False Recall in Manipulations of the DRM Paradigm

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Abstract

This study was conducted using the DRM paradigm to try to further comprehend false recall positioning. The objective of this study was twofold: to demonstrate that gist, verbatim, and gist + verbatim instructions can alter the positional output of true versus false memories, and to see whether placement of these memories can be affected by other manipulations and their interactions. Results showed that altering the instructions given has a statistically significant effect (at the $p <.000$ level) in regards to the placement of false memory and true memory. Significant effects were also witnessed for various other manipulations that confirm the dual process theory. Although the study presented limitations, the results are very useful when applied to criminal investigations and psychotherapy.

False Recall in Manipulations of the DRM Paradigm

Memory, which can be defined as the mental potential or ability of preserving and reviving facts, ideas, events, impressions, etc. or of recalling or recognizing and being able to reconstruct prior occurrences, is an intricate process that is still incompletely understood today. However, it is now common knowledge and has been proven time and time again that human memory can be unreliable to some extent, whether it be by failing to remember at all, known as forgetting, or by remembering incorrectly, known as false memory or memory distortion.

Unlike in forgetting, when one has a false memory, one is not consciously aware of the distortion, and one remains unaware that one's memory is inconsistent with fact. This makes the questions surrounding memory distortion important. Research on the phenomenon of false memory was unfocused throughout most of the history of psychology. However, despite the lack of focus on this important area of psychology, various psychologists, including Alfred Binet, Jean Piaget, and Frederic Bartlett, did pose questions of enduring significance as well as generate findings that remain influential today and led to modern conceptualizations around false memory.

Over the past 30 years, answers to questions surrounding how and why memory becomes distorted have begun to emerge. Laboratory experiments have supported the existence of memory errors time and time again (see Roediger, 1996 and Schacter et al., 1995 for review). Research currently suggests that most cases of memory distortion are, surprisingly, the result of perception and comprehension operating normally (Hunt & Ellis, 2004). In order to understand this concept, it is critical to comprehend the various theoretical explanation of false memory. The three early explanations of false memory are constructivism, schema theory, and the source monitoring framework. However, one of the most influential and critical explanations that has been proposed relatively recently is that of dual retrieval processes, and various further explanations fall under this umbrella.

Strong's work on memory in 1913 laid the early basis for what later became known as dual-retrieval process theory of memory, proposed by Brainerd, Wright, Reyna, and Payne (2002). In Strong's original work, he used introspection test in which he read words and then gave a follow up word list and asked subjects to circle the words they recalled, and for each circled word the subject has to state how they recalled it. Although subjects made numerous statements, the results can be mostly placed under two categories – specific recollections, or verbatim memory (which involved subjects plainly recalling the word) and non-specific feelings of certainty, or gist memory (where subjects were really confident about having heard the word but had no distinct memory of hearing the word). From this, the idea of recognition being divisible into recollection (a memory of a conscious, specific experience) and familiarity (a weaker form of memory when you "know" something happened) later began to emerge. This finding means that recollection can be attributed with the surface form of memory and verbatim traces, while familiarity is associated with semantic forms of memory and gist traces.

The data that supported this theory, named "cognitive triage", states that in direct access, which is the initial stage of free recall, the weakest verbatim traces are output first and the strongest verbatim traces are output last. This distinction was shown by Brainerd et al. (1991) and lead to the proposition of the dual process theory (Brainerd et al., 2002). The theory goes on to state that in the second phase of free recall, called reconstructive retrieval, stronger traces are output first. This late output of non-presented critical distractors and the earlier output of presented critical words that has been proposed are consistent with the conception that reconstructive retrieval is present following the free recall retrieval process. Because of cognitive triage, dual-retrieval theory predicts that presented critical words should be output last during the first phase of free recall as this is when the strongest traces are output. As a result, the output position for presented critical words should be both prior to that for non-presented critical words and occupy a relatively central order position in the complete output. Also, because of this hyptheses, the output positions of presented and non-presented critical words should be expected differ by about one word or one position (Barnhardt et al, 2006). Following this theory, three explanations for the inner workings of the concept emerged to further augment it. The one with the more evidence states that recollection experience is not all semantic; one reinstates physical qualities of experience familiarity.

Various false memory paradigms have been developed to explain the "phenomenon" of memory distortion, and there are currently nine main modern paradigms surrounding false memory that have generated extensive study. The nine paradigms, as defined in The Science of False Memory (Brainerd & Reyna, 2005), include semantic intrusions in list recall, semantic false alarms in list recognition, false memory for semantic inferences, suggestibility of eyewitness memory, false identification of criminal suspects, false memory for schema consistent events, false memories in reality monitoring, false memories from reasoning, and autobiographical false memory. These paradigms are all important because they showcase the basic two types of responses that have been used to detect the presence of false memories. These two types of responses are are intrusions of meaning-preserving information on recall tests and false alarms to meaning preserving distractors on recognition tests. Both of these types have the ability to induce false memory responses at high levels because they use standard verbal learning tasks involving listening to or reading word lists that continually cue certain familiar meanings.

The first of the paradigms listed above is that of semantic intrusions in list recall. The list recall procedure, which has been central to memory research over the past decades, consists of having subjects merely recall as many of the words as they can from the ones that they just studied, and no additional words. It has been discovered that, in general, more studied words are recalled when the lists consist of words that have been categorized based on meaning (semantically), and even more words tend to be recalled if categories are cued. This paradigm also results in a characteristic intrusion effect, where subjects recall some words that were not studied but have similar meanings to those of the studied words. Such false recalls of words that are similar in meaning to those on the list are known as semantic intrusions. These findings of semantic intrusions in list recall have been demonstrated in both adults and children. Furthermore, it has been shown the intrusion rate can be increased by certain manipulations; for example, the recall rate of intrusions has been shown to higher when short irrelevant activity is presented before recall, or when a few days pass before recall (Brainerd & Reyna, 2005).

In 1959, James Deese performed two studies to explain the variations in false recall of stimulus words from lists of associated words (Deese, 1959). The method he used yielded extremely high rates of semantic intrusions of the stimulus words, even when subjects were given an immediate recall test, and the stimulus words were not presented in the associated word list. Deese had developed 36 lists of words, each containing 12 words which all associated to a single critical item for the first study. He used norms of word association (Russell & Jenkins, 1954) to do so, which means that the first 12 forward associates (what people think of most often when they hear a word) of the stimulus word were selected for the list. The subjects in this initial study listened to the 12 words on each list and were asked to recall as many words as possible immediately after hearing the list. The main results showed that the stimulus word had been falsely recalled by a large number of subjects, ranging from 0% - 42% (depending on the list). 32 of the 36 lists resulted in intrusion rates more than double the 5% rate that is usually obtained in other semantic intrusion list recall tasks, and exactly two thirds of the lists yielded 20% or higher intrusion rates. A major question resulting from this study revolved around the potentially large difference in intrusion rates between lists. Deese suspected that it was the backward associations that were being made from the list words to the stimulus words that caused this variation. These suspicions caused Deese to measure the backwards association variable for each of the list, which involved him presenting the lists to a new group of participants and asking them to give the first word that came to mind after hearing the list words (instead of recalling the words on the list). The results showed that in line with Deese's prediction, false recall was strongly predicted by backward association, with a correlation of .873 (Deese, 1959).

In 1995 Roediger and McDermott used materials developed by Deese in their studies of recall and recognition. Participants were presented with such lists developed by Deese of 12 – 15 words, and the important manipulation was that, as previously mentioned, the stimulus word was absent. When subjects were told to recall the words that they heard on such lists, the probability of falsely recalling the stimulus words was just as high in both recall and recognition tests (about 60% and 84% respectively) as it was for remembering the associated words on the list. The critical item was discovered to be just as likely to be stated as the words that were actually presented (Roediger & McDermott, 1995).

This false memory word list task and idea regarding false memory has become known as the DRM (Deese-Roediger- McDermott) paradigm. The way in which the DRM word lists are constructed practically guarantees that the distinct part of the brain corresponding to the stimulus words in both recall and recognition networks will receive large amounts of activation, and possibly even more activation than the part of the brain that is cued for the list words themselves. One explanation that has been presented for this result is that over the time course of the brain trying to grasp the presented material, the associated information comes to mind. The brain essentially “infers” that the related information was present during the original experience of hearing the list because it is in a sense synonymous with what was actually presented. With this task, it has even been shown that subjects cannot avoid creating false memories in the false recognition paradigm even if they are forewarned about the memory illusion (Gallo et al., 1997).

There are still many questions that surround the field of false memory research, including further explanation of why this effect occurs, and whether or not the associated information comes to mind unconsciously or consciously. One of these areas is where research on memory distortion meets social issues, especially in regard to eyewitness testimony and recovering past memories (via therapy in particular). For example, we now have confirmation that eyewitness reliability in criminal trials can potentially be based on imprecise memory due to the emergence of DNA evidence testing (Hunt & Ellis, 2004). In the past few years in particular, there have been cases of innocent people who are put behind bars due to positive eyewitness identifications and then are later exonerated due to scientific evidence. There have even been cases in which a victim's identifications have been sufficient for conviction on rape and murder charges, yet later it is proven that the victims' accounts were false. Such events illustrate the power of memory evidence and its inconsistent accuracy, and hence the need to do further research to determine false memory placement in order to mitigate such problems in society.

The DRM model has been important, and some would say even critical, to research surrounding false memory. Using this particular theoretical framework and task is highly applicable to modern memory research and has the ability to provide valuable information when utilized. Thus far, the DRM paradigm has shown support for the dual retrieval process theory of free recall and false memories in studies of output position and world relatedness effects. In general, studying the order of false recall is a critical test of dual process theories as positional output has the ability to prove or disprove the theories main assertions of two successive recall processes. In an overview study by Barnhardt et al. (2006), the findings from five DRM experiments in which critical words were presented or not presented in study lists were all shown to support the theory. These experiment results were in line with the idea that: "(1) there are two successive retrieval processes (direct access of verbatim traces and reconstruction from gist traces) in free recall, (2) items are recalled in ascending order of strength during direct access and descending order of strength during reconstruction from gist, and (3) false memories for words are attributable to reconstruction from gist traces" (Barnhardt et al, 2006).

One of the studies highlighted was a 2003 Brainerd et al. study on phantom recall which was, as pointed out previously, conducted to generate evidence in support of dual process theory using DRM lists. The methodology was applied to two distinct paradigms (repeated recall and conjoint recall), and with both, levels of phantom recollection were high and usually equal to or greater than levels of true recollection for the material that was presented. Theory-driven manipulations were used to disassociate phantom and true recollection, specifically list blocking, strength of false-memory illusions, repetition, and study-test delay, and results suggested different retrieval processes as consequences of the two different types of recollection, which obviously showcases support for dual process theory.

In 1996 Payne et al. conducted a study on illusions in memory. Results showed that the critical non-presented items were recalled and recognized nearly as often as studied items. Plus, subjects' responses on meta-memory tasks that were also given indicated that they understood the critical non-presented items (distractors) as being very similar to the presented items that they were recalling and/or recognizing.

In particular, it would be of huge consequence if the DRM paradigm could be used to determine when an individual will have a false memory, which is the goal of this study. If we can determine false memory placement, this would have huge positive implications in many areas, including in courtroom testimony and repressed memory cases. This particular study was conducted to determine a) whether the output placement of false critical distractors can be shifted from their normal position at the end of output to earlier positions, as a function of instructions that emphasize reconstructive retrieval rather than direct access and b) whether placement can also be affected by certain experimental manipulations (in this case list repetition and retrieval time allotted) that should influence reliance on direct access vs. reconstruction. Another important part of this experiment involves the other manipulations that were performed. The manipulations involved altering the amount of times that the lists were repeated, the amount of time available for subjects to recall the words, and being subjected to either a pleasantness or letter encoding condition. All of these instructional and experimental design manipulations were performed and tested because they should all have a differential effect on verbatim and gist memory.

Methods

This study was based on pre-collected data. The experiment was originally conducted by Dr. C. J. Brainerd. The data of the experiment were provided to me by Dr. Brainerd, for use in this honors thesis project. The use of the data for all other purposes remains the property of Dr. Brainerd.

Participants

The subjects were 55 undergraduate psychology students from the University of Arizona, who participated in the experiment for extra course credit. The sample was approximately equally male and female, and was 90% Caucasian and 10% Hispanic.

Design

The data that were available consisted of 20 of the subjects randomly placed in a pleasantness encoding condition, while 35 were placed in a letter encoding condition for the purpose of instigating verbatim versus gist memory. Within the letter encoding condition, 9 were given R instructions at recall, 13 were given T instructions at recall, and 13 were given R+T instructions at recall. R instructions mean that the subject is asked to recall words not on the list but similar to those on the list, T instructions mean that the subject is asked to recall only words that they heard on the list, and R+T instructions mean that the subject was asked to recall words on the list that they heard plus words that are similar to those on the list. Within the pleasantness encoding condition, 11 subjects were given P instruction, 4 were given T instructions, and 5 were given R+T instructions. T instructions involved telling the subjects to recall as many words as possible from the list, R instructions consisted of telling the subjects to give words that were similar to the ones on the list but not on the list, and R+T instructions were to give both words on the list and words associated with those on the list. In response to the 16 lists, for half of the lists each subject had 60 seconds to write down their responses, while for the other half of the lists they were given 90 seconds. Half of the lists were read only once, while the other half were read three times. Both the number of times that the lists were read as well the amount of time subjects were given to record their answers was randomized, and the breakdown ended up being 4 lists read once with 60 seconds for recall, 4 lists read three times with 90 seconds for recall, 4 lists read once with 90 seconds for recall, and 4 lists read three times with 90 seconds for recall.

Materials

The study lists were 16 of the lists used by Roediger and McDermott (1995). Each list contained words related to a critical non-presented word – the lists were the ones characterized by the following so-called critical distractors: ANGRY, CHAIR, CITY, COLD, CUP, DOCTOR, MOUNTAIN, NEEDLE, ROUGH, SLEEP, SMELL, SMOKE, SOFT, SWEET, TRASH, and WINDOW. The study words in each list were the 15 highest associates to the critical item. The order of presentation of the study words was held constant. The lists were presented orally, via audiotape. Separate recordings of each list were prepared, and the recordings were played in random order for each subject.

Procedure

Subjects were informed that they would hear a series of word lists presented by playing an audio cassette tape. The participants were also told that following each list they would be tested for recall. Participants in the semantic encoding condition were informed that after they heard each word they were to rate it for pleasantness on a 5-point scale. The scale ranged from 1, very unpleasant, to 5, very pleasant. The subjects were encouraged to use the whole scale and to choose the rating that most accurately represented their pleasantness judgment for each verbal item. In the non-semantic encoding condition the subjects were instructed to make yes/no decisions as to whether each study item contained the letter ``a' ' . Prior to the presentation of a list, each subject was given a sheet of paper to record his or her pleasantness or letter decisions.

In the semantic conditions subjects were instructed to record their ratings by simply writing a number at the top of the sheet reflecting their pleasantness assessment of the first item and then proceeding down the page to make each successive rating. They were also told that on occasion they might experience some indecision, but to try to provide a pleasantness rating for each word. The non-semantic processors were asked to record their responses, graphemic decisions, in the same manner as the semantic processors by writing a "Y" for yes or a "N"for no indicating that the word either did or did not contain the letter "a." These subjects were further informed that the task was difficult and they should try to provide an answer for every word, but not to worry if occasionally they could not make a yes/no determination in the time allotted. However, the four-second interval was a sufficient amount of time, as determined during pilot testing, for participants to accurately perform their assigned orienting tasks.

Following the orienting instructions the subjects were presented with the 16 study lists in a random order using the rules outlined in the design section above. Following the presentation of the first list, either one or three times (see the design section above), subjects were asked to turn over their rating sheets to the blank side. Then they were either asked to recall as many words as possible in any order from the list that had just been heard, as many words that were directly related to the ones on the list but not actually on the list, or both words on the list and ones that were related to ones on the list (as outlined above in the design section). The time allotted to complete each free recall test followed the rules outline above in the design section as well – either 60 seconds or 90 seconds. After a recall period had expired the sheets were collected. Then subjects were given a clean sheet of paper and a brief reminder of the encoding instruction before the tape was restarted. The same set of procedures was followed for all 16 lists (Toglia et al, 1999).

Data were analyzed using the SPSS statistical software package. This analysis rested on the computation of certain information derived from data. It consisted of calculating the mean output position for (1) the critical distractor and (2) the list targets for each of the conditions, as well as the (3) the mean output position for the first target that subjects recalled, were computed. For (1), if the critical distractor was not recalled, its position was considered to be "0," and if it was recalled, it was computed as its positional output number divided by the total number of words recalled. For (2), if no targets were recalled (mostly in the R condition), the position was considered to be "0," yet if targets were recalled, their mean was computed on the basis of the presence or absence of the critical distractor. If the critical distractor was not recalled, the positional output numbers of the N targets recalled were added and then were divided by the N number of targets that were recalled. If the critical distractor was recalled, similarly the position output numbers of the N targets added together were computed, but this time they were divided by the N number of targets that were recalled plus 1 to denote that the distractor, which in this case is considered a target, was recalled. For (3), as for (2), if no targets were recalled the output was considered "0." If one or more targets were recalled, however, the output number of the first target recalled was divided by the total number of items recalled (targets plus non-targets plus the critical distractor if recalled). In essence, the first measure of the mean output position of the critical distractor is telling us when someone is making their first false memory, the second measure of the mean output of target words is telling us if none, a few, or many targets were recalled, and the third measure of the mean position of the first target recalled is alerting us to when a first true memory is being made. In addition, the second measure is telling us about the accuracy of recall and essentially serves as a validity check because the manipulations that have been inserted in the design should affect the accuracy of recall. In particular, fewer list words should be recalled under R instructions than under T or T + R instructions.

This information was then all amalgamated into sets of descriptives taking into account the various manipulations that were used in the tasked and were further analyzed using ANOVA techniques to yield results.

Results

As this experiment consisted of between-subject manipulations of encoding with either letters or pleasantness and instructions of either T, R, or T+R, and within subject manipulations of one or three list repetitions, and 60 or 90 seconds to recall words, a repeated measures analysis of variance (ANOVA) was conducted with each of the three dependent variables that were computed: the critical distractor mean recall position, the target word mean recall position, and the first target recalled mean position. This was a 2 (encoding manipulation) x 3 (instructional manipulation) x 2 (list repetition manipulation) x 2 (retrieval time manipulation) ANOVA. Order of recall was used because of its centrality to the theoretical basis for this experiment. In this analysis, the alpha level was set at .05. As expected, there was a highly significant instructional effect of $F\ (2,52) = 114.05$, $p < .000$; $F(2,52) = 46.757$, $p < .000$ level; and $F(2,52) = 169.329$, $p < .000$ for each of the three conditions respectively.

Critical Distractor Mean Recall Position:

This measure is indicative of the mean position in which the critical distractor was recalled. The recall of the critical distractor in this case is demonstrative of the first true false memory that a subject has in the overall sequence of words recalled.

In regards to subject effects, the instructions for recall were found to be significant for the mean recall position of the critical distractor at the $F\ (2,52) = 114.025$, $p < .000$ level while the encoding condition was not found to be significant. No significance was found for the interaction between the encoding condition and instructions (see Table 1).

Table 1: The tests of between-subject effects of the mean recall position of the critical distractor.

Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Instructions	2.804	2.000	1.402	114.025	0.000
Encoding Condition	0.015	1.000	0.015	1.196	0.280
Instructions X Encoding Condition	0.035	2.000	0.017	1.406	0.255

This instructional effect significance result can be traced back to the mean recall position of the critical distractors (see Figure 1in appendix and Table 2).

Figure 1: Mean recall of critical distractors for each of the three different instruction types: verbatim, gist, and verbatim plus gist.

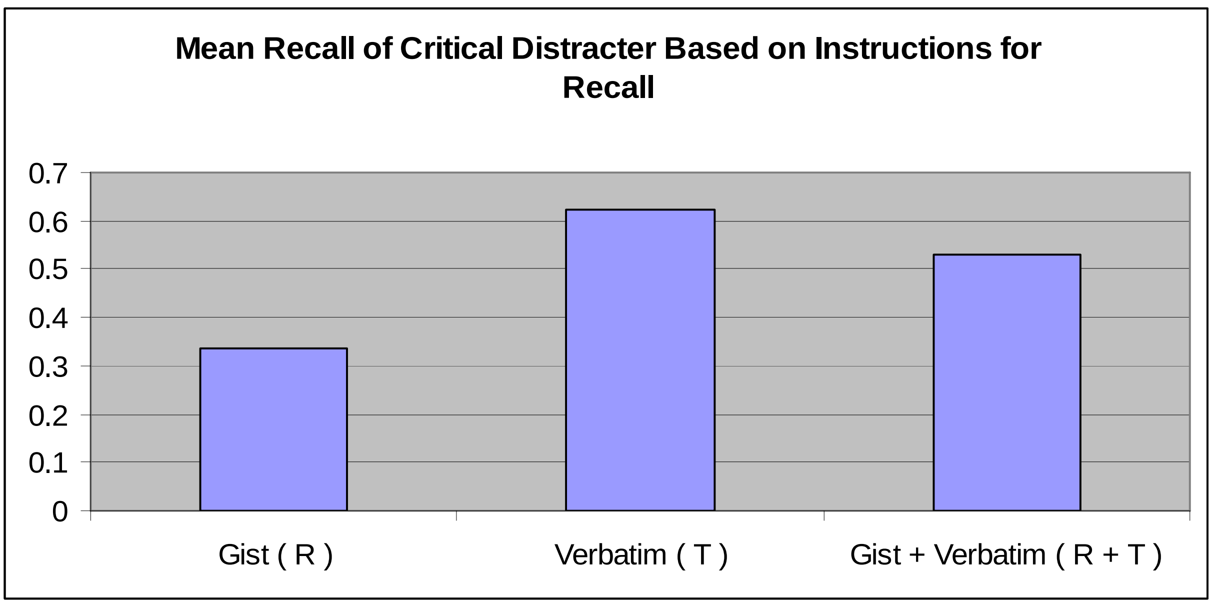

Table 2: Mean of critical distractor positioning based on the different instructions for recall (see Figure 1 above for graphical representation).

Means Based on Instructions for Recall

Instructions	Mean (Standard Deviation)
Gist (R)	.336 (.101)
Verbatim (T)	.625 (.056)
Gist + Verbatim (R + T)	.530 (.108)

This finding demonstrates that a subject is more likely to recall a critical distractor earlier when given (gist) instructions to recall words similar to those on the list, and later when given (verbatim) instructions to recall the exact words on the list, but in between when given instructions to recall words on the list but also words that are similar to those on the list (gist plus verbatim instructions), which is in line with the hypothesis that the critical distractor is more likely to arise earlier when given R instructions compared to T instructions.

In regards to the within-subject manipulations, the critical distractor mean recall position was found to be statistically significant for list repetitions, $F (1, 53) = 18.592$, $p < .015$, but not for retrieval time alone. Hence, the critical distractor was found to be recalled earlier when the list was repeated more times. When taking into account the interaction between retrieval and repetitions, results were significant at the $F (1,53) = 32.815$, $p < .000$ level (see Table 3 in appendix). Time for retrieval and the number of times that a list is repeated seem to acting in opposition to each other and canceled each other out here.

Table 4: The mean position of recall of the critical distractor based on list repetitions.

Mean Recall Position of Critical Distractor Based on List Repetitions

Repetitions	Mean (Standard Deviation)
1 Repetition	.512 (.084)
3 Repetitions	.479 (.093)

Table 5:

Retrieval X Repetitions for Critical Distractor Position	Mean (Standard Deviation)

60 seconds, 1 repetition	0.557 (.091)
60 seconds, 3 repetitions	0.445 (.097)
90 seconds, 1 repetition	0.474 (.077)
90 seconds, 3 repetitions	0.513 (.089)

In addition, it can be seen that the results for retrieval x encoding condition (Table 6), retrieval x instructions (Table 7), and retrieval x encoding condition x instructions (Table 8) were significant. Hence, retrieval on its own is not significant, but when it interacts with any of the other conditions, significance emerges. The interactions of repetitions x instructions (Table 9), retrieval x repetitions x instructions (Table 10), and retrieval x repetitions x instructions x encoding condition (each distinct condition of the 2 x 2 x 3 x 2 ANOVA) all showed significance in the results as well (for details on the p values, see Table 3 above). These significant results can be traced back to the descriptive outputs under each of these varied conditions.

Table 6:

Retrieval X Encoding Condition for Critical Distractor	**Mean**
60 seconds, Letter	0.472
60 seconds, Pleasantness	0.530
90 seconds, Letter	0.504
90 seconds, Pleasantness	0.483

This is demonstrative of the fact that the critical distractor is consistently recalled later under the pleasantness condition than the letter condition, and is recalled even later when given only 60 seconds in the pleasantness condition. In the letter condition, the critical distractor is recalled earlier when time allotted to recall is shorter, yet in the pleasantness condition, the critical distractor is recalled later when given a shorter period of time for recall. Hence, these two forces seem to be working in opposition to each other and are canceling each other out.

Table 7:

Retrieval X Instructions for Critical Distractor	**Mean**
60 seconds, Gist (R)	0.325
60 seconds, Verbatim (T)	0.610
60 seconds, Gist (R) + Verbatim (T)	0.568
90 seconds, Gist (R)	0.347
90 seconds, Verbatim (T)	0.639
90 seconds, Gist (R) + Verbatim (T)	0.492

In Table 7 it is evident that under R+ T instructions, the critical distractor is recalled much earlier when given a greater 90 second time to recall then when given only 60 seconds to recall in this condition. Overall, as demonstrated prior, this data further supports that regardless of the retrieval time allotted, the critical distractor is recalled latest in the verbatim condition, earliest in the gist condition, and in the middle in the R + T condition.

In Table 8, mean output position for the critical distractor is always much earlier in the gist than it is in the verbatim and gist plus verbatim conditions, which show later positioning of recall. In most instances (the dominant pattern is that) the verbatim condition always gives you the largest number which corresponds to a much later output of the critical distractor. The 60 second, letter interaction did not showcase this pattern, yet verbatim and verbatim plus gist were much larger albeit equal.

Table 8:

Retrieval X Encoding Condition X Instructions for Critical Distractor Position	**Mean**

60 seconds, Letter, Gist (R)	0.325
60 seconds, Letter, Verbatim (T)	0.542
60 seconds, Letter, Gist (R) + Verbatim (T)	0.551
60 seconds, Pleasantness, Gist (R)	0.325
60 seconds, Pleasantness, Verbatim (T)	0.679
60 seconds, Pleasantness, Gist (R) + Verbatim (T)	0.586
90 seconds, Letter, Gist (R)	0.293
90 seconds, Letter, Verbatim (T)	0.703
90 seconds, Letter, Gist (R) + Verbatim (T)	0.515
90 seconds, Pleasantness, Gist (R)	0.402
90 seconds, Pleasantness, Verbatim (T)	0.576
90 seconds, Pleasantness, Gist (R) + Verbatim (T)	0.470

Table 9:

Repetitions X Instructions	**Mean**
1 repetition, Gist (R)	0.339
1 repetition, Verbatim (T)	0.697
1 repetition, Gist (R) + Verbatim (T)	0.510
3 repetitions, Gist (R)	0.333
3 repetitions, Verbatim (T)	0.553
3 repetition, Verbatim (R) + Gist (T)	0.551

Table 10:

Retrieval X Repetitions X Instructions for Critical Distractor Position	**Mean**
60 seconds, 1 repetition, Gist (R)	0.354
60 seconds, 1 repetition, Verbatim (T)	0.766
60 seconds, 1 repetition, Gist (R) + Verbatim (T)	0.550
60 seconds, 3 repetitions, Gist (R)	0.295
60 seconds, 3 repetitions, Verbatim (T)	0.454
60 seconds, 3 repetitions, Gist (R) + Verbatim (T)	0.587
90 seconds, 1 repetition, Gist (R)	0.323
90 seconds, 1 repetition, Verbatim (T)	0.628
90 seconds, 1 repetition, Gist (R) + Verbatim (T)	0.470
90 seconds, 3 repetition, Gist (R)	0.371
90 seconds, 3 repetition, Verbatim (T)	0.651
90 seconds, 3 repetition, Gist (R) + Verbatim (T)	0.515

Tables 9 and 10 are showcasing the same thing as Table 8 – the dominant pattern is that verbatim instructions in particular seem to be causing the critical distractor to be recalled much later than in the other instructional conditions. Again, the mean output position for the critical distractor is always much earlier in the gist than it is in the verbatim and gist plus verbatim conditions, which show later positioning of recall. However, in Table 9, under the 3 repetition manipulation the effect was not as strong and the verbatim and verbatim plus gist instructions yielded nearly equal recall, and Table 10 shows that the effect does not occur in the 60 seconds, 3 repetition interaction, and in fact in the 90 second, 3 repetition interaction it isn't as pronounced, so the increasing repetitions seem to be lowering the interaction effect between the instructions and the recall time.

Target word mean recall position:

The dependent variable differs from the previous one in that it is measuring the mean output position of the target words that were recalled by the subject, which is essentially a measure of total recall, as the less number of target recalled, the lower the mean output position should be and visa versa.

In regards to between-subject effects, instructions for recall were found to be quite significant for the mean recall position of the target words at the $F(2, 52) = 46.757$, $p < .000$ level. Encoding conditions, as well as instructions for recall by encoding condition, were found to be statistically insignificant (see Table 11).

Table 11:

Between-Subjects Effects

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Instructions	126.666	2	63.333	46.756	0.000

Encoding Condition	1.767	1	1.767	1.304	0.259
Instructions X Encoding Condition	4.683	2	2.342	1.729	0.188

This instructional effect significance result can be traced back to the mean recall position of the target words, much like the critical distractor was above (see Figure 2 and Table 12). In this case, the mean is lower for targets under gist instructions, highest for gist plus verbatim instructions, and in the middle for verbatim instructions only, which is in line with the hypothesis.

Figure 2: Mean recall position of target words for each of the three different instruction types: verbatim, gist, and verbatim plus gist.

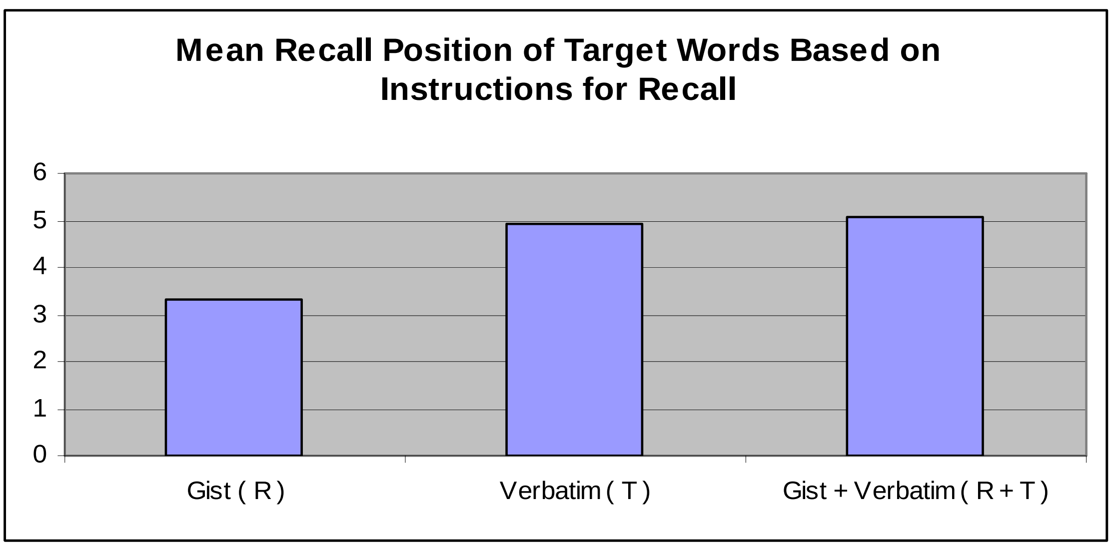

Table 12: Mean of target word positioning based on the different instructions for recall (see Figure 1 above for graphical representation).

Means Based on Instructions for Recall

Instructions	**Mean (Standard Deviation)**
Gist (R)	3.328 (.713)
Verbatim (T)	4.913 (.820)
Gist + Verbatim (R + T)	5.061 (.738)

In regards to the within-subject manipulations, the mean target recall position was found to be significant at the $F(1,53) = 26.116$, $p < .000$ level for retrieval times, and at the $F(1,53) = 87.006$, $p < .000$ level for list repetitions. However, the retrieval time and repetition interaction was not found to show statistical significance (see Tables 13 in appendix, 14, and 15). As can be seen, the longer the retrieval time allotted the greater number of target words recalled, and the more times a list is repeated within this interaction, the more target words are recalled as well.

Table 14:

Mean Recall Position of Target Words Based on Retrieval Time

Retrieval	**Mean (Standard Deviation)**
60 seconds	4.148 (.655)
90 seconds	4.719 (.860)

Table 15:

Mean Recall Position of Target Words Based on List Repetitions

Repetitions	**Mean (Standard Deviation)**
1 Repetition	3.980 (.704)
3 Repetitions	4.888 (.811)

The only other interactions found to be significant were repetitions X instructions by encoding condition (Table 16) and retrieval X repetitions X instructions (Table 17) and their significance can be traced to the means discovered via the descriptive statistical analysis that was performed on the data. In Table 16, the interaction showcases that 3 repetitions of the list result in greater overall recall, and that on average, there is significantly less recall under the gist condition than in the verbatim and gist plus verbatim conditions, in which recall amount tends to be similar (albeit slightly higher on average for the gist plus verbatim conditions). In Table 17, the gist condition seems to be producing much less recall overall for all interactions.

Table 16:

Repetitions X Instructions X Encoding Condition for Mean Target Word Recalled	**Mean**
1 repetition, Gist (R), Letter	3.110
1 repetition, Gist (R), Pleasantness	2.947
1 repetition, Verbatim (T), Letter	4.196
1 repetition, Verbatim (T), Pleasantness	4.552
1 repetition, Gist (R) + Verbatim (T), Letter	4.099
1 repetition, Gist (R) + Verbatim (T), Pleasantness	4.970
3 repetitions, Gist (R), Letter	3.411
3 repetitions, Gist (R), Pleasantness	3.842
3 repetitions, Verbatim (T), Letter	5.810
3 repetitions, Verbatim (T), Pleasantness	5.093
3 repetition, Verbatim (R) + Gist (T). Letter	5.380
3 repetition, Verbatim (R) + Gist (T), Pleasantness	5.794

Table 17:

Retrieval X Repetitions X Instructions for Mean Target Word Recalled	**Mean**
60 seconds, 1 repetition, Gist (R)	2.366
60 seconds, 1 repetition, Verbatim (T)	4.040
60 seconds, 1 repetition, Gist (R) + Verbatim (T)	4.418
60 seconds, 3 repetitions, Gist (R)	3.472
60 seconds, 3 repetitions, Verbatim (T)	5.111
60 seconds, 3 repetitions, Gist (R) + Verbatim (T)	5.482
90 seconds, 1 repetition, Gist (R)	3.691
90 seconds, 1 repetition, Verbatim (T)	4.708
90 seconds, 1 repetition, Gist (R) + Verbatim (T)	4.650

90 seconds, 3 repetition, Gist (R)	3.781
90 seconds, 3 repetition, Verbatim (T)	5.792
90 seconds, 3 repetition, Gist (R) + Verbatim (T)	5.693

First target recalled mean position:

This dependent variable is a calculation of the exact true-memory of first target's mean output position, hence, as opposed to the critical distractor which is showing us the position where the first false recall occurs, this measure is telling us when in a sequence of memories the first true recall occurs.

In regards to between-subject effects, it has been found that for the mean recall position of the first target recalled, instructions for recall yielded statistically significant results at the F (2,52) = 161.329, p < .000 level. Although the encoding condition on its own did not affect the results, the instructions for recall and encoding condition interaction was significant at the F (2,52) = 8.568, p < .001 level (see Table 18).

Table 18:

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Instructions	2.905	2	1.452	161.329	0.000
Encoding Condition	0.018	1	0.018	2.054	0.158
Instructions X Encoding Condition	0.154	2	0.077	8.568	0.001

This instructional effect significance result can be traced back to the mean recall position of the target words. As expected, the first target was recalled significantly sooner when instructions were given to recall words on the list (and words on the list plus related words) than when instructions were given to recall only words similar to those on the list (see Figure 3 and Table 19).

Figure 3:

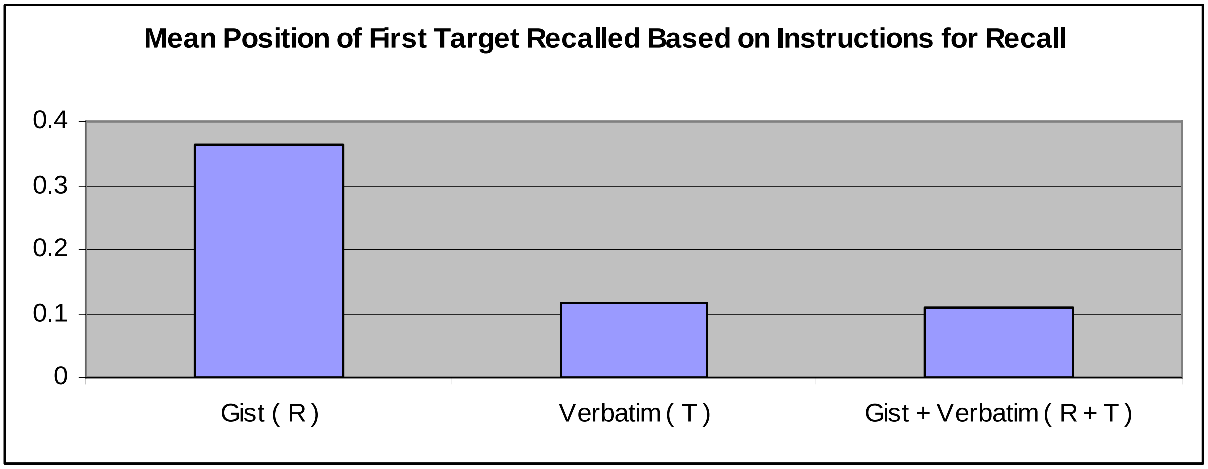

Table 19:

Mean Position of First Target Recalled Based on Instructions for Recall

Instructions	**Mean (Standard Deviation)**
Gist (R)	0.365 (.094)
Verbatim (T)	0.118 (.028)
Gist + Verbatim (R + T)	0.108 (.032)

Instructions interacting with the encoding condition produced a significant effect on when the first target was recalled (see Table 20). This is evident under the gist instructions where the encoding condition has made a significant difference, much more so in the pleasantness condition, but still in the letter condition, than it has under the verbatim or verbatim plus gist instructions.

Table 20:

Instructions X Encoding Condition for First Target Word Recalled	**Mean (Standard Deviation)**
Gist (R), Letter	0.317 (.106)
Gist (R), Pleasantness	0.414 (.082)
Verbatim (T), Letter	0.125 (.033)
Verbatim (T), Pleasantness	0.112 (.022)
Gist + Verbatim (R + T), Letter	0.120 (.042)
Gist + Verbatim (R + T), Pleasantness	0.096 (.023)

In regards to within-subject effects on the position of the first target recalled, it was found that number of list repetitions was statistically significant at the F( ) = 7.159, p < .010 level. Retrieval time on its own did not show significance, and neither did the interaction of repetitions and retrieval (see Table 21 in appendix).

The repetition effect on the mean recall position of the first target recalled can be traced back to the descriptive analysis that was conducted (Table 22).

Table 22:

Repetitions Effect on Mean Position of First Target Recalled	**Mean**
1 repetition	0.206
3 repetitions	0.186

In addition, two other interactions were found to be significant in producing the results: retrieval X instructions X encoding condition and repetitions X encoding conditions, at the F = 4.289, p < .019 and F = 4.087, p < .049 levels respectively. The descriptives showcase these significances in Tables 23 and 24 below. The pattern evident in Table 23 shows that in the gist condition the first target was recalled much later than in the verbatim and verbatim plus gist conditions, and that in most conditions (except 90 seconds, letter) verbatim on its own had slightly later recall than gist plus verbatim. Table

24 showcases that 1 repetition leads to earlier recall in both encoding conditions, but has a significant effect in making recall of the first target earlier in the letter condition as opposed to the pleasantness condition when 3 repetitions of the list are given.

Table 23:

Retrieval X Encoding Condition X Instructions	**Mean**
60 seconds, Letter, Gist (R)	0.330
60 seconds, Letter, Verbatim (T)	0.130
60 seconds, Letter, Gist (R) + Verbatim (T)	0.118
60 seconds, Pleasantness, Gist (R)	0.384
60 seconds, Pleasantness, Verbatim (T)	0.120
60 seconds, Pleasantness, Gist (R) + Verbatim (T)	0.101
90 seconds, Letter, Gist (R)	0.303
90 seconds, Letter, Verbatim (T)	0.119
90 seconds, Letter, Gist (R) + Verbatim (T)	0.121
90 seconds, Pleasantness, Gist (R)	0.445
90 seconds, Pleasantness, Verbatim (T)	0.104
90 seconds, Pleasantness, Gist (R) + Verbatim (T)	0.092

Table 24:

Repetitions X Encoding Condition	**Mean**
1 repetition, Letter	0.207
3 repetitions, Letter	0.167
1 repetition, Pleasantness	0.212
3 repetitions, Pleasantness	0.205

Discussion

Performance on memory tasks is based on the retrieval of both verbatim and gist traces. In regards to recall memory performance, there is an order of operations individuals use when making recall judgments according to dual process theory. Direct access of verbatim traces and reconstruction from gist traces are the two successive retrieval processes in free recall. It has also further been thought that that item are recalled in ascending order of strength during direct access yet recalled in descending order of strength during gist reconstruction. In addition, an underlying concept to theory states that false memories for words are ascribed to reconstruction from gist traces (Barnhardt et al., 2006).

According to dual process theory, one would expect to see false recall (in our case demonstrated by critical distractor) latest under the T instructional conditions because the subjects were instructed to use verbatim memory and will hence recall targets at the start, and only potentially recall critical distractors when you fall back on this and must resort to using gist reconstruction. Hence, you would expect un-presented items to appear earliest under R instructions, and in between R instructions and T instructions when given T+ R instructions.

This is a key prediction of dual process theory, and the results of this study provide strong evidence in support of this prediction. The false memory occurred much earlier under gist instructions with a mean placement ratio value of .336, while the value for verbatim instruction and verbatim plus gist instructions were .625 and .530 respectively. An underlying question in research surrounding false recall involves whether the brain always first begins with verbatim memory and then switches to reconstruction using gist. The results found here show us that this is not the case; where and when these two processes are used can be moved around as a function of instructions given for a task. This is a critical finding that proves that if the type of memory that one relies on to recall is shifted, then the positional output of where true versus false recall appears should experience a shift as well, which fully supports the existence of two successive separate processes (namely direct recall followed by reconstruction) that contribute to memory and false recall.

The mean output position of the first target recalled parallels the mean output of the critical distractor variable in that it is demonstrative of the first true memory that a subject has (while of course the critical distractor is alerting us to the first false memory a subject has). In this case, theory predicts that targets are recalled earlier under the T condition because these instructions requests one to report words that were on the list (which are the targets). In line with this, it is predicted that targets are recalled later under the R instructional condition and in between the results from the R instructional condition and the T instructional condition when R + T instructions are given (Brainerd & Reyna, 2005). The results of this study are almost directly aligned with this key theoretical prediction. The mean position of the first target recalled when looking at the instructional manipulation is .118 under verbatim instructions and .365 under gist instructions as the theory predicts. However, the gist + verbatim mean is .108, which is slightly lower than expected as it is below the mean of the verbatim instruction results. This flaw in the results can be attributed to study limitations which will be discussed later. This effect is also evident as an interaction effect in the results (see Table 8) where output that has the gist condition in the manipulation is consistently much earlier than output that lack the gist instructions and instead give verbatim or verbatim + gist instructions.

Another important part of this experiment involves the other manipulations that were performed. The manipulations involved altering the amount of times that the lists were repeated, the amount of time available for subjects to recall the words, and being subjected to either a pleasantness or letter encoding condition. All of these experimental design manipulations were performed because they should all have a differential effect on verbatim and gist memory.

First of all, theory states that repetition tends to strengthen verbatim memory more than it does gist memory (reviewed in Brainerd & Reyna, 2005). This makes sense logically, because one would expect to recall words on a list better when you have heard the words on the list repeated multiple times, and direct access is the best way to reach this information as it has been more solidly encoded. One should not have to rely on gist memory as much because one should be less likely to need to resort to making a reconstruction of what was presented, and hence, should be making more true associations prior to making false ones. This part of the theory is evidence by the results of repetitions effect on the mean output position of the first critical distractor. If Table 22 is referenced, it is clear that the first target, which is representative of the first true memory that a subject has, is output significantly sooner when the subject has been exposed to three repetitions of the list as opposed to just one.

In regards to retrieval time allotted, in this case 60 seconds versus 90 seconds, theory states that it is harder to do reconstruction when one has less time as in normal recall one begins by direct access of verbatim traces as they are more salient and easy to grasp, and only once this is exhausted will one revert to reconstruction. As gist based on reconstruction is a comparatively slow process, the 60 second condition should favor verbatim memory and so more recall should be verbatim than in the 90 second condition where one is able to reach the reconstruction phase. From this it follows that the placement of the critical distractor will be later in the 60 second condition on average than in the 90 second condition as we are looking at ratio and one has more time for retrieval – and of course false memory is a result of reconstruction from gist (again according to theory, reviewed in Brainerd & Reyna, 2005). Results from this experiment are surprisingly contrary to this part of the theory – in Table 7, 90 seconds, instead of favoring earlier placement of the false memory, showcases a slightly later recall of the false memory under both verbatim and gist instructional conditions, and the theory seems to only holds true under the gist + verbatim instructional condition. Perhaps in other areas of the results this can be attributed to the interaction effect playing a role.

The differences in the two encoding conditions that were used also have theoretical predictions that surround then. Because the letter condition is expected to reinforce and tap into verbatim memory, and the pleasantness condition revolves around semantic, meaning-based memory which favors gist and reconstruction, it would follow that variation in type of process used under each condition would ensue. More specifically, theory predicts that under a pleasantness encoding, more gist reconstruction should be occurring, and hence more false memories should be present and they should be present earlier on average (reviewed in Brainerd & Reyna, 2005). This is evidenced by Table 6, in which under the interaction of the pleasantness encoding X 90 seconds for retrieval time condition (both of which support gist memory as opposed to verbatim), the critical distractor is being recalled earlier than it is under the other conditions. Also, we witness a similar effect in Table 20, which shows that the interaction between gist and pleasantness produces ones first true memory significantly later than in any of the other conditions. From this, a conclusion can be drawn that the encoding condition, although never seemingly producing significant results on its own, produces results that evidence the dual process theory when it interacts with other manipulations.

All in all, when the mean recall position of the critical distractor, the mean recall position for target words, and the mean recall position of the first target were examined, in all three cases the results when different instructions were delivered were found to be highly statistically significant. As expected, the highly significant (at the $p < .000$ level) instructional effect for each of the three conditions confirms that manipulating instructions and hence how a person performs recall plays a critical role in ones ability to produce false memory.

No experiment is perfect, and this one was no exception. There were numerous limitations that should be briefly addressed. One is the sample for the study was not highly representative, as it is composed of college students from a single institution. However, a more pressing limitation of this particular study is that some of the numerical data is based on very few subjects: for example, under the pleasantness encoding, only 4 subjects were given T instructions and 5 subjects were given T + R instructions. Future research should have a more equal distribution of manipulation conditions. In addition, this study could only incorporate so many manipulations. It would be good for further research to be done into other permutations of these types of manipulations, such as having 1 repetition, 3 repetitions, and 5 repetitions of the list, or having 60 seconds for recall, 90 seconds for recall, 120 seconds for recall, and an infinite time to recall, both on an individual basis and on an interactional basis, to provide further and more extensive proof for dual process theories. In addition, perhaps even looking at other types of manipulations, such as order in which words are presented in the lists, would serve useful in providing more evidence for dual process.

Limitations aside, this experiment has several significant implications in connection with the realms of criminal investigations and psychotherapy. In criminal investigations, witnesses' inaccurate reports could inadvertently lead to the prosecution and conviction of innocent people. In psychotherapy (and also in connection with repressed memory cases), if patients report false memories, therapists will not be able to connect their symptoms to past events since the events themselves are being falsely reported. This prevents the therapists from helping the patient and ultimately deters a patient's inner conflicts from being fully resolved so they can live a normal as possible life.

Basically, the stronger or more rigid the instructions that are given to those in an investigation or in psychotherapy are, and the more someone is told to simply recall only what he or she absolutely remembers as true, the greater the chances are that false memory will not surface, and if it does surface, that it will surface much later than it would if other instructions were given. If one is told, as is common police protocol and psychotherapy, to say as much as one can remember regardless of whether one absolutely recalls if it occurred or not, then there are much higher chances that false recall will manifest itself among the real true memories and that it will also manifest itself earlier. Under these types of instructions, only the first recall outputs can be trusted, because once direct access is overcome by reconstruction and in this case because it is encouraged to surpass direct access sooner via the instructions, many memories could potentially be false as they are based on gist and cannot be trusted. In addition, it is also harder to distinguish between the true memories and the false memories which exacerbates the situation. The standard in criminal investigation interviews and interrogations as well as in psychotherapy of giving this type of gist + verbatim recall instructions to witnesses, suspects, and patients can have far reaching effects on memory accuracy.

Overall, the results of this study accomplish the goals of showing that the output placement of false critical distractors can be shifted from their normal position at the end of output to earlier positions when instructions emphasize reconstructive retrieval rather than direct access, and that placement can also be affected by certain experimental, manipulations, in this case list repetition and retrieval time allotted) that influences reliance on direct access vs. reconstruction. All of this is in accordance with dual process theory, and has numerous important implications for criminal investigations and psychotherapy.

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Appendix

List 1: The 16 DRM word lists that were used in this study.

MAD
FEAR
HATE
RAGE
TEMPER
FURY
IRE
WRATH
HAPPY
FIGHT
HATRED
MEAN
CALM
EMOTION
ENRAGE

TABLE
SIT
LEGS
SEAT
COUCH
DESK
RECLINER
SOFA
WOOD
CUSHION
SWIVEL
STOOL
SITTING
ROCKING
BENCH

TOWN
CROWDED
STATE
CAPITAL
STREETS
SUBWAY
COUNTRY
NEW YORK
VILLAGE
METROPOLIS
BIG
CHICAGO
SUBURB
COUNTY
URBAN

HOT
SNOW
WARM
WINTER
ICE
WET
FRIGID
CHILLY
HEAT
WEATHER
FREEZE
AIR
SHIVER
ARCTIC
FROST

MUG
SAUCER
TEA
MEASURING
COASTER
LID
HANDLE
COFFEE
STRAW
GOBLET
SOUP
STEIN
DRINK
PLASTIC
SIP

NURSE
SICK
LAWYER
MEDICINE
HEALTH
HOSPITAL
DENTIST
PHYSICIAN
ILL
PATIENT
OFFICE
STETHOSCOPE
SURGEON
CLINIC
CURE

HILL
VALLEY
CLIMB
SUMMIT

TOP
MOLEHILL
PEAK
PLAIN
GLACIER
GOAT
BIKE
CLIMBER
RANGE
STEEP
SKI

THREAD
PIN
EYE
SEWING
SHARP
POINT
PRICK
THIMBLE
HAYSTACK
THORN
HURT
INJECTION
SYRINGE
CLOTH
KNITTING

SMOOTH
BUMPY
ROAD
TOUGH
SANDPAPER
READY
JAGGED
COARSE
UNEVEN
RIDERS
RUGGED
SAND
BOARD
GROUND
GRAVEL

BED
REST
AWAKE
TIRED
DREAM
WAKE
SNOOZE
BLANKET

DOZE
SLUMBER
SNORE
NAP
PEACE
YAWN
DROWSY

NOSE
BREATHE
SNIFF
AROMA
HEAR
SEE
NOSTRIL
WHIFF
SCENT
REEK
STENCH
FRAGRANCE
PERFUME
SALTS
ROSE

CIGARETTE
PUFF
BLAZE
BILLOWS
POLLUTION
ASHES
CIGAR
CHIMNEY
FIRE
TOBACCO
STINK
PIPE
LUNGS
FLAME
STAIN

HARD
LIGHT
PILLOW
PLUSH
LOUD
COTTON
FUR
TOUCH
FLUFFY
FEATHER
FURRY
DOWNY

KITTEN
SKIN
TENDER

SOUR
CANDY
SUGAR
BITTER
GOOD
TASTE
TOOTH
NICE
HONEY
SODA
CHOCOLATE
HEART
CAKE
TART
PIE

GARBAGE
WASTE
CAN
REFUSE
SEWAGE
BAG
JUNK
RUBBISH
SWEEP
SCRAPS
PILE
DUMP
LANDFILL
DEBRIS
LITTER

DOOR
GLASS
PANE
SHADE
LEDGE
SILL
HOUSE
OPEN
CURTAIN
FRAME
VIEW
BREEZE
SASH
SCREEN
SHUTTER

Table 3:

Test of Within-Subjects Contrasts

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Retrieval	0.003	1	0.003	0.400	0.530
Retrieval X Instructions	0.102	2	0.051	7.138	0.002
Retrieval X Encoding Condition	0.068	1	0.068	9.540	0.003
Retrieval X Instructions X Encoding Condition	0.266	2	0.133	18.592	0.000
Repetitions	0.058	1	0.058	6.291	0.015
Repetitions X Instructions	0.244	2	0.122	13.164	0.000
Repetitions X Encoding Condition	0.025	1	0.025	2.656	0.110
Repetitions X Instructions X Encoding Condition	0.038	2	0.019	2.026	0.143
Retrieval X Repetitions	0.253	1	0.253	32.815	0.000
Retrieval X Repetitions X Instructions	0.182	2	0.091	11.840	0.000
Retrieval X Repetitions X Encoding Condition	0.000	1	0.000	0.003	0.953
Retrieval X Repetitions X Instructions X Encoding Condition	0.066	2	0.033	4.264	0.020

Table 13:

Tests of Within-Subjects Contrasts

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Retrieval	14.555	1	14.555	26.116	0.000
Retrieval X Instructions	3.069	2	1.534	2.753	0.074
Retrieval X Encoding Condition	1.005	1	1.005	1.802	0.186
Retrieval X Instructions X Encoding Condition	2.135	2	1.068	1.916	0.158
Repetitions	36.947	1	36.947	87.006	0.000
Repetitions X Instructions	2.472	2	1.236	2.911	0.064
Repetitions X Encoding Condition	1.083	1	1.083	2.550	0.117
Repetitions X Instructions X Encoding Condition	5.686	2	2.843	6.695	0.003
Retrieval X Repetitions	1.298	1	1.298	3.495	0.068
Retrieval X Repetitions X Instructions	2.899	2	1.450	3.905	0.027
Retrieval X Repetitions X Encoding	0.015	1	0.015	0.040	0.843
Retrieval X Repetitions X Instructions X Encoding Condition	0.348	2	0.174	0.469	0.629

Table 21:

Tests of Within-Subjects Contrasts

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Retrieval	3.7986E-09	1	3.7986E-09	1.2E-06	0.999
Retrieval X Instructions	0.008	2	0.004	1.207	0.308
Retrieval X Encoding Condition	0.006	1	0.006	1.972	0.167
Retrieval X Instructions X Encoding Condition	0.027	2	0.014	4.289	0.019
Repetitions	0.022	1	0.022	7.159	0.010
Repetitions X Instructions	0.000	2	0.000	0.077	0.926
Repetitions X Encoding Condition	0.013	1	0.013	4.087	0.049
Repetitions X Instructions X Encoding Condition	0.000	2	6.25007E-05	0.020	0.980
Retrieval X Repetitions	0.001	1	0.0014	0.746	0.392
Retrieval X Repetitions X Instructions	0.001	2	0.0005	0.258	0.774
Retrieval X Repetitions X Encoding Condition	0.000	1	0.0003	0.151	0.700
Retrieval X Repetitions X Instructions X Encoding Condition	0.000	2	0.0002	0.116	0.891