

Influence of Modality-Specific Expertise in the Auditory and Visual Recall: An Exploratory Study

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ABSTRACT

Memory is a cognitive ability that basically deals with information retention. It consists of three stages: encoding, storage and retrieval of information. Encoding is assumed to vary as function of modality of stimulus presentation. Studies pertaining to this direction has evoked mixed findings. The objectives of the current study compare auditory recall and visual serial recall in visual artists (specialised in visual modality like architects and photographers), musicians (have expertise in auditory modality) and control group (individuals without formal music training and formal experience in photography) and to investigate whether there is any significant difference between auditory and visual recall abilities within each of the three groups. 30 neurotypical individuals between the age ranges of 18-35 years served as participants. The participants were divided into sub group based on the expertise. Recall in auditory and visual modality was carried out on the participants. The results show that expertise in a specific modality had a major bearing on performance in recall tasks.

Keywords: *Influence, Modality-Specific Expertise, Auditory, Visual Recall*

Memory is a cognitive ability that basically deals with information retention. It consists of three stages: encoding, storage or maintenance and retrieval of information (Bonhage et al., 2014; Li et al., 2018). Encoding is the first stage in memory processing; it basically revolves around the information registered from the senses that is then converted to a storable form. This process, along with maintenance, occurs almost simultaneously in serial recall tasks or tasks involving working memory (Baddeley, 1992). The term echoic memory is used for storing information in the auditory modality (Clark, 1987), while the term iconic memory is used for storing information in the visual modality (Sakitt, 1976). Some recent studies suggest that effective incidental encoding results in the efficient formation of episodic memory, which is responsible for retrieval tasks (Buckner et al., 2001).

One of the most intensively studied tasks in cognitive psychology is serial recall. The most interesting aspect of serial recall is that it takes into account numerous operations and a

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Received: April 28, 2023; Revision Received: August 03, 2023; Accepted: August 08, 2023

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variety of cognitive skills which make up this system responsible for the task (Page et al., 1998). Since 1950s, when there was a surge in interest in recall studies, researchers have been intrigued to know the underlying cognitive processes and brain areas involved in this task. The maximum number of unrelated words that a healthy adult can recall in a serial fashion is six (Walker & Hulme, 1999) or seven items plus or minus two, according to George Miller (1956).

Memory plays a crucial role in storage, recall and encoding (Baddeley, 2004; Parker et al., 2002). However, several other external and internal factors can generally or specifically affect these processes. The factors that probably affect memory recall are trauma, physical activity, food consumption, gender, state-dependent memory, context, attention, motivation and interference (Baddeley, 1999; Parker et al., 2002). According to Baddeley et al. (1975), the accuracy of recall was dependent on the number of items that an individual could recite in about 2 seconds, and further evidence indicated that with ageing, the recitation rate slowed down (Kynette et al., 1990). The serial position effects seen in older adults are different from those produced by young adults (Maylor et al., 1999; Murphy et al., 2000). Gammada (2020) reported in his study that women demonstrated a gender-specific verbal memory advantage for initial and medial items. This could be attributed to the engagement of deep semantic processing. From the model of Cowan (1999), it can be concluded that the representations of the items to be memorised will be discarded out of the focus of attention if the focus is disrupted. This, in turn, will lead to memory impairment.

There is a lot of literature revolving around serial recall tasks. The research question of the current study on the effect of modality on recall is often investigated (Peynircioglu, 1986; Deboth & Dominowski, 1978; Pazdera & Kahana, 2022). These studies cited better auditory recall over visual recall. However, similar studies by Doty and Savakis (1997) and Grenfell-Essam (2017) suggested no significant difference between auditory and visual recall. The reason for better auditory recall over visual recall in the former studies was that auditory learning was assumed to be better than visual learning. In contrast, more recent studies state that modality-specific effects are observed, but they may be because of the temporal dynamics of the auditory stimuli rather than the sensory mode (Pazdera & Kahana, 2022). In the latter studies, there was no significant difference between auditory and visual recall because the lateralisation was different for both tasks. The visual information was speculated to be processed in the right hemisphere, and auditory information was thought to be processed in the left hemisphere. Hence, it can be inferred that the studies investigating the effect of modality over recall have not yielded uniform results.

We hypothesize that visual and auditory recall encoding should vary with modality-specific expertise in the current study. Some professionals like photographers and architects (visual artists) may have better visual encoding and perform better on visual recall tasks and certain other professionals like musicians may have better auditory encoding and may thus, perform better on auditory recall tasks. To the best of our knowledge, there are no studies tapping into the effect of modality-specific expertise on recall, particularly in visual artists. However, there are a number of previous studies comparing musicians with non-musicians on recall and memory tasks. Most of these studies suggest a better performance by musicians in comparison to non-musicians (Brandler & Rammsayer, 2003; Jakobson et al., 2008). This study hence can be regarded as an exploratory study.

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Need for the study

The effect of modality on recall has been investigated, and the studies in this direction yield mixed results. The effect of modality-specific expertise on recall, in general, has not been explored, hence these two findings necessitated the current study.

Aim and Objectives

The aim of the current study was to investigate the effect of modality-specific expertise on auditory and visual recall.

The objectives were to compare auditory recall and visual serial recall in visual artists (specialised in visual modality like architects and photographers), musicians (have expertise in auditory modality) and control group (individuals without formal music training and formal experience in photography) and to investigate whether there is any significant difference between auditory and visual recall abilities within each of the three groups.

METHOD

Participants

The study involved 30 neurotypical individuals aged 18-35, with a mean age of 23.9. They were divided into three groups; Group 1 was the Control Group (CG), consisting of ten individuals (five males, five females) without any formal music training and who had no formal or vocational experience in photography. Group 2 was the Musician Group (MG) consisted of ten musicians (five males, five females) who received formal training with any musical instrument for a minimum of three years. Group 3 was the Artist Group (AG) which consisted of ten Visual Artists, this group involved a combination of both photographers (five males) and architects (two males, three females) with a minimum of three years of professional experience in their respective fields. It was ensured that all participants were literate with the formal education of at least 12 years, with no visual or hearing sensory impairment and no cognitive or psychological impairments.

Basic demographic details such as age, gender, years of training in their respective professions (MG and AG), education, handedness, line of work or job, hobbies/talents and learning styles were noted. All participants gave informed voluntary consent to participate in the study, which had received the approval of the Institute Ethics Committee and was carried out in compliance with the regulations of our institution.

Materials

A total of 42 words were used for the current experiment, which were divided into three sets. The same words were used for both modalities, namely auditory and visual. Each modality contained six sets of stimuli, and each stimulus set comprised seven units. Two categories of stimuli were used in each task; abstract words like emotions, for instance, and concrete words like verbs. All the words chosen were high-frequency words. We additionally controlled the positions of semantically related items in each list, such that closely related items were not in the same set. Pre-recorded verbal stimuli and pictures of abstract and concrete words were used for both tasks. The duration of the auditory stimulus was within 600 msec for each stimulus and was presented via earphones. Each stimulus set for the visual task was presented for 10 seconds on a 15.6-inch laptop screen.

Design

A standard group comparison research design was used with counterbalancing in each group where one half of the participants underwent the visual task first and the other half

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underwent the auditory task first. This was a cross-sectional study where snowball sampling was used to recruit participants.

Procedure

First, a delayed recall task was taken from the Montreal Cognitive assessment (Nasreddine, 2005) to ensure intact baseline recall ability. Then the main experiment employed a serial recall task wherein the participants had to recall the stimulus in the order of presentation. They were given an explanation about the task and its required response. The experiment involved two tasks; an auditory recall and a visual recall task.

Before the auditory task, the participants were first made to listen to a video, on the internet, irrelevant to the study and adjust the volume to their sensation level, this was done to ensure that the participants would be able to hear the auditory stimuli used in the study clearly at a comfortable level. During the task, the six sets of auditory stimuli were presented. After the presentation of each set, the participants were expected to recall the items in a serial order. The responses were recorded manually by the examiner.

Before the visual task, training with images of stimulus items along with their names was given. This was done to facilitate associations between the images with their respective names, and there was no time limit for the same. The six sets of visual stimuli were presented. After the presentation of each set, the participants were expected to recall the items in a serial order. The responses were recorded manually by the examiner.

Each correct response on serial recall was given a score of 1, while an incorrect response was given a score of 0. If the order of the recall was disrupted and errors like insertion, substitution, omission or transposition were seen, no further score was awarded. The maximum score that an individual could obtain in auditory or visual modality was 42 (7x6).

RESULTS

The study was carried out with the aim of investigating the effect of modality on recall. In order to accomplish the aim, the objectives were divided into two broad heads. The first objective dealt with the comparison of performance on auditory and visual recall in the three group of participants. The first group comprised of 10 participants with no formal music training or expertise in visual modality. The second group on the other hand consisted of 10 participants who were trained in music. In other words, participants of the group had expertise' in auditory modality i.e. music. The third group consisted of 10 individuals with specialisation in 'visual modality'. The participants were recruited on purposive sampling basis. It was speculated that the group 1 were neutral participants while the participants of second and third group had expertise in auditory and visual modality respectively hence it was assumed that the modality of recall also would vary as a function of expertise. The second objective dealt with the within group comparison for participants of each of these groups. In other words, the performance on visual recall and auditory recall was compared within group 1 and group 2. Recall for both auditory and visual recall was tested by employing stimulus sets. Each stimulus set comprised of 7 stimuli (7 units) and 6 such stimulus sets were used. Thus, the maximum score accounted to 42.

The mean scores were calculated for group 1, group 2 and group 3 participants on auditory and visual recall. For group 1 participants, the mean score on auditory recall and visual recall was 19 and 26, respectively. For group 2, mean auditory and visual recall scores were

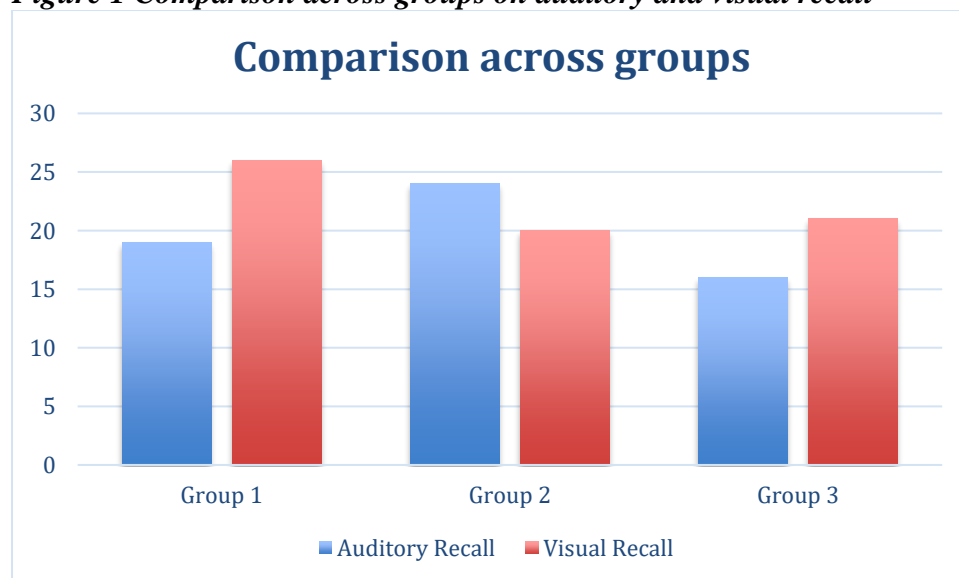
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24 and 20, respectively. For group 3, the mean scores were 16 and 21 on auditory and visual recall, respectively.

Table 1 Scores on visual and Auditory Recall for group 1, group 2 and group 3 participants

	Auditory Recall	Visual Recall
Group 1	19	26
Group 2	24	20
Group 3	16	21

Figure 1 Comparison across groups on auditory and visual recall



The first objective was to compare the auditory and visual recall abilities based on recall scores obtained. Kruskal-Wallis Test and the statistic showed a χ^2 value of 2.3, and the corresponding p-value showed a significant difference between auditory recall for the three groups. The χ^2 value for visual recall was 3.6, and corresponding p values showed a significant difference between the groups for visual recall. Further Mann-Whitney U test was used in order to verify if there was any significant difference across the pair of groups. On comparing group 1 with group 2, group 2 with group 3 and group 3 with group 1, |z| scores of 1.38, 2.26 and 1.96 was obtained and the corresponding p values showed significant difference between group 1 and group 3; group 2 and group 3.

The second objective was to compare if there was any significant difference between auditory and visual recall scores within each of the three groups. The |z| scores for the three groups were 2.38, 2.64 and 2.43 respectively, there was a significant difference for each of these groups i.e. there was a significant difference for auditory versus visual recall for all the three groups (when the performance on auditory and visual recall was compared for each group individually).

DISCUSSION

The performance on recall varied as a function of modality. Group 1 participants comprised of individuals who were neutral. The participants in this group were not trained musicians nor had expertise in visual modality. This group served as control group. The second group participants had specialisation in auditory modality while the third group of participants had specialisation in visual modality. Incidentally it was noticed that group 2 participants

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performed well on auditory recall while group 3 participants performed well on visual recall compared to auditory recall. However, correlation was not carried as it was beyond the purview of the current study. The current study would be extended by considering the mode of specialisation and also by carrying out correlation between the 'level of expertise' and performance on auditory and visual recall. In summary for the first group, recall was better for visual recall compared to auditory recall. For the second group (expertise in auditory modality/music), auditory recall was better than visual recall while for the third group (expertise in visual modality), recall scores were better for visual over auditory stimuli. Thus, expertise played an essential role in deciding the relationship between recall and modalities.

The other salient feature of the current study was that for the control group, the recall was found to be better for visual stimulus. This finding contradicts the results obtained in the previous studies (Peynircioglu, 1986; Deboth & Dominowski, 1978). This could be because visual stimuli are easily encoded, stored and retrieved as compared to auditory stimuli.

SUMMARY AND CONCLUSION

The study was carried with the aim of investigating the effect of modality of recall on expertise. Three group of participants were recruited for the current study. The first group of participants were neutral while the second and third group of participants had specialisation in auditory and visual media respectively. Group 1 and group 3 participants performed well on visual recall compared to auditory recall tasks. While group 2 participants performed well on auditory modality thus showing the mode of specialisation would influence the performance on recall.

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Acknowledgement

The author(s) appreciates all those who participated in the study and helped to facilitate the research process.

Conflict of Interest

The author(s) declared no conflict of interest.

How to cite this article: Dudwadkar, M., Nazir, A., Mavis, E. & Abhishek, B.P. (2023). Influence of Modality-Specific Expertise in the Auditory and Visual Recall: An Exploratory Study. *International Journal of Indian Psychology*, *11*(3), 1739-1746. DIP:18.01.167.20231103, DOI:10.25215/1103.167