($M = .527$, $SD = .18$) than from abstract lists ($M = .473$, $SD = .14$), $F(1,122) = 23.72$, $MSe = .007$. However, the Attention X List Type interaction was also significant, $F(1,122) = 15.04$, $MSe = .007$. Post hoc tests revealed no difference between the abstract and concrete lists ($M = .371$, $SD = .11$, and $M = .382$, $SD = .11$, respectively) in the Divided Attention condition ($t < 1$) but significantly more items were recalled from concrete ($M = .650$, $SD = .13$) than abstract lists ($M = .560$, $SD = .10$) in the Full Attention condition, $t(66) = 6.66$.

Recalls of nonpresented critical words. The proportion of critical words recalled, across all lists, was .48 ($SD = .38$). As may be seen in the middle of the Table 1, and as anticipated, the Full

Attention condition ($\underline{M} = .373$, $\underline{SD} = .37$) recalled significantly fewer critical words than the Divided Attention condition ($\underline{M} = .605$, $\underline{SD} = .36$), $\underline{F}(1,122) = 19.92$, $\underline{MSe} = .167$. In contrast to the results of Toglia et al. (1999), significantly more critical words were falsely recalled from abstract ($\underline{M} = .532$, $\underline{SD} = .38$) than concrete ($\underline{M} = .427$, $\underline{SD} = .37$) lists, $\underline{F}(1,122) = 7.29$, $\underline{MSe} = .091$. The Attention Level X List Type interaction was not significant, $\underline{F} < 1$.

Recall of all other nonpresented words. Other (noncritical) intrusions were anticipated to be affected by the experimental manipulations in the same manner as critical nonpresented words. The mean numbers of these errors are given at the right of Table 1. The expected difference between Divided ($\underline{M} = 1.570$, $\underline{SD} = 1.37$) and Full Attention conditions ($\underline{M} = .918$, $\underline{SD} = 1.34$) was obtained, $\underline{F}(1,122) = 9.49$, $\underline{MSe} = 2.763$. Similarly, as with critical intrusions, there were significantly more noncritical intrusions recorded for abstract ($\underline{M} = 1.355$, $\underline{SD} = 1.26$) than concrete lists ($\underline{M} = 1.081$, $\underline{SD} = 1.51$), $\underline{F}(1,122) = 4.69$, $\underline{MSe} = .889$. The interaction was nonsignificant, $\underline{F} < 1$.

Insert Table 2 about here

Remember - Know Judgments. Table 2 presents the proportion of R judgments for list items, critical words, and other intrusions as a function of attention level and list type. Judgments were made only on recalled items, therefore the proportions of K judgments are simply the inverse of the R judgment values ($1 - R$). To complete the within-subjects analyses involving list type on critical and noncritical intrusion errors, only those participants who provided R/K judgments for

items from both list types could be included, as reflected in Table 2. First, for correctly recalled list items, there was no effect of attention: Thus, when a list item was recalled, full and divided attention participants were equally likely to report that recollective information was available. The only significant effect obtained was list type with a higher proportion of R judgments made to concrete ($\underline{M} = .827$, $\underline{SD} = .19$) than to abstract ($\underline{M} = .779$, $\underline{SD} = .21$) words, $F(1,122) = 12.12$, $\underline{MSe} = .013$. The Attention Level X List Type interaction only approached significance [$F(1,122) = 2.99$, $\underline{MSe} = .013$, $p = .09$], but it is clear that this concrete-abstract difference arose primarily within the Divided Attention condition. Indeed, post hoc tests revealed significantly more R responses were given to concrete ($\underline{M} = .823$, $\underline{SD} = .16$) than to abstract ($\underline{M} = .748$, $\underline{SD} = .19$) lists in the Divided Attention condition, $t(56) = 2.96$, but no difference obtained between these list types ($\underline{M} = .830$, $\underline{SD} = .22$, and $\underline{M} = .805$, $\underline{SD} = .22$, respectively) under Full Attention ($t < 1$).

Second, as also may be seen in Table 2, the R judgments assigned to critical words recalled reflected neither main effects of attention nor list type nor their interaction, $\underline{Fs} < 1$. We had predicted higher frequencies of R judgments to false recalls following full than divided attention but, as for recalled list items, these differences were not obtained. Apparently, variations in attention had similar phenomenological consequences for list items and critical nonpresented words.

In contrast, however, the predicted pattern of R judgments as a function of attention level was obtained for other noncritical intrusions. Specifically, R judgments were markedly and significantly higher in the Full ($\underline{M} = .591$, $\underline{SD} = .41$) than the Divided Attention condition ($\underline{M} =$

.250, $SD = .36$), $F(1, 54) = 17.79$, $MSe = .168$. The Attention Level X List Type interaction was nonsignificant, $F(1, 54) = 2.95$, $MSE = .144$, $p = .092$.

Supplementary analyses. Recall of list words was compared with the recall of nonpresented critical words. For the Full Attention condition, the recall of list words ($M = .605$) was significantly higher than the recall of critical words ($M = .333$), $t(66) = 5.29$. However, in the Divided attention condition the inverse pattern was obtained: recall of critical words ($M = .605$) significantly exceeded that of list words ($M = .376$), $t(56) = 6.30$. Further, this pattern held across both abstract and concrete lists: with Full Attention correct recall exceeded false recall for both concrete [$t(66) = 6.64$] and abstract [$t(66) = 2.473$] lists; with Divided Attention false recall exceeded correct recall for both concrete [$t(56) = 3.39$] and abstract [$t(56) = 6.01$] lists. The typical relationship between false and correct recall is one in which correct recall exceeds or matches false recall of critical words (although a few studies have reported false recall in excess of correct recall; for example, Toglia et al., 1999). The inversion of this pattern under divided attention is striking and may be relevant to an understanding of those studies in which false has exceeded correct recall.

Experiment 2

It is clear from the results of Experiment 1 that the variables of attention level and word concreteness are powerful determinants of the false memory effect. Another variable that has recently been shown to dramatically reduce false memory rates is visual presentation (e.g., Anastasi et al., 2000; Kellogg, 1999; Robinson & Roediger, 1997; Smith & Hunt, 1998; Smith, Payne & Engle, 2000). This effect has been hypothesized to result from relatively enhanced

discriminability at test of visually presented compared to auditorily presented words (cf. Smith & Hunt, 1998). At least some portion of this increased distinctiveness may result from a participant's ability to form an image of the presented word. If so, one would expect that imagery ability would to some degree also be related to the reduction of false memories. Accordingly, in Experiment 2 participants were assessed for individual differences in imagery ability and words were presented visually. Further, the generality of the effects of concreteness seen in Experiment 1 were assessed as well. Finally, the availability of Spanish participants and the use of Spanish word lists (constructed from sources similar to the DRM lists) afforded an opportunity to assess the generality of the effects of attention and word concreteness on the false memory effect for a language other than English.

Method

Participants. A total of 125 Universidad Autónoma de Madrid students in introductory psychology completed the experiment on a volunteer basis. One participant data were excluded because of failure to follow instructions. Data were collected in group settings with group sizes that ranged from 1 to 5.

Design and Materials. The experimental design was identical to that of Experiment 1. Two lists of concrete words [balcón (balcony) and joya (jewel)] were obtained from Algarabel, Ruiz, and Sanmartín (1988) norms. The two abstract lists [futuro (future) and odio (hatred)] were generated by another group of 75 Universidad Autónoma de Madrid introductory psychology students following similar instructions provided by Algarabel et al. (1989); that is, participants recorded the first three associates that came to mind after hearing a critical word read aloud by

the experimenter [e.g., futuro (future)]. Although lists were constructed in a manner identical to those of Experiment 1 with a descending order of association to the critical word, the specific lists could not be matched to the English words used in Experiment 1. The four 12-item lists were recorded on videotape at a 2-sec. rate. Although not all list words are available within published norms, comparisons of the words for which data are available (Algarabel et al., 1989; Sebastián, 2000) revealed that the two low-concreteness lists had significantly lower concreteness ratings ($M = 3.688$) than the two high-concreteness ($M = 5.30$) lists, $t(41) = 5.51$, $p < .01$. Further, a comparison between the low-concreteness list with the highest mean concreteness rating (futuro) and the high-concreteness list with the lowest mean concreteness rating (joya) revealed a significant difference, $t(18) = 2.48$, $p < .05$. On the other hand, mean word frequencies obtained from the Sebastián (2000) norms were equivalent between the two sets of words, t 's (n 's $= 48$) ≤ 1.20 , $p > .05$. Taken together, these results demonstrate that the low and high concrete lists differed significantly in rated concreteness, but not in word frequency.

Procedure. To manipulate level of attention in a manner similar to that of Experiment 1, participants either saw each word list alone or while monitoring an auditory shadowing task. During list presentation Divided Attention participants listened simultaneously to an audio tape containing a random sequence of digits and letters, recorded at a 2-sec. rate. Their job was to record either a dash "-" for each letter heard or an "x" for each digit heard. Participants were able to respond to the audio tape without having to look away from the words presented on video. Response sheets were collected after each list presentation. The auditory sequence always began before the first word was presented and continued beyond the last word of the

study list. During the 120-sec period between list presentation and recall all participants completed arithmetic problems. A total of 90 sec was allowed for written recall of list items.

As in Experiment 1, prior to the presentation of the four experimental lists, all participants received instructions and practice in the auditory monitoring, list presentation, and recall procedures. On practice trials two additional lists from Algarabel et al. [*peso* (weight) and *reino* (kingdom)] were used in counterbalanced order. All other details matched those of Experiment 1.

We anticipated that visual presentation of the list items would maximize the effects of the individual difference variable of imagery ability. Accordingly, a measure of imagery ability, the VVIQ [Marks (1973); Spanish version by M. de Vega (1989)], followed list presentation. This measure proved to be only weakly related to correct list recall and was not at all related to false memory errors.

Results

There was neither a main effect nor interaction of list presentation order with any other manipulated variable ($F_s < 1$); therefore, the data were collapsed across presentation orders to perform mixed-factors ANOVAs on the various dependent measures. Overall, the pattern of results was very similar to that obtained in Experiment 1.

Insert Table 3 about here

Correct recall of list items. The mean proportions of list items recalled are given in Table 3 as a function of attention level and type of study list. As found in Experiment 1, significantly more list items were recalled following Full ($\underline{M} = .766$, $\underline{SD} = .12$) than Divided Attention ($\underline{M} = .505$, $\underline{SD} = .14$), $\underline{F}(1,122) = 206.66$, $\underline{MSe} = .021$. Also as anticipated, significantly more list items were recalled from concrete ($\underline{M} = .692$, $\underline{SD} = .17$) than abstract lists [$\underline{M} = .579$, $\underline{SD} = .18$], $\underline{F}(1,122) = 111.28$, $\underline{MSe} = .007$] and the magnitude of the concrete-abstract difference was equivalent across levels of attention, $\underline{F} < 1$.

Recall of nonpresented critical words. Overall, the proportion of critical words recalled, across lists, was substantially lower ($\underline{M} = .24$) than the overall proportion ($\underline{M} = .48$) obtained in Experiment 1, a difference similar to that reported by Smith and Hunt (1998) for visual compared to auditory presentation. Nonetheless, as may be seen in Table 3, Full Attention participants ($\underline{M} = .161$, $\underline{SD} = .29$) again reported significantly fewer critical words than Divided Attention participants ($\underline{M} = .315$, $\underline{SD} = .37$), $\underline{F}(1,122) = 11.09$, $\underline{MSe} = .131$. Also in agreement with Experiment 1, critical words were reported significantly more frequently from the abstract ($\underline{M} = .343$, $\underline{SD} = .38$) than concrete ($\underline{M} = .133$, $\underline{SD} = .25$) lists, $\underline{F}(1,122) = 43.22$, $\underline{MSe} = .063$. However, the Attention X List Type interaction was also significant, $\underline{F}(1,122) = 8.73$, $\underline{MSe} = .063$. Post hoc tests revealed that although a significant difference between concrete and abstract lists was obtained under both levels of attention, $\underline{t}(61) = 2.68$, and $\underline{t}(61) = 6.40$ respectively, the difference was much larger with divided attention. Overall, the pattern of results for false recalls of critical words was highly similar across the two experiments.

Other intrusions. As may also be seen in Table 3 and also in agreement with Experiment 1, significantly more intrusions were given in the Divided ($\underline{M} = 1.024$, $\underline{SD} = 1.13$) than Full Attention conditions ($\underline{M} = .347$, $\underline{SD} = .65$), $\underline{F}(1,122) = 28.45$, $\underline{MSe} = 1.00$. Whereas there was no main effect of list type ($\underline{F} < 1$), the Attention X List Type interaction did reach significance, $\underline{F}(1,122) = 3.99$, $\underline{MSe} = .682$. Post hoc tests revealed that the difference between abstract and concrete lists was marginally significant [$\underline{t}(61) = 1.85$, $\underline{p} = .07$] under Divided but not under Full attention conditions ($\underline{t} < 1.0$). This pattern of differences is also consistent with the results of Experiment 1.

Insert Table 4 about here

Remember - Know Judgments. The proportions of R judgments assigned to list recalls, critical and noncritical intrusions are given in Table 4. In line with our prediction, there was a significant main effect of attention for list items evidenced by a higher proportion of R judgments following Full ($\underline{M} = .805$, $\underline{SD} = .18$) than Divided Attention conditions ($\underline{M} = .729$, $\underline{SD} = .19$), $\underline{F}(1,122) = 5.66$, $\underline{MSe} = .062$. Similarly, for nonpresented critical words as well, analyses revealed a significant main effect of attention level with, again, a substantially higher proportion of R judgments in the Full ($\underline{M} = .607$, $\underline{SD} = .48$) than Divided Attention condition ($\underline{M} = .281$, $\underline{SD} = .40$), $\underline{F}(1,21) = 4.19$, $\underline{MSe} = .247$, $\underline{p} = .05$. The numbers of critical word recalls are problematic in these analyses however because so few were reported and the within-subjects analyses requires equal \underline{n} 's across list types.

Table 4 also presents the mean proportions of R judgments for other noncritical intrusions. In agreement with the pattern for both list items and critical intrusions, R judgments were more frequent in the Full ($\underline{M} = .458$, $\underline{SD} = .43$) than Divided Attention condition ($\underline{M} = .155$, $\underline{SD} = .31$), $\underline{F}(1,27) = 5.54$, $\underline{MSe} = .115$. Neither the main effect of list nor its interaction with attention were significant, $\underline{Fs} < 1$.

Supplementary analyses. Overall, in the Full and Divided Attention conditions, list words (\underline{M} 's = .766 and .505, respectively) were recalled significantly more frequently than critical words (\underline{M} 's = .162 and .315, respectively), $\underline{t}(61) = 18.11$, and $\underline{t}(61) = 4.97$, respectively. However, this pattern was inconsistent across list types as a function of attention level. Specifically, under Full Attention, correct exceeded false recall for both abstract and concrete lists, $\underline{ts}(61) = 22.08$ and 10.37 , respectively. However, under Divided Attention correct recall significantly exceeded false recall for concrete [$\underline{t}(61) = 10.90$] but failed to do so for abstract lists where false recall numerically exceeded list item recall, $\underline{t}(61) = -.36$, as was observed in Experiment 1 for both list types.

Individual Differences analyses. The overall mean on the VVIQ scale was 3.84 ($\underline{SD} = .60$) of a maximum of 5. Analyses in which the VVIQ score was used as a covariate did not alter any of the effects reported above and, therefore, visual imagery ability as assessed by this instrument was not significantly related to performance on the recall tasks. A median split was also used to assign participants to a good or poor imager condition and these groups were compared on all dependent measures. Few differences were noted, and those few occurred only under conditions of divided attention. Specifically, good imagers recalled significantly more list items than poor

imagers in divided [$t(60) = 1.962, p = .05$] but not full attention conditions. As anticipated, this pattern was somewhat stronger for concrete than abstract lists, $t(60) = 2.17, p = .03$. No differences however, were obtained in the recall of nonpresented critical words.

Combined analyses of Experiments 1 and 2

Although presentation modality was not manipulated factorially, the pattern of results in Experiments 1 and 2 is similar to that reported by Smith and Hunt (1998) and supports the completion of an ANOVA in which presentation modality (or Experiments) is treated as a between-subjects variable. Our interest here is only in the main and two-way interaction effects of presentation modality. For correct recall, participants recalled significantly more correct list items following visual ($M = .635, SD = .18$) than auditory ($M = .50, SD = .16$) list presentations, $F(1,244) = 134.40, MSe = .019$. Further, the beneficial effects of word concreteness on correct recall were significantly larger for visual than for auditory presentation, $F(1,244) = 17.53, MSe = .007$.

For nonpresented critical words, visual modality participants were similarly and significantly less likely ($M = .24, SD = .34$) than auditory participants ($M = .48, SD = .38$) to recall the critical word as a list item, $F(1,244) = 52.41, MSe = .149$. Again, this main effect was moderated by list type [$F(1,244) = 4.53, MSe = .077$] in which the effects of word concreteness were significantly larger with visual than with auditory presentation: that is, visual presentation appeared to exaggerate the beneficial effects of concreteness on the production of false memories. A virtually identical pattern of results was obtained for noncritical intrusions with significantly fewer intrusions reported following visual ($M = .685, SD = .98$) than auditory ($M = 1.122, SD = 1.39$) presentation, $F(1,244) = 20.50, MSe = 1.881$ and more frequently from abstract than concrete word lists, $F(1,244) = 5.75, MSe = .786$.

Finally, a significant interaction between list type and modality reflected the equivalent frequencies of R judgments on concrete and abstract lists with visual presentation contrasted with the significantly higher frequency of R judgments for concrete than abstract words

following auditory presentation, $F(1,244) = 5.84$, $MSe = .011$. With respect to the recall of critical words, R judgments were more frequent following visual than auditory presentation and the magnitude of this difference was greatest in the Full Attention condition $F(1,89) = 4.73$, $MSe = .239$.

General Discussion

The false memory effect has proven remarkably resistant to a variety of experimental manipulations. The present results, however, demonstrate that the level of attention available at the time of study has large effects upon false memory reports and in a direction opposite to that predicted by other researchers (e.g., Roediger et al., 1998). Specifically, when participants heard or saw list words while engaged in a secondary task in Experiments 1 and 2, the rate of recalling critical nonstudied words virtually doubled that observed when full attention was available at study. Moreover, the frequencies of noncritical intrusions increased by a similar magnitude. Because attention was held constant at retrieval the results strongly suggest that the secondary task did not reduce the elicitation of implicit associative responses, but rather prevented participants from monitoring, identifying, or encoding the cognitive processes and phenomenological experiences related to those elicited associates. The significantly higher proportion of R judgments assigned to noncritical intrusions in Experiment 1 following Full than Divided Attention and the significantly higher proportions of R judgments assigned to both critical and noncritical intrusions in Experiment 2 following Full than Divided Attention strongly supports the view that the division of attention reduces the encoding of recollective experience rather than reducing the activation of semantic associates. Given the secondary task's demands, it seems likely that these elicitations occurred automatically or with little conscious effort (cf. Seamon et al., 1998). Although the rate of correct list items recalled was also significantly reduced by dividing attention such that one might argue that the (disproportionately) greater numbers of false recalls following divided attention might reflect an altered response criterion rather than a disruption of monitoring processes, the decreased rates of Remember judgments in the Divided Attention condition would not be similarly predicted. As a result, the present

evidence is not consistent with the response criterion interpretation of the production of false memories with DRM lists offered by Miller and Wolford (1999).

Within the Deese paradigm, the repeated activation or elicitation of the nonpresented critical words should provide several opportunities for participants to identify and encode these specific items as self-generated. When engaging in a concurrent task however, these monitoring opportunities are substantially reduced and, as a result, fewer discriminative cues related to self-generation are available at recall by which presented and nonpresented items may be distinguished. Despite large differences in the numbers of correctly recalled list items, the full and divided attention participants in Experiment 1 were, surprisingly, equally likely to assign R judgments to these list items. More surprising was the equivalence of R judgments to nonpresented critical words across attention levels in Experiment 1. Whereas participants may frequently recall perceptual or contextual experiences for list items, any recollective experience reported for nonpresented items, of necessity, must have been internally generated. It is possible, of course, that R judgments about presented and nonpresented words may differ substantially in the kinds of experiences to which they refer (cf. Mather et al., 1997; Norman & Schacter, 1997). The fact that these kinds of information about the critical nonpresented words were, apparently, as relatively available at test for divided as for full attention participants in Experiment 1 suggests that once an elicited word was accepted into the study and rehearsal sequence it may have had the same opportunities as a list member to be accompanied later by recollective experiences relating to contextual (e.g., list position), perceptual (e.g., internally generated acoustic characteristics), and cognitive information (cf. Norman & Schacter, 1997).

In Experiment 2 our prediction concerning differential R judgments was, in contrast, consistently supported. The second experiment differed from the first in several ways including the specific word lists, language, and mode of presentation. Of these, mode of presentation has been previously shown to alter false recalls across lists. Perhaps this variable is also responsible for the differential R judgments assigned to recalls of list items and intrusions following full and divided attention in Experiment 2. Specifically, while many researchers argue that, compared to

auditory presentation, visual presentation affords more item-discriminating cues (and use of the distinctiveness heuristic) than does auditory presentation (Schacter et al., 1999; Smith and Hunt, 1998) it is also possible that the monitoring process during study and rehearsal is affected in such a way by visual presentation as to render less likely the repeated elicitation of associates (as might be experienced with auditory presentation). This possibility is, of course, highly speculative but, in contrast to visually presented words, auditorily-presented words may more easily provide a phonological code that is assimilated into the rehearsal activities of participants. That is, auditory presentation may engender a rehearsal of words that is more "like thinking" (cf. Smith & Hunt, 1968) than does visual presentation. If true, visual presentation would be seen to reduce false recalls through two mechanisms: the encoding of more item-discriminating information (that is available at recall) for presented than nonpresented words and the affording during study of better opportunities to monitor and reject as list members those items that are self generated.

For other noncritical intrusions in Experiment 1 however, the proportions of R judgments for full and divided attention did, in fact, differ: when an "other" intrusion was given following full attention it was significantly more likely to be assigned an R judgment following full attention than following divided attention. This difference, together with the equivalence in R judgments for the critical nonpresented words suggests that it is also likely the frequency with which a specific word is elicited or activated that determines whether experiences are encoded that later form the basis of recollection. Those associates most frequently elicited are those that are most likely to benefit from the rehearsal and encoding of additional information that becomes the basis of the participants' recollective experiences and the recognized organizing theme of the list (e.g., Mather et al., 1997). With visual presentation in Experiment 2, the R judgments assigned to noncritical intrusions were also significantly higher under full than divided attention. Thus, regardless of the rates of these elicitations, when opportunities exist for encoding cognitive and perceptual experiences for generated items, participants are likely to do so.

Strong and consistent effects were observed in both experiments for variations in word concreteness and particularly so with visual presentation in Experiment 2. Correct recall of concrete lists always exceeded that of abstract lists and the recall of nonpresented words from abstract lists usually exceeded that of concrete lists. The higher correct recall of words from concrete than abstract lists has frequently (e.g., Paivio, 1991) been attributed to the availability of a greater variety of encodings for concrete than abstract words (e.g., as in imaginal and verbal encodings) or greater distinctiveness as a result of encoding processes (cf., Gee et al., 1999; Marchark & Surian, 1992). If abstract words generally engage more semantic processing than concrete words, more associates may be elicited to abstract words, one of which is deemed, for our purposes, a critical nonpresented word, or gist of the list. Support for this idea derives from the greater number of all types of intrusion errors recalled following abstract than concrete lists. Because abstract words may more easily elicit words that reflect semantic relationships between list items (as compared to specific category exemplars) these associates may also have fewer features than concrete words by which presented and nonpresented items may be discriminated (cf. Gee et al., 1999; Hirshman & Arndt, 1997), a position consistent with fuzzy trace theory. By focusing on word concreteness, on the other hand, the source monitoring framework would similarly predict fewer recalls of critical words for concrete lists because they are presumed to be represented by a greater variety of qualitative characteristics by which they may be distinguished at test. Given the similarity in predictions, the present experiments cannot speak to the adequacy of either theoretical perspective.

Although presentation modality was manipulated across, rather than within experiments, both the reduction in false memory rates and the increase in correct recall observed with visual as compared to auditory presentation are consistent with findings reported by Smith and Hunt (1998), and Kellogg (1999) and may cautiously be considered a replication of these findings. Our interpretation differs from that of Smith and Hunt: visual presentation provides both greater opportunity for differential processing/encoding of list items than does auditory presentation but also may provide for more successful monitoring of elicited items during study. Because Smith

and Hunt reported reductions in false memory rates on both recall and recognition tests, the effect appears to be one of an encoding as opposed to a retrieval.

We recognize, of course, that differences in correct and false recall rates obtained in our experiments may be the result of the two experiments' different lists, languages, and participants in addition to, or instead of, presentation modality. There are however several reasons why the list, linguistic, and population differences are likely to be considerably less important than those of presentation modality. First, as noted, our results are entirely consistent with those of other researchers who manipulated presentation modality in a factorial fashion. Second, the effects of word concreteness were highly similar across eight lists (four English and four Spanish) suggesting that effects observed in the experiments were not peculiar to a few specific lists. Further, the overall rates of false recalls reported for a large collection of Spanish lists (García-Bajos & Migueles, 1998) closely matches that for English lists reported by Stadler et al. (1998). Finally, the details of the method, including instructions, procedure, and the experimenter (M. N. P-M) were identical across experiments.

In neither experiment were the individual differences measures related to false memory production. Thus verbal ability, field dependence, and visual imagery join the lengthy list of individual differences that have failed to predict the rate of false memories within the Deese paradigm. To date, only a measure of dissociative tendencies has demonstrated any consistency in such a relationship (see Read and Winograd, 1999).

Finally, across the two experiments, five comparisons assessed the generality of the intriguing "more is less" phenomenon described by Toglia et al. (1999). However, in each comparison of the two levels of our variables (i.e., attention level, word concreteness, and presentation modality), higher correct recall was consistently accompanied by lower, not higher, false recall predicted by the "more is less" effect. Therefore, our results suggest that the relationships reported by Toglia et al. are likely restricted to a fairly specific set of conditions which perhaps induced a deeper or qualitatively different type of processing than did the two experiments reported here.

References

- Algarabel, S., Ruiz, J. C., & Sanmartin, J. (1989). The University of Valencia's computerized word pool. Behavior Research Methods: Instruments and Computers, 20, 398-403.
- Anastasi, J. S., Rhodes, M. G., Dill, C. E., Stokes, M. J., Pritchard, A. L., Velino, V., Warner, J. M., Weeb, T., & Montague-Smith, T. (2000, November). Effects of manipulated activation and age differences on illusory memories. Poster presentation at 41st Annual Meeting of the Psychonomic Society, New Orleans.
- Bennett, D. J. (1996, November). Where do false memories come from? separating the recollective and automatic influences. Poster presented at the 37th Annual Meeting of the Psychonomic Society, Chicago.
- Brainerd, C. J., Reyna, V. F., & Kneer, R. (1995). False-recognition reversal: When similarity is distinctive. Journal of Memory and Language, 34, 157-185.
- Brédart, S. (2000). When false memories do not occur: Thinking of the lure or remembering that it was not heard? *Memory*, 8, 123-128.
- Bruce, D., Phillips-Grant, K., Conrad, N., & Bona, S. (2000). Encoding context and false recognition memories. Under review.
- Bruce, D., & Winograd, E. (1999). Remembering Deese: The zeitgeist, the sociology of science, and false memories. Psychonomic Bulletin & Review.
- Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. Journal of Experimental Psychology, 58, 17-22.
- de Vega, M. (1989). Versión castellana del Cuestionario de Imaginabilidad VVIQ. Universidad de La Laguna, Trabajo inédito.
- Freyd, J. J., & Gleaves, D. (1996). "Remembering" words not presented in lists: relevance to the current recovered/false memory controversy. Journal of Experimental Psychology: Learning, Memory, and Cognition, 22, 811-813.
- Gallo, D. A., Roberts, M. J., & Seamon, J. G. (1997). Remembering words not presented in lists: Can we avoid creating false memories? Psychonomic Bulletin & Review, 4, 271-276.

García-Bajos, E., & Migueles, M. (1997). Falsas memorias en el recuerdo y reconocimiento de palabras. Estudios de Psicología, 1997, 58, 3-14.

Gardiner, J. M., Ramponi, C., & Richardson-Klavehn, A. (1998). Experiences of remembering, knowing, and guessing. Consciousness and Cognition, 7, 1-26.

Gee, N. R., Nelson, D. L., & Krawczyk, D. (1999). Is the concreteness effect a result of underlying network interconnectivity? Journal of Memory and Language, 40, 479-497.

Hicks, J. L., & Marsh, R. L. (1999). Attempts to reduce the incidence of false recall with source monitoring. Journal of Experimental Psychology: Learning, Memory and Cognition, 25, 1195-1209.

Hirshman, E., & Arndt, J. (1997). Discriminating alternative conceptions of false recognition: The cases of word concreteness and word frequency. Journal of Experimental Psychology: Learning, Memory, and Cognition, 23, 1306-1323.

Israel, L., & Schacter, D. L. (1997). Pictorial encoding reduces false recognition of semantic associates. Psychonomic Bulletin & Review, 4, 577-581.

Jacoby, L. L. (1996). Dissociating automatic and consciously controlled effects of study/test compatability. Journal of Memory and Language, 35, 32-52.

Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. Psychological Bulletin, 114, 3-28.

Kellogg, R. T. (1999, November). Putting it in writing: Consequences for verbal false memories. Paper presented at the 40th Annual Meeting of the Psychonomic Society, Los Angeles.

Kensington, E. A., & Schacter, D. L. (1999). When true memories suppress false memories: Effects of aging. Cognitive Neuropsychology, 16, 399-415.

Lampinen, J. M., Neuschatz, J. S., & Payne, D. G. (1997). Memory illusions and consciousness: Exploring the phenomenology of true and false memories. Current Psychology, 16, 181-224.

Lampinen, J. M., Neuschatz, J. S., & Payne, D. G. (1999). Source attributions and false memories: A test of the demand characteristics account. Psychonomic Bulletin & Review, 6, 130-135.

Lindsay, D. S., & Read, J. D. (1994). Psychotherapy and memories of childhood sexual abuse: a cognitive perspective. Applied Cognitive Psychology, 8, 281-338.

Marks, D. J. (1973). Visual imagery in the recall of pictures. British Journal of Psychology, 64, 17-24.

Marschark, M. & Surian, L. (1992). Concreteness effects in free recall: The roles of imaginal and relational processing. Memory and Cognition, 20, 612-620.

Mather, M., Henkel, L. A., & Johnson, M. K. (1997). Evaluating characteristics of false memories: Remember/know judgments and memory characteristics questionnaires compared. Memory & Cognition, 25, 826-837.

McDermott, K. B. (1996). The persistence of false memories in list recall. Journal of Memory and Language, 35, 212-230.

McDermott, K. B., & Roediger, H. L., III. (1998). Attempting to avoid illusory memories: Robust false recognition of associates persists under conditions of explicit warnings and immediate testing. Journal of Memory and Language, 39, 508-520.

McDermott, K. B., & Watson, (in press) The rise and fall of false recall: The impact of presentation duration. Journal of Experimental Psychology: Learning, Memory & Cognition.

Miller, M. B., & Wolford, G. L. (1999). The role of criterion shift in false memory. Psychological Review, 106, 398-405.

Multhaup, K. S., & Conner, C. A. (1999, November). The effects of source monitoring vs. standard instructions on the DRM memory illusion. Poster presented at the 40th Annual Meeting of the Psychonomic Society, Los Angeles, CA.

Neuschatz, J. S., Payne, D. G., Lampinen, J. M., & Tolia, M. P. (2001). Assessing the effectiveness of warnings and the phenomenological characteristics of false memories. Memory, 9, 39-51.

Newstead, B. A., & Newstead, S. E. (1998). False recall and false memory: The effects of instructions on memory errors. Applied Cognitive Psychology, 12, 67-79.

Norman, K. A., & Schacter, D. L. (1997). False recognition in younger and older adults: Exploring the characteristics of illusory memories. Memory & Cognition, 25, 838-848.

Paivio, A. (1991). Dual-coding theory: Retrospect and current status. Canadian Journal of Psychology, 45, 255-287.

Paivio, A., Khan, M., & Begg, I. (2000). Concreteness and relational effects on recall of adjective-noun pairs. Canadian Journal of Experimental Psychology, 54, 149-159.

Payne, D. G. (2001, June). Truth in memory: data, theory, and implications of false memory research. Paper presentation at the Meetings of the Society for Applied Research in Memory and Cognition, Kingston, Ontario.

Payne, D. G., & Elie, C. J. (1998, November). Repeated list presentation reduces false memories for pictures and words. Paper presented at the 39th Annual Meeting of the Psychonomic Society, Dallas.

Payne, D. G., Elie, C. J., Blackwell, J. M., & Neuschatz, J. S. (1996). Memory illusions: Recalling, recognizing and recollecting events that never occurred. Journal of Memory and Language, 35, 261-285.

Praterelli, M. E., Bowers, M., & Tiedt, A. (1998, November). Imageability and depth of processing effects on false recognitions. Poster presented at the 39th Annual Meeting of the Psychonomic Society, Dallas.

Read, J. D. (1996). from a passing thought to a false memory in two minutes: Confusing real and illusory events. Psychonomic Bulletin and Review, 3, 105-111.

Read, J. D., & Winograd, E. (1999). Introduction to the special issue on individual differences and memory distortion. Applied Cognitive Psychology, 12, 1-4.

Reyna, V. F. (1998). Fuzzy trace theory and false memory. In M. J. Intons-Peterson & D. L. Best (Eds.), Memory distortions and their prevention (pp.15-27). Mahwah, N. J.: Lawrence Erlbaum Associates.

Robinson, K. J., & Roediger, H. L. III. (1997). Associative processes in false recall and false recognition. Psychological Science, 3, 231-237.

Roediger, H. L. III., Gallo, D. A., Watson, J. M., & Balota, D. A. (1998, November). Eliminating and enhancing illusory memories. Paper presented at the 39th Annual Meeting of the Psychonomic Society, Dallas.

Roediger, H. L., III, & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. Journal of Experimental Psychology: Learning, Memory, and Cognition, 21, 803-814.

Roediger, H. L. III. McDermott, K. B., & Robinson, K. J. (1998). The role of associative processes in creating false memories. In M. A. Conway, S. E. Gathercole, and C. Cornoldi (Eds.). Theories of memory. II (pp. 187-245). Hove, Sussex: Psychological Press.

Schacter, D. L., Israel, L., & Racine, C. (1998, November). Suppressing false memories: The distinctiveness heuristic. Paper presented at the 39th Annual Meeting of the Psychonomic Society, Dallas.

Seamon, J. G., Luo, C. R., & Gallo, D. A. (1998). Creating false memories of words with or without recognition of list items: Evidence for nonconscious processes. Psychological Science, 9, 20-26.

Sebastián, N. (Coord.). LEXESP. Lexico informatizado del español, 2000. Barcelona: Edicions de la Universitat de Barcelona.

Smith, R. E., & Hunt, R. R. (1998). Presentation modality affects false memory. Psychonomic Bulletin & Review, 5, 710-715.

Smith, R. E., Payne, T. H., & Engle, R. W. (2000, November). The modality effect on false recall as a function of working memory. Poster presentation at the 41st Annual Meeting of the Psychonomic Society, New Orleans.

Stadler, M. A., Roediger, H. L. III, & McDermott, K. B. (1999). Norms for word lists that create false memories. Memory & Cognition, 27, 494-500.

Thapar, A. & McDermott, K. B. (in press). False recall and false recognition induced by presentation of associated words: Effects of retention interval and level of processing. Memory and Cognition.

Toglia, M. P. (1998, August). Unlocking illusory memories: The semantic processing key. Paper presented at the International Congress of Applied Psychology, San Francisco.

Toglia, M. P., & Neuschatz, J. S. (1996, November). False memories: Where does encoding opportunity fit into the equation? Poster presented at the 37th Annual Meeting of the Psychonomic Society, Chicago, IL.

Toglia, M. P., Neuschatz, J. S., & Goodwin, K. A. (1999). Recall accuracy and illusory memories: When more is less. Memory, 7, 233-256.

Tulving, E. (1985). Memory and consciousness. Canadian Psychologist, 26, 1-12.

Underwood, B. J. (1965). False recognition produced by implicit verbal responses. Journal of Experimental Psychology, 70, 122-129

Wallace, W. P., Malone, C. P., Swiergosz, M. J., & Amberg, M. D. (2000). On the generality of false recognition reversal. Journal of Memory and Language, 43, 561-575.

Table 1. Mean proportion recall of list items, mean proportion of nonpresented critical items and mean other intrusions in Experiment 1 as a function of type of word list and level of attention at study (FA = Full Attention; DA = Divided Attention). Standard deviations are brackets.

List Type	Correct Recall			Critical Items			Other Intrusions		
	FA	DA	Total	FA	DA	Total	FA	DA	Total
Concrete	.650 (.13)	.382 (.11)	.527 (.18)	.313 (.34)	.561 (.37)	.427 (.37)	.701 (1.49)	1.526 (1.42)	1.081 (1.51)
Abstract	.560 (.10)	.371 (.11)	.473 (.14)	.433 (.39)	.649 (.34)	.532 (.38)	1.134 (1.15)	1.614 (1.33)	1.355 (1.26)
Totals	.605 (.12)	.376 (.11)	.50 (.16)	.373 (.37)	.605 (.36)	.479 (.38)	.918 (1.34)	1.57 (1.37)	1.218 (1.39)

Table 2. Proportion "R" judgments in Experiment 1 for correct responses, nonpresented critical items, and other intrusion errors as a function of type of word list and level of attention at study (FA = Full Attention; DA = Divided Attention). Standard deviations in brackets. Sample n's provided for critical items and intrusion errors.

List Type	Correct Recall			Critical Items			Other Intrusions		
	FA	DA	Total	FA	DA	Total	FA	DA	Total
Concrete	.830	.823	.827	.345	.488	.428	.536	.323	.399
	(.22)	(.16)	(.19)	(.47)	(.44)	(.44)	(.49)	(.41)	(.44)
<u>n</u> 's				29	41		20	36	
Abstract	.805	.748	.779	.448	.427	.436	.647	.177	.345
	(.22)	(.19)	(.21)	(.47)	(.46)	(.47)	(.44)	(.29)	(.41)
<u>n</u> 's				29	41		20	36	
Totals	.818	.786		.397	.458		.591	.25	
	(.22)	(.18)		(.47)	(.42)		(.46)	(.36)	

Table 3. Mean proportion recall of list items, mean proportion of nonpresented critical items and mean other intrusions in Experiment 2 as a function of type of word list and level of attention at study (FA = Full Attention; DA = Divided Attention). Standard deviations are brackets.

List Type	Correct Recall			Critical Items			Other Intrusions		
	FA	DA	Total	FA	DA	Total	FA	DA	Total
Concrete	.822 (.09)	.561 (.12)	.692 (.17)	.105 (.22)	.161 (.27)	.133 (.25)	.387 (.71)	.855 (1.08)	.621 (.90)
Abstract	.710 (.12)	.448 (.13)	.579 (.18)	.218 (.33)	.468 (.39)	.343 (.38)	.306 (.59)	1.19 (1.16)	.750 (.96)
Totals	.766 (.12)	.505 (.14)	.635 (.18)	.161 (.29)	.315 (.37)	(.238) (.34)	.347 (.65)	1.02 (1.13)	.685 (.98)

Table 4. Proportion "R" judgments in Experiment 2 for correct responses, nonpresented critical items, and other intrusion errors as a function of type of word list and level of attention at study (FA = Full Attention; DA = Divided Attention). Standard deviations in brackets. Sample n's provided for critical items and intrusion errors.

List Type	Correct Recall			Critical Items			Other Intrusions		
	FA	DA	Total	FA	DA	Total	FA	DA	Total
Concrete	.813	.725	.769	.714	.188	.348	.292	.176	.192
	(.16)	(.18)	(.17)	(.49)	(.40)	(.45)	(.34)	(.35)	(.35)
<u>n</u> 's				7	16		4	25	
Abstract	.796	.733	.765	.500	.375	.413	.625	.133	.201
	(.20)	(.21)	(.20)	(.50)	(.39)	(.42)	(.48)	(.26)	(.37)
<u>n</u> 's				7	16		4	25	
Totals	.805	.729		.607	.281		.458	.155	
	(.18)	(.19)		(.49)	(.40)		(.43)	(.31)	

Author Notes

This research was supported in parts by research grants to the second author from the National Sciences and Engineering Research Council of Canada while at the University of Lethbridge and to the third author from DGICYT (Project PB-96-0079). The authors thank D. Stephen Lindsay for highly constructive comments on an earlier draft of this manuscript.

Correspondence concerning this article should be directed to the second author at the Department of Psychology, University of Victoria, P. O. Box 3050, Victoria, B.C., Canada, V8W 3P5 or e-mail to jdread@uvic.ca.

Appendix

Word lists used in Experiments 1 and 2. English translations are provided for the Spanish words of Experiment 2.

Experiment 1

Concrete Lists		Abstract Lists	
BREAD	MOUNTAIN	SLEEP	ANGER
Butter	Hill	Rest	Mad
Food	Valley	Awake	Fear
Sandwich	Summit	Tired	Hate
Rye	Top	Dream	Rage
Jam	Molehill	Wake	Temper
Milk	Peak	Snooze	Fury
Flour	Plain	Doze	Ire
Jelly	Glacier	Slumber	Wrath
Dough	Goat	Snore	Happy
Crust	Bike	Nap	Fight
Wine	Climber	Peace	Hatred
Loaf	Range	Yawn	Mean

Experiment 2

Concrete Lists				Abstract Lists			
BALCÓN	BALCONY	JOYA	JEWEL	FUTURO	FUTURE	ODIO	HATRED
Ventana	Window	Oro	Gold	Trabajo	Work	Rencor	Rancour
Casa	House	Diamante	Diamond	Mañana	Tomorrow	Amor	Love
Terraza	Terrace	Dinero	Money	Presente	Present	Dolor	Pain
Flores	Flowers	Brillante	Brilliant	Vida	Life	Ira	Wrath
Calle	Street	Valor	Value	Pasado	Past	Maldad	Badness
Mirador	Mirador	Perla	Pearl	Negro	Black	Rabia	Rage
Maceta	Flowerpot	Rubí	Ruby	Porvenir	Prospects	Venganza	Vengeance
Vista	View	Lujo	Luxury	Incierto	Uncertain	Violencia	Violence
Reja	Grille	Collar	Necklace	Felicidad	Happiness	Mal	Harm
Mirar	Look	Anillo	Ring	Lejano	Distant	Muerte	Death
Piso	Floor	Alhaja	Gem	Familia	Family	Desamor	Coldness
Aire	Air	Riqueza	Wealth	Destino	Destiny	Agresión	Aggression

