

Original Paper

Effect of Modality on Transfer of Linguistic Stimuli from Short-Term to Long Term Memory: Evidence on Immediate and Delayed Recall

Abhishek Budiguppe Panchakshari¹, Getcy Bebayal² & Nithyashree²

¹ Assistant Professor in Language Pathology, Centre of Speech Language-Sciences, AIISH Mysore, Karnataka, India

² Post Graduate student, Department of Speech Language Pathology, AIISH Mysore

* Abhishek Budiguppe Panchakshari Aradhya, Assistant Professor in Language Pathology, Centre of Speech Language-Sciences, AIISH Mysore, Karnataka, India

Received: December 2, 2022 Accepted: December 28, 2022 Online Published: January 7, 2023

doi:10.22158/wjeh.v5n1p1

URL: <http://dx.doi.org/10.22158/wjeh.v5n1p1>

Abstract

Memory is considered as an important cognitive domain found to be important in our daily-walks of life. Short term and long term memory are considered as the main variants under memory. The information in short term memory is prone to be transferred to the long term memory through attention, practice, rehearsal. The current study aims to investigate the effect of modality on transfer of linguistic stimuli from short to long term memory. 20 neuro-typical Tamil speaking participants were recruited for the study. The participants were divided into two groups based on random sampling. Auditory task was administered on the first group where the participants were presented with sentences and were asked to remember the key/content word. While auditory plus visual task was administered on the second group of participants. Recall of key/content words was tested at the level of immediate and delayed recall conditions. On immediate recall condition, there was no difference between the two groups but on delayed recall condition, modality of stimulus presentation had a significant role as the group presented with auditory stimulus performed well compared to the group presented with auditory plus visual modalities

Keywords

Short term memory, long term memory, transfer

1. Introduction

Memory is the ability of recording an event which can be accurately recalled later in the same form as it was learned by means of encoding the event and storing it and retrieving it later for further usage. According to multi-store model of memory (Cowan, 1988). Memory is processed in a linear sequence i.e., sensory memory, short-term memory, long-term memory. Sensory memory stores fleeting information from sensory stimulus which is detected by sensory organs. If it is attended, information goes to short term memory and if the information is given meaning it is passes on to the long-term memory. As information are encoded through various stimulus, modality of presenting such stimulus have influences on processing that information.

Short term memory is considered as the primary memory (Cowan, 1988). The information in the short term memory is transferred to the long term memory through rehearsal. In other words the information is to be rehearsed for it to get transferred to the long-term memory. The difference in long term and short term memory can be explained based on two dimensions duration and capacity. A duration difference means that items in short-term storage decay from this sort of storage as a function of time. A capacity difference would indicate that there is constraint in terms of the number of items which this type of memory can hold. It is commonly concerned that the information present in short term memory is vulnerable for replacement. Both types of limit are controversial.

The role of practice and rehearsal on transfer of information from short term memory to long term memory is often discussed (Davelaar, Gottstein, Ashkenazi, Haarman, & Usher, 2008). The effect of rehearsal can be viewed as facilitator, however there is a contradicting claim that this rehearsal can also lead to interference especially when there is articulatory suppression associated with rehearsal. Hence the specific role of rehearsal on transfer of information from short term to long term memory remains controversial.

Attention is considered as a potential factor, which may influence the transfer of information from short term memory to long term memory (Friedman, Miyake , Corley , Young, DeFries, & Hewitt, 2006). The role of attention on short to long term transfer is pretty straight foreword however the amount of resource allocation required for the transfer remains unclear. However there is consensus regarding the role of attention and can be deemed as a factor governing transfer

Modality of stimulus presentation is considered as a potential dimension explored in studies unveiling the relationship short term and long term memory. Several studies by Murdock⁵ attempted to find out the modality effect in presenting the stimulus in short term memory task. Their findings reported that the stimulus which were presented in auditory modality are recalled at a much higher rate comparatively than visual modality. Supporting evidence were also found in several studies (Penney, 1975; Craik, 1969; Murdock & Walker, 1969). This can be attributed by the fact that primarily short-term memory is acoustic or auditory in nature. The stimulus presented through auditory modality would enter this short-term memory store directly, but when the stimulus presented through visual modality, first it must be converted into acoustic code before entering the short- term memory. Contradicting this claim, there are

accounts that propose the short term and long-term memory are proposed by separate systems (Baddeley, 2012; Baddeley, Gathercole, & Papagno, 1998). Hence there is no consensus on how the transfer the transfer of information takes place.

In Summary, short term memory is often viewed as a platform for the transfer of information to long term memory. In other words, the information in short term memory is transferred to long term memory. Contradicting this claim, some proponents in this direction believe that the short term and long term memories are distinct systems. Thus there is no consensus between the interaction and representation of information from short term to long term memory. There is a need to explore modality effect in transferring the information from short term memory to long term memory through immediate recall and delayed recall task. The current study tries to explore the pattern of association and dissociation between long- and short-term memory in relevance to linguistic stimulus. In other words, the intrinsic relationship between linguistic properties of the stimuli transfer of information from short term memory to long term memory was explored, in adjunct with the investigation of the effect of modality and information transfer. The immediate recall task used in current study tapped short-term memory while the delayed recall task tapped long-term memory.

2. Method

Aim of the study

To examine modality effect on immediate and delayed recall task in typical individual with the age range of 18 to 30 years.

Objective

- To compare the number of words recalled in group 1 and group 2 on immediate recall
- To compare the number of words recalled in group 1 and group 2 on delayed recall

2.1 Methods

2.1.1 Participants

The study was carried out on 20 neuro-typical participants in the age range of 18-30 years. Since the premise of the study was exploratory in nature, only young neuro-typical participants were considered in the current study. The participants were selected based on volitional sampling after seeking informed consent. All the 20 participants were native speakers of Tamil. The participants were further sub-divided into two sub groups based on random basis. The participants did not have any history of cognitive, communicative and sensory disorders. Two different experiments was administered on the participants of the two sub-groups

2.1.2 Stimulus

Since the primary aim focused on transfer of linguistic information across the auditory and visual modality. The stimulus was prepared in the auditory modality for one group. For the second group, the stimulus was presented in auditory plus visual modality The stimuli consisted of 10 sentences in Tamil and consisted of 25 content words and same set of stimuli was given for both Group 1 and group 2. The

stimuli presented in auditory plus visual modality was audio recorded by a native Tamil speaker with natural supra-segmental features. The sentences were specially constructed for the study and care was taken to ensure that the stimuli was imageable (as the stimuli was presented in visual modality for the second group).

Example of sentence presented in auditory modality for group 1 There was a traffic jam (The word represented in red indicates the content word)

Example of sentence presented in auditory plus visual modality for group 2 I thought that you will read well (The word represented in red indicates the content word)



Figure 1. The Content Word Was also Represented in Pictures for Group 2

2.1.3 Instructions

The participants were asked to recollect the content word and they were also informed that there could be more than one content word in each sentence. The same instruction was provided for participants of both the groups regardless of the modality of presentation. However the modality of presentation was specified prior to the administration of the task (based on the group he participant represented)

2.1.4 Procedure

The participants were provided instruction about the stimulus and how to respond to the stimulus the mode of response. Group 1 participants were presented with auditory stimuli. The participants were required to listen to these stimuli and the content word was reiterated again at the end. The stimuli consisted of 10 sentences and 25 content words were present in these 10 sentences. The participants were asked to recollect the content words immediately after completion and they were asked to recollect the same content word after the lapse of 2 days. Immediate recall of the content words tapped for short term memory while the delayed recall of the content words after the lapse of 2 days tapped for the long term memory

The stimuli was presented in auditory plus visual modality for group 2 participants. The number of sentences and number of content words were same for the visual + auditory task used for the second group and the only difference was that the stimulus was presented in two modalities for group 2. The content word/s was reiterated at the last alike the auditory stimulus. The only difference here was that the

stimuli was presented in auditory plus visual modality for this group (whereas the stimuli was presented only in auditory modality for group 1).

Scoring: Each correct recall yielded a score of 1. The maximum score was 25. The maximum score corresponded to the maximum number of content words represented in the sentences. The average mean/median for group 1 and group 2 was computed separately on immediate recall and delayed recall tasks to investigate the effect of modality on transfer of linguistic information from short to long term memory.

3. Result

The study aimed to examine the effect of modality on immediate and delayed recall. Immediate and delayed recall tapped short and long term memory respectively. Group 1 participants were exposed to auditory modality while group 2 participants were exposed to auditory plus visual modality. Each group was exposed to 10 sentences with 25 key words. The participants were asked to recall these key words immediately after the stimulus exposure (immediate recall) and lapse of 2 days (delayed recall). The first objective was to compare the number of words learnt by group 1 and group 2 participants on immediate recall task. The second objective dealt with number of words learnt by group 1 and group 2 participants on delayed recall task.

Group 1 secured a median score of 21, while group 2 secured a mean score of 24 on immediate recall. On delayed recall task, the participants of group 1 and group 2 secured a score of 19 and 11. In the immediate recall task, group 2 participants over performed group 1 participants. On delayed recall task, group 2 participants could recall more items than group 1 participants

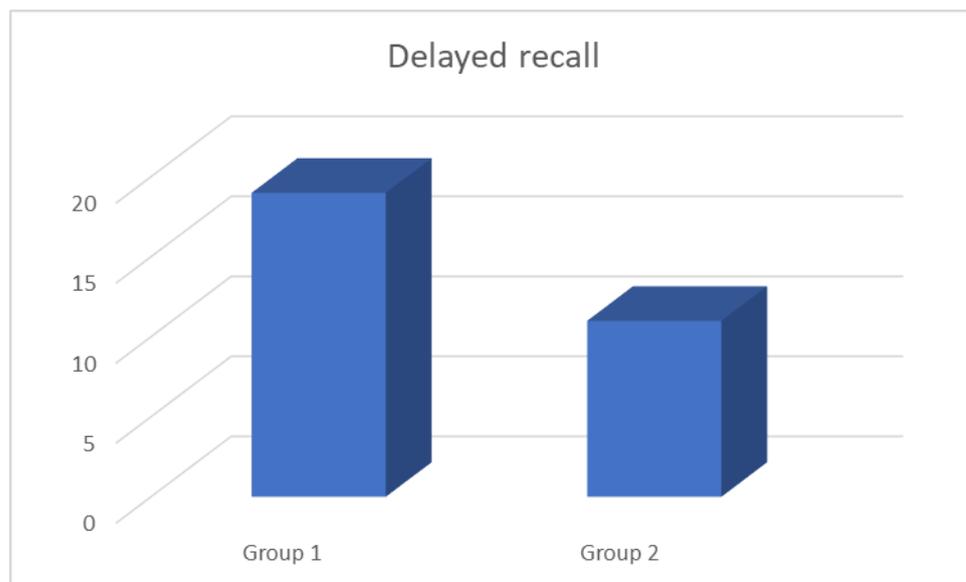


Figure 1. Number of Items Recalled by Group 1 and Group 2 on Immediate Recall

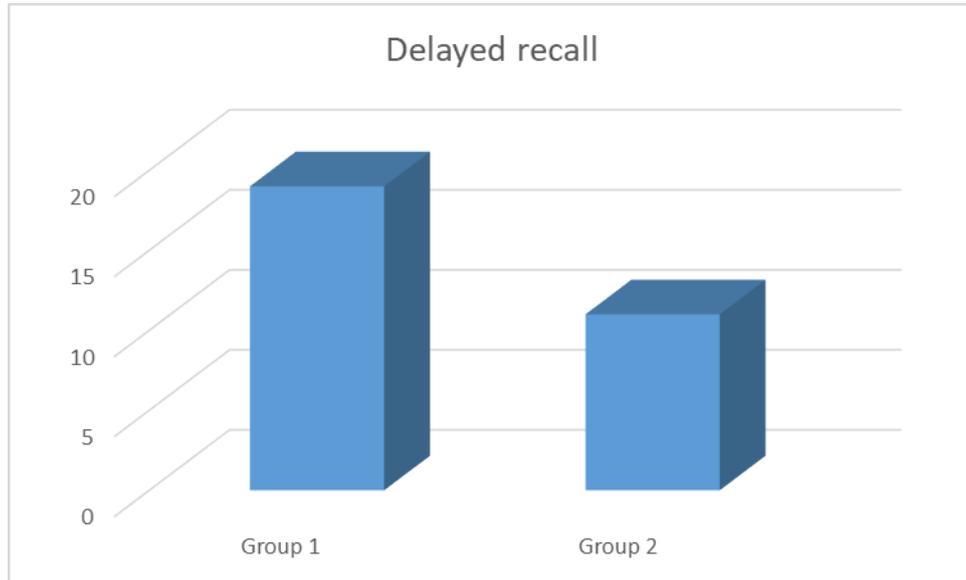


Figure 2. Number of Items Recalled by Group 1 and Group 2 on Delayed Recall

The primary objective was to compare the performance of group 1 and group 2 on immediate and delayed recall. The data did not abide by the properties of normal distribution using Shapiro-Wilk's test ($p < 0.05$) depicting that data was non-parametric Mann-Whitney U test was used to compare the performance of group 1 and group 2 on immediate and delayed recall, the Z score was 0.34 and 2.24. The corresponding p value showed only significant difference for delayed recall. In summary there was no significant difference between the number of items recalled by group 1 and group 2 on delayed recall.

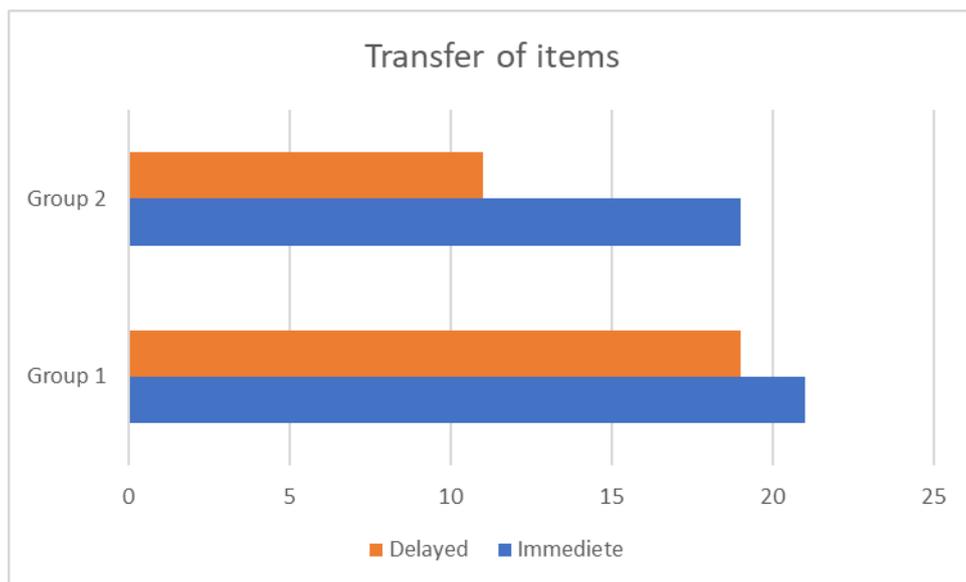


Figure 3. Transfer of Items from Short to Long Term Memory

In addition to the above mentioned objectives. The number of words transferred from short-term memory to long term memory (tested through immediate recall and delayed recall conditions respectively) was compared. The number of items learnt on immediate recall reduced from 21 to 19 for group 1 while the number of items learnt on immediate recall reduced from 19 to 11 for group 2. In order to verify if there was difference between the number of words recalled on immediate and delayed naming tasks, within group comparison was carried out using Wilcoxon's signed rank test (group 1 immediate versus delayed and group 2 immediate vs delayed) and the Z score was 1.34 and 2.68 and corresponding p value showed significant difference only for group 2.

3.1 Discussion

The stimulus was presented in auditory modality for group 1 while the stimuli was presented in visual plus auditory modality for group 2. In other words, stimulus was mainly presented in visual while the content word was presented in auditory modality. Between group comparisons on Mann Whitney U test showed significant difference between group 1 and group 2 on delayed recall only. The median score was better for group 2 on immediate recall while the scores were better for group 1 on delayed recall. Thus, there a dissociation pattern observed. This result did not comply with the findings of earlier studies (Murdock & Walker, 1969; Penney, 1975) The proponents of these studies suggest that the information presented through auditory modality would be recalled better as the auditory recall would convert the auditory stimulus to acoustic signals which has the privilege to be encoded directly owing to which recall would better as there was no significant difference between group 1 and group 2 on immediate recall. The scores on delayed recall reduced by half for group 2. This could because the information encoded in visual modality would have not been sustained or transferred to short term as effectively as auditory stimuli. The auditory modality would have facilitated transfer resulting in better recall on delayed recall. Thus, there was a significant effect of modality on the transfer of information from short to long term memory. The other possible explanation could be that the attention was divided between visual and auditory modalities for group 2 owing to this the number of items learnt on delayed recall task would have come down in this group (Cowan, 1988).

In summary, memory would involve encoding, storage, and retrieval. Encoding is assumed to vary as a function of modality of presentation. The current study aimed to investigate the effect of modality on immediate and delayed recall. 20 participants in the age range of 18-30 years served as participants. The stimulus was presented in auditory modality for group 1 while the stimulus was presented in visual modality. There was no effect of modality on immediate recall while the modality proved to have an effect on delayed recall with stimulus presented in auditory modality showing superiority.

Acknowledgement

The authors would like to thank the Director, All India Institute of Speech and Hearing and the participants of the study

References

- Baddeley, A. (2012). Working memory: Theories, models, and controversies. *Annual review of psychology*, 63, 1-29. [PubMed: 21961947] <https://doi.org/10.1146/annurev-psych-120710-100422>
- Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review*, 105(1), 158-173. <https://doi.org/10.1037/0033-295X.105.1.158>
- Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191. [PubMed: 3054993] <https://doi.org/10.1037/0033-2909.104.2.163>
- Craik, F. I. (1969). Modality effects in short-term storage. *Journal of Verbal Learning and Verbal Behaviour*, 8(5), 658-664. [https://doi.org/10.1016/S0022-5371\(69\)80119-2](https://doi.org/10.1016/S0022-5371(69)80119-2)
- Davelaar, E. J., Goshen-Gottstein, Y., Ashkenazi, A., Haarman, H. J., & Usher, M. (2005). The demise of short-term memory revisited: Empirical and computational investigations of recency effects. *Psychological Review* 2005, 112, 3-42. [PubMed: 15631586] <https://doi.org/10.1037/0033-295X.112.1.3>
- Friedman, N. P., Miyake, A., Corley, R. P., Young, S. E., DeFries, J. C., & Hewitt, J. K. (2006). Not all executive functions are related to intelligence. *Psychological Science*, 17, 172-179. [PubMed: 16466426] <https://doi.org/10.1111/j.1467-9280.2006.01681.x>
- Murdock Jr, B. B., & Walker, K. D. (1969). Modality effects in free recall. *Journal of Verbal Learning and Verbal Behaviour*, 8(5), 665-676. [https://doi.org/10.1016/S0022-5371\(69\)80120-9](https://doi.org/10.1016/S0022-5371(69)80120-9)
- Penney, C. G. (1975). Modality effects in short-term verbal memory. *Psychological bulletin*, 82(1), 68. <https://doi.org/10.1037/h0076166>