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RESUME

The aim of the present study is to ascertain as to how previous visual experience, feedback conditions, and task complexity affects short-term retention of a linear positioning task.

A variety of movements have been studied by psychologists in the past two decades. It includes discrete graded movements involving manipulation of a lever or a slide. It has been generally reported that a simple movement involves two types of movement cues, i.e., location and distance cues. In behavioural studies of movement, location and distance information are isolated by changing the starting position of recall of a movement and subsequently demanding recall of either the end point of criterion movement or the total extent of movement. It has been reported that target locations are better retained over an unfilled retention interval and are subject to interference from the attention demanding tasks. Distance information, on the other hand, is spontaneously lost with lapse of time and attention demanding tasks show little or no interference in its retention.[59,64] Moreover, it has been suggested that location information is coded in terms of motor kinesthetic cues.[206] Since, no kinesthetic sensory system is readily available for the coding of distance information, non motor cues such as visual imagery are suggested to be necessary for its

Coding.[88,89] It has also been reported that subject defined (preselected) movement is more precisely coded than experimenter defined (constrained) movement. There are two explanations for the precise coding of preselected movements. Jones[95] found that subjects reproduced movement extent precisely from both variable and constant starting points. He proposed that internal efference commands generated for recall of movement may be centrally monitored and compared to the stored efference copy of the criterion movement for accurate recall. In preselected condition, in which the subject has got prior knowledge of movement extent, efferent discharge is stored as an efference copy; whereas in constrained condition the subjects do not have accurate efference copy in the absence of prior knowledge of movement extent and, therefore, they show inferior recall. Stelmach, Kelso and Wallace[94] disagreed from the previous explanation that centrally monitored efference copy could serve as a coding mechanism. They argued that efference copy is disturbed in case of isolated location which is still better recalled than distance. It means that efference copy alone cannot be a sufficient explanation for coding movement. They proposed that preselection functions as a corollary discharge mechanism due to which internal information flows from motor to sensory system, which is pre-set for the reception of feedback information. A major drawback of this hypothesis is that, it does not take into account the planning process occurring prior to the generation of supporting signals. These two motor views could not explain the better coding of preselection satisfactorily. Most of the motor memory experiments have been performed on blindfolded sighted subjects. It is said that even when a sighted person closes his eyes he cannot give up the use of visual imagery. In view of this the study of the role of visual imagery in motor memory has recently assumed greater importance. Stelmach, Kelso and Wallace,[94] and, Jones[95] overlooked the role of visual imagery in motor memory.

Kelso and Wallace[103] made an attempt to bring out an eclectic view of the better reproduction of preselected movement by having the joint contribution of cognitive and motor explanations. They have emphasized the role of 'imagery' or 'plan' in better reproduction of movement.

The role of augmented and attenuated feedback has also been studied in the processing of kinesthetic information. Posner[58] reported that visually guided movements are better retained over short retention intervals and are subject to interference from attention demanding task. Blind movements, on the other hand, show substantial forgetting even over unfilled retention intervals. In subsequent studies, it is supported that additional feedback helps in retention and vision is found to be more effective than other sensory modalities.[27,121,212] These studies undoubtedly support the dominance of visual reference system in movement learning of sighted people.

Movement complexity also affects the retention. Glencross[137] reported that when response complexity is increased in terms of the number of sets of response units that have to be organized into a spatio-temporal sequence, the response latency correspondingly increased.

In this study, three experiments have been reported. Here, an attempt has been made to examine the role of visual imagery, feedback, and task complexity in short-term memory of movement.

Experiment I involved short-term recall of location and distance information in active and passive movement modes with and without preselection. The sample consisted of 224 subjects (112 sighted and 112 blind). This experiment required a 2 x 2 x 2 x 2 x 2 factorial design involving groups (sighted/blind), modes of movement presentation (active/passive), preselection (preselected/constrained), information (location/distance), and sectors (short/long). The dependent variables were absolute error, i.e., the mean of un-signed mis-matches; variable error, i.e., the standard deviation of algebraic mis-matches; and constant error, i.e., the mean of algebraic mis-matches. A mis-match refers to the difference between the standard and reproduction responses recorded in centimeters. In addition, execution time and movement time were also recorded. A linear positioning task consisting of a 60 cm long rectangular metal bar mounted with a near frictionless moving lever was used.[23] For the recording of execution time and movement time, two electronic timers were attached to it. Only right handed male subjects were included in the sample. The results show that an active movement is better reproduced than passive movement, the location cue shows less variability and is more precisely coded than the distance cue. In short, both the groups, i.e., blind and sighted, differ in processing, storage and retrieval of movement information in several ways.

In Experiment II, an attempt has been made to ascertain the role of feedback in motor learning. In all, 224 subjects (112 sighted/112 blind) participated in this experiment. A 2 x 2 x 4 x 2 factorial design having groups (sighted/blind), preselection (preselected/constrained), feedback conditions (auditory/proprioceptive/both auditory and proprioceptive present/both auditory and proprioceptive absent), and sectors (short/long) was used. The apparatus used in this experiment was the same as used in Experiment I. Additional arrangements were made to manipulate the feedback. The performance of the two groups were very different in the augmented and attenuated feedback conditions. Moreover, the sighted group show the use of visual reference system which facilitated their recall on preselected condition, while the blind group could not avail the facility of preselection more effectively.

Experiment III has been conducted to find out as to how the response complexity is related to short-term recall of a linear movement. 112 subjects (56 sighted and 56 blind) volunteered in this experiment. A 2 x 4 x 2 factorial design involving groups (sighted/blind), experimental conditions (Horizontal-Horizontal, horizontal-vertical, vertical-vertical, vertical-horizontal), and sectors (short/long) was used. The apparatus used in this experiment was the same as in earlier experiments. Results of this experiment show that, though, the short movements are overestimated and the long ones are underestimated, such effects are not similar in the blind and sighted groups.

In short, the results of the above mentioned 3 experiments throw light on the role of visual experience, kinesthesis, feedback, and response complexity in coding, storage, and retrieval of movement information.

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