

Relationship between Memory and Modality of Stimulus Presentation

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Abstract

Memory is the mental faculty that encodes, stores and retrieves information. Recall is the third stage involved in memory. It is influenced by both internal and external variables including stimulus presentation modality. Researchers in the past have compared recall for words presented across the auditory and visual modality, claiming one to be superior to the other. The present study aimed to compare the recall abilities for visual (pictures) and auditory (words) modalities in neurotypical younger and older adults. Based on age, the participants were divided into two groups comprising of 20 participants each. The first group comprised of participants aged 18–25 years and the second group comprised of participants aged 60–80 years. Pictures presented in the visual modality and words presented in auditory modality served as the stimuli for the study. The task of participants was to recall six pictures presented in a sequence and recall a word string comprising of six items presented in the auditory modality. As proven earlier, recall was superior for younger participants as compared to older participants. Recall was also found to be better for words presented in the auditory modality as compared to pictures for both groups. However, the difference was statistically significant only for the second group, indicating that visual attention would be relatively more affected compared to auditory attention. The study can be extended to the cognitively impaired population to understand if the recall varies as a function of stimuli property and modality of presentation.

Keywords: Recall, modality, aging

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INTRODUCTION

Memory is the mental faculty that enables one to retain and recall previously experienced sensations, impressions, information and ideas. Recall in memory refers to the mental process of retrieval of information from the past. After encoding and storage, recall is the third stage involved in memory. It is influenced by both internal and external variables.

Internal variables include motivation, attention, age, sensory abilities, neurological and mental health of the subject. Memory recall abilities fade with age. Research showed that the white matter conduits connecting different regions of the brain withered over time, hence impairing the communication between different parts of the brain, in turn affecting recall [1]. Sensory abilities include intact hearing and vision sensations, depending on the task at hand. Neurological disorders such as tumors, trauma and

neurodegenerative diseases, psychiatric disorders, metabolic diseases and infectious diseases were also noted to affect recall [2].

External factors like the stimulus presentation modality and testing environment also extend their influence on the participants recall abilities. Modality of presentation refers to the auditory or visual presentation of stimuli. Researchers in the past have reported the influence of sensory modality on memory recall [3].

Some studies have revealed visual recall to be superior to auditory recall [4]. This could be attributed to a greater ease of dual coding in case of pictures than sounds or words and also that visual attention was considered to be better than auditory attention. On the contrary, few other studies find auditory recall to be superior to visual recall stating that auditorily presented words were easier to recall than

visually presented pictures due to the nature of their encoding pathways [5]. In most of the studies carried out in this direction, recall has been compared for words presented across auditory and visual modality. Studies probing on recall of pictures and auditory presented words are sparse in literature.

NEED FOR THE STUDY

Recall is a complex phenomenon influenced by various factors including age and stimulus presentation modality. Limited studies have taken into consideration the age of the participants. Studies reporting the influence of modality of stimulus presentation have compared visual versus auditory recall. Not many studies have compared the recall for words and pictures. This factor necessitates the present study.

AIM

To test and compare the recall abilities in visual and auditory modality in neurologically healthy younger and older adults.

METHOD

Participants

40 neurologically healthy adults were considered as participants. They were further divided into two groups 18–25 years (group 1) and 60–80 years (group 2) with mean ages of 20 and 68 years respectively. Both the groups comprised of 20 participants and had same number of males and females. Participants

were screened for perceptual (auditory and visual) deficits. Kannada was the native language as well as the medium of instruction for all the participants in both groups.

Materials

The study was carried out in Kannada. Recall was tested using eight stimuli sets including four in auditory and four in visual modalities, with six items in each set. Presentation of visual and auditory stimuli was alternated with each participant. The pictures and words selected for the study were considered familiar to the participants of both groups.

Procedure

The stimuli for the auditory recall task were presented verbally by the researcher at a rate of one word per second and the stimuli (pictures) for the visual recall task were presented through Power point presentation at the rate of one picture per 2 sec. The words had a syllable length ranging from 2–5 words. The pictures also had the same syllable length (name of the pictures). The participants were asked to pay attention and listen to the words/see the pictures, as per the task. They were then asked to immediately recall all the items, as far as possible, in the same order of presentation. A score of 1 was given for each word or picture correctly recalled and thus the maximum score was 6 for each set and 24 for the each modality. The scores obtained by participants in both the groups for each of the two modalities were tabulated and analyzed.

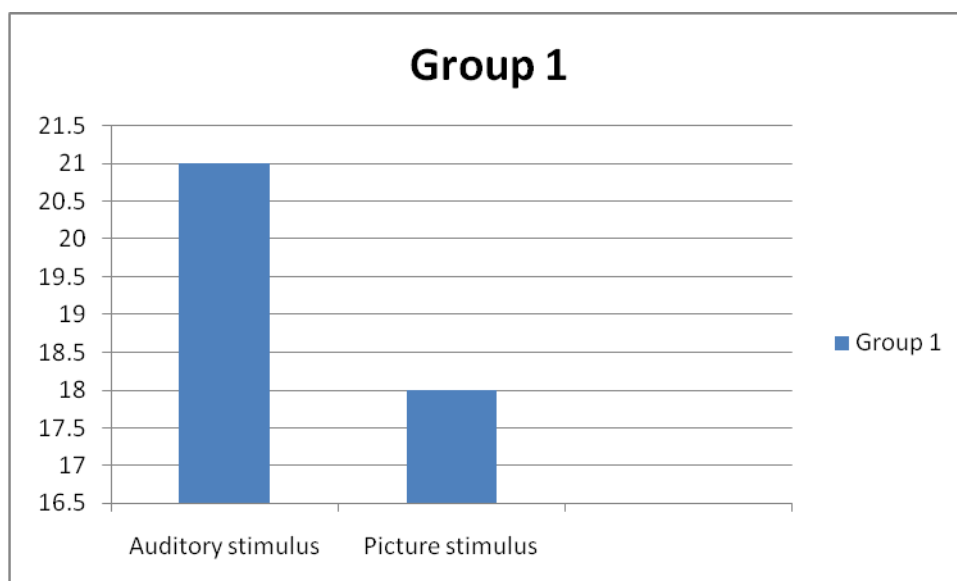


Fig. 1: Performance of Group 1 Participants on Auditory and Picture Stimulus.

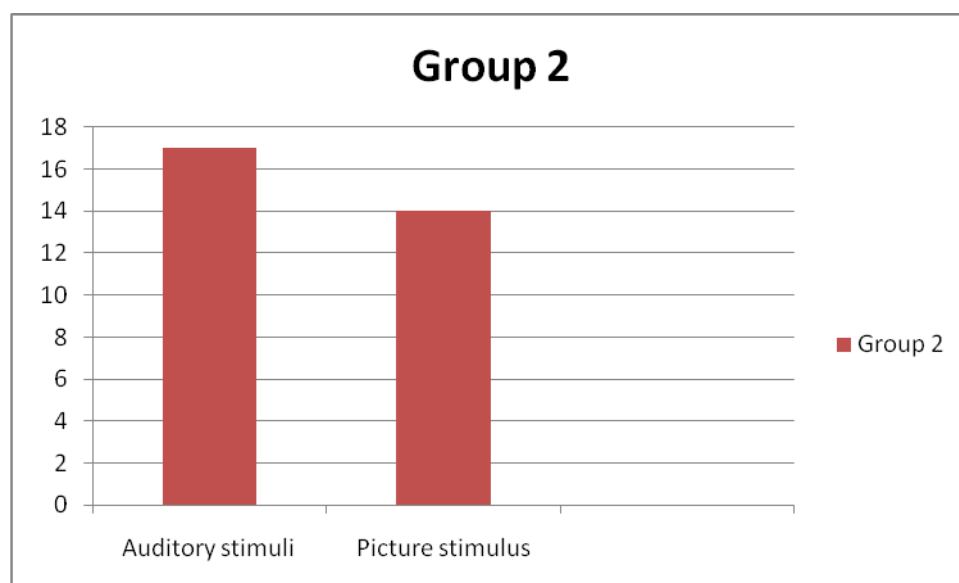


Fig. 2: Performance of Group 2 Participants on Auditory and Picture Stimulus.

RESULTS AND DISCUSSION

Group 1 participants secured a score of 21 for auditory presented words and 18 for pictures (Figure 1). Group 2 participants obtained a score of 17 for words and 14 for pictures (Figure 2). Within group and between group comparisons was carried out statistically.

In order to verify if there was any significant difference between the stimuli, Wilcoxon's signed ranked test was carried out (due to non-normal distribution of samples). The data would have been non-normally distributed as the number of participants considered for the study was less. The statistic revealed a Z score of 2.44 for group 1 and 3.11 for group 2. The corresponding p values showed significant difference for group 2 only. Mann Whitney U test was used for comparing the performance across the two groups for auditorily presented words and pictures and the Z scores were 3.18 and 3.97 respectively and corresponding p value showed significant difference for both the stimuli.

For both the groups, recall was better for words presented in auditory modality compared to pictures, however the difference was significant statistically only for group 2. The inference of the finding is that the recall was better for words. Words presented in auditory modality in general are assumed to be easy to remember as auditory attention would be better compared to visual memory or the

sensory memory for auditory stimulus would be stronger. The ease of processing also favors better recall for auditory stimulus. In group 1, performance did not vary as a function of modality; this could be because the sensory memory for both the modalities may be equipotential. The other finding derived from the study is that the recall was better in younger individuals compared to older individuals. This fact has already been proved through many studies and the findings can be called as obvious. The study can be extended in cognitively impaired population, for example MCI to understand if the recall varies as a function of stimuli property and modality of presentation.

CONCLUSIONS

Memory abilities can be expressed in terms of recall and recognition. Many potential factors grouped as internal and external can alter recall. Stimuli property is one of the main external factors which would affect recall. The present study aimed to study recall for pictures and words presented in auditory modality. A total of 40 participants were considered for the study. Participants were divided into two groups based on age. First group comprised of 20 participants in the age range of 18–25 years while the second group comprised of 20 participants in the age range of 60–80 years. Pictures and words presented in auditory modality served as the stimuli for the study. The task of participants was to label the six

pictures presented in sequence and recall the word string comprising of six items presented in auditory modality. Recall was better for younger participants compared to older participants. Recall was better for words presented in auditory modality compared to pictures for both younger participants, and older participants. However the difference was statistically significant for the older participants indicating that the visual attention would be relatively more affected compared to auditory attention.

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