

## Impact of study modality on false memory

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### ABSTRACT

Human memory is thought to be perfect but it has inaccuracy and errors which are technically known as false memory. These memories can be affected by the way the learning material presented to subjects (Study Modality). With this view-point, the main objective of the present paper was to study the influence of study modality on false memory. A sample of 100 students from the age group of 12 – 25 years was drawn through convenient sampling technique. Two types of presentation were utilized: one visual and the other auditory. One group of Students was presented the lists visually and the other group heard the lists (auditory group). After presentation of each list, a Recognition Test was given to the respondents. Mann Whitney U test has been used to analyze the data. The results showed that there is a significant difference between Visual and Auditory modes of presentation for false recall ( $Z_u = 2.522$ ,  $p < 0.01$ ). The present investigation has implications in the area of education and eyewitness testimony.

**Keywords:** Study Modality, DRM Paradigm, False Memory

**F**alse memory can be defined as the misinterpretation of the past events that were never happened but the person believed they are happened in real situations. False memory has been defined as: "A mental experience that is mistakenly taken to be a veridical representation of an event from one's personal past. Memories can be false in relatively minor ways (e.g., believing one last saw the keys in the kitchen when they were in the living room) and in major ways that have profound implications for oneself and others (e.g., mistakenly believing one is the originator of an idea or that one was sexually abused as a child)" (Johnson, 2001). Hence, false memories are mingling of real and imagined experiences or events which occurred differently but may remembered as occurring together. In other words, the person believes that the events he saw repeatedly in dreams are the real experiences.

DRM Paradigm has been frequently used for creating and investigating false memories, originally conceptualized by Deese (1959) and revived by Roediger and McDermott (1995). In DRM (Deese, Roediger and McDermott) paradigm, participants study lists of words that are all highly associated with non-presented critical items. Recall and recognition tests were

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administered after the presentation of lists. The ease of administration and simplicity of the procedure make the paradigm more popular and useful for not only cognitive psychologists but for other researchers also.

Researchers have also used DRM lists to investigate the controversial issue of recovered memories for childhood sexual abuse. Researches on childhood sexual abuse found that individuals who claimed that they have recovered their childhood memories of sexual abuse are more expected to recall critical items than individuals that have always known they were sexually abused as a child. These research findings implied that the individuals with regained memories may likely to have problems with source monitoring, and so they may believe that their internally created ideas as true memories (Geraerts et al., 2005).

Senese, Sergi, and Iachini (2010) compared the activation levels of true and false memories in DRM paradigm using lexical decision task (LDT). Results indicated that the classification rate for the critical non-presented items was the same as actually studied words but shorter than new words. Otgaar et al. (2012) showed that children by typical FM implantation paradigm, had generated a rich false memory that they had taken a ride in a hot air balloon (which never happened), are also more vulnerable in a DRM test than children who do not develop false memory by implantation paradigm.

Bui et al. (2013) studied how implementation of prioritization processes increase false memories by using modified DRM paradigm. They conducted three experiments and found that words paired with higher values tend to increase true memory by selecting the most relevant information. This selectivity led to a greater vulnerability to false memories. Oliver et al. (2016) examined the effects of imagery manipulation on semantic and phonological lists. They presented semantic and phonological DRM lists to 102 participants with a free recall test and final recognition test. The findings suggested that imagery instructions enhanced correct memories and decreased false memories. They also found that phonological lists produced higher false memories at recall, whereas semantic lists elicited higher false memories at recognition.

Otgaara et al. (2017) studied the production and consequences of nonbelieved true and false memories using the DRM paradigm. They presented DRM word lists to participants with a recognition task and false feedback. They found nonbelieved true memories were identified more slowly in comparison to nonbelieved false memories. Brainerd and Reyna (2018) used DRM procedure to elicit false memory in participants and found that list words and critical distractors are remembered quite differently. Memory for list words is compensatory but memory for critical distractors is complementary.

Hellenthal et al. (2019) conducted experiments using both within and between experimental designs to study false memory formation for high and low arousing valenced DRM lists in full and reduced attention condition. Both experiments revealed that the negative high arousing false memory was increased in reduced attention conditions. In other words, recognition of critical lures for negative high arousing conditions were higher than low arousing conditions.

**Study Modality** can be understood as the effect of mode of presentation on the learned material. In other words, the modality effect refers to how the presentation modes affect the ability of an individual to learn the desired material. Researchers suggested that visually presented material may likely to reduce the probability to falsely recall the critical items the

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material presented auditorally (Smith and Hunt, 1998). This phenomenon can be referred as the modality effect.

A number of studies (Buskirk, 2007; Foos and Goolkasian, 2005; Goolkasian, Foos, and Eaton, 2009) have investigated modality effects in short-term memory. Most of these studies have found auditory presentation of verbal material to result in better retention than visual presentation. This effect occurs with serial lists and with paired associates, with recall and with recognition, and with tests of item and of order information.

Previous researchers (Rummer, Schweppe, and Martin, 2013; Rummer et al., 2011; Tabbers et al., 2004; Bol, Weert, Haes, Loos, and Smets, 2015; Smith and Engle, 2011; Lehnert and Zimmer, 2008) have concluded that the modes of presentation, whether it is visual or auditory, affect the person's ability to learn and recognize the presented material because people have the tendency to extract the gist and base their decisions on the simplest gist that allows them to accomplish the task. So, the presentation mode of the content directly influences the recall or recognition of the content.

Olszewska et al. (2015) compared false memory for material presented visually versus orally. The results indicated that the correct recognition of studied words was better for auditory study lists in short term memory, but there were no modality differences in correct recognition in long term memory.

Ulatowska, Olszewska, and Hanson (2016) used misinformation paradigm to study modality effects. They used video, pictures, a written narrative, and an auditory narrative in encoding phase whereas the misinformation and memory testing phases were presented in writing. They found that participants in the written and auditory modalities had less false memory than participants in the video and pictures modalities. They explained their findings based on the encoding-specificity effect, stating that the written and auditory modalities matched the written testing format, which made it easier for participants to retrieve the original information.

Chatburn, Kohler, Payne, and Drummond (2017) explained that the DRM task only uses a single sensory modality; however, there may be differences in false memory in different sensory modalities because they use different regions of the brain. Sanchez and Naylor (2018) explored the possible impact of changes in perceptual disfluency on false memory. They concluded that the participants in perceptual disfluency condition significantly recalled unrepresented information than the participants without perceptual disfluency condition. Thus, disfluency did significantly influence false memory.

### ***Problem***

- To study the impact of study modality (visual and auditory) on false memory.

### ***Hypothesis***

- Critical items will be recalled more in auditory group in comparison to visual group.

### ***Variables***

#### **Independent Variable**

Study Modality

Visual auditory

#### **Dependent Variable**

False Memory

## OPERATIONAL DEFINITIONS OF THE TERMS USED

**False Memory:** A false memory is a memory of an event which has not actually occurred but the person believes it has happened. In other words, false memories are distorted recollections of the past experiences.

**Study Modality:** The term ‘Study Modality’ refers to the dependability of learner’s performance on the mode of presentation of studied items. In other words, advantage of one mode of presentation over the other modality is termed as Modality Effect.

### *Sample*

100 students were selected through convenient sampling technique for the investigation out of which 50 students with equal number of boys and girls were in visual group and 50 students were placed in auditory group as shown in Table 1.

**Table 1: Levels of Independent Variable (Study Modality)**

Study Modality	
Visual	Auditory
50 Subjects	50 Subjects

### *Tools*

**False Memory:** ‘DRM Paradigm List’ was used to measure false memory. It consists of ten DRM lists with 10 associates of critical items, used by Howe et al. (2015). A Recognition Test was also administered in which some words were previously presented in the DRM Paradigm List and some words were new. Blair, Lenton, and Hastie (2002) calculated the Test-Retest Reliability and Cronbach Alpha of ‘DRM Paradigm Lists’ and found high reliability of lists in the production of false memories.

### *Controls*

1. Gender: Equal number of male and female respondents was selected for the study.
2. Educational qualification: Respondents selected for the study were from IX to Graduate level.
3. Age: Respondents between 12 – 25 years of age were included in the sample.

### *Design*

Matched-Double Groups Design was used to analyze the data.

### *Preliminary Setup*

The respondents were comfortably seated in a well-lit room in which the testing material was already kept in order. The environment was made calm and peaceful, noise was controlled and rapport was established in order to make the subject feel relaxed and cooperate in the experiment. The informed Consent for participating in the research was taken from the respondents before the experiment.

### *Instructions*

The following instructions were given to the subjects, “You have to read/ listen some lists of words and after each list, then, you will be given a recognition test to recognize those words which were previously presented to you.”

### *Actual Procedure*

After the appropriate instructions were given to the respondents, two types of presentations were utilized: one visual and the other auditory. For the visual presentation, 10 lists, each

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containing 10 words were shown to the subjects with the help of Power Point presentation. Further, for auditory presentation, the lists of 10 words were 'read out' in audible medium voice. After visual and auditory presentation of the list, the respondents were given a recognition test which included 10 previously used words, 1 critical word and 9 other new words. The responses were noted down. This procedure was repeated for all the 10 lists. After the completion of all the 10 recognition tests, scoring was done and the further statistical treatment was given to the raw data.

### *Analysis and interpretation*

After the two types of mode of presentation of the list of words were used i.e., visual and auditory to produce false recall; recognition test was administered for both visual and auditory presentation modes. The data was statistically treated with the help of Mann Whitney U Test shown in Table 2.

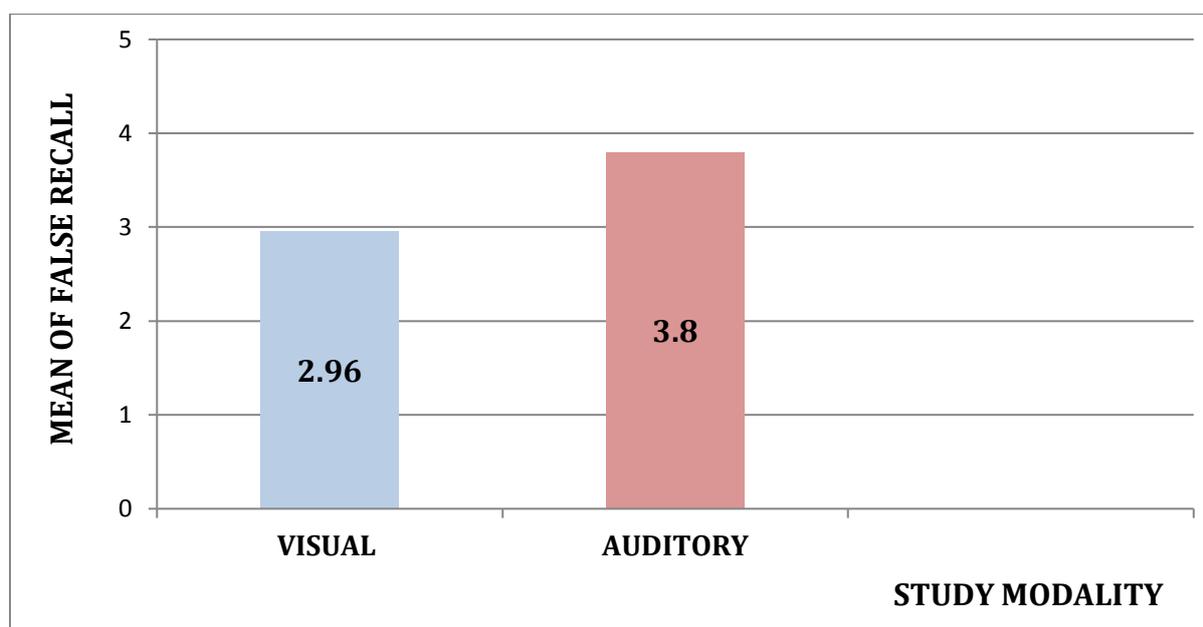
**Table 2: Mean, SD and Zu Value of False Recall for Visual and Auditory Mode of Presentation**

Study Modality	N	M	Sd	Zu	Level of Significance
Visual	50	2.96	1.91	2.522	p < 0.01
Auditory	50	3.80	1.65		

Table 2 indicates the mean value, SD and Zu value of false recall committed by subjects in different modes of presentation i.e., visual and auditory. Results show that the mean of visual group (M = 2.96) is lower than the mean of auditory group (M = 3.80) which means that the auditory group subjects recall more critical items than visual group. The obtained Zu value (Zu= 2.522, p < 0.01) is highly significant at 0.01 level of significance, which suggests that there is a significant difference between the visual and auditory modes of presentation. Hence, the hypothesis which stated that, "**Critical items will be recalled more in auditory group in comparison to visual group**" is accepted.

The above results reveal that the respondents of auditory group recalled more critical items as the mean value of the group is high. The subjects of visual group recalled less critical items which indicate lower false recall. This implies that the visual group of subjects retains the words from the list more and they are also accurate in their responses. Hence, it can be deduced that the visual group of subjects are more accurate in their responses as compared to auditory group of subjects. In other words, subjects of auditory group recalled more non-presented critical words. The results of Table 1 are graphically represented in Figure 1.

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N = 100 respondents, 50 in Visual group and 50 in Auditory group

**Figure 1: Comparing Mean Values of False Recall for Different Study Modality**

The present results are also supported by the study conducted by Gallo, McDermott, Percer, and Roediger (2001), Kellogg (2001), who found increased false recognition in auditory format than in visual format. Pierce, Gallo, Weiss, and Schacter (2005) also used DRM paradigm to elicit false memory and the results support the present findings that the accuracy rate is higher in visual group. A study conducted by **Otgaar et. al. (2014)** on false memory also found that critical lures were recalled less in visual group.

**Bol et al. (2015)** conducted a study on the modality effect and found a significant difference between the performance of audio-visual and written modality groups. They found better performance in audio-visual group. Smith and Hunt (1998) in their research paper, "Presentation Modality Affects False Memory" have given the explanation for their results. They explained the difference in performance between auditory and visual presentation in terms of "Distinctive and Relational Processing". Smith and Hunt's experimental results and present findings suggest that the visual presentation reduce the chances of recalling critical items at retrieval. The respondents of visual group are likely to recognize the critical words as presented in the list. Hence, the visual group discriminates between the words that are externally presented and the words that are generated internally.

Ulatowska et al. (2016) conducted research using the DRM paradigm have also shown that a match between the encoding and testing formats leads to lower recall of critical items. In the present study, the same modalities were used in encoding and testing phase for visual group. Thus, the recall of critical items was less in visual group in comparison to auditory group where the modalities used in encoding and testing phase were different.

#### **Implications of the study**

*The implications of the present research can be traced in the following areas for:*

1. Teachers and academicians to test the false memory of their students and take proper measures to improve their performance.

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2. Educationists and teachers to make more use of visual aids to enable their students to learn more accurately than through lecture method alone.
3. Eyewitness testimony and in legal areas, as the human memory is vulnerable to false recall.

### CONCLUSION

It can be concluded that the DRM Paradigm used in the present research was successful in producing false recall in respondents. In previous researches, DRM paradigm has also been a useful tool for assessing factors that might influence false memory formation. For example, researches have shown that stressful learning most likely reduced the recall of learned material but it may not impact the recall of critical items. This implied that the possibility to falsely recall the memories of crime by the witnesses and victims of stressful criminal situations are lessened than their other everyday events (Smeets, Jelicic, and Merckelbach, 2006). Therefore, the results are in agreement with the fact that the human memory is not perfect and accurate but it has errors and distortions which make the actual event distorted.

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### **Conflict of Interest**

The author declared no conflict of interest.

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