Interference in Motor Learning

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Abstract

Learning requires network of neurons to generate new activity patterns.Here It is investigated whether an existing network, constraints the pattern that a subsetof it's neurons is capable of exhibiting.I am aiming to make a computer interface in which people learn to control the cursor with the hand gestures.It is aimed to observe the response under different experimental conditions and make inferences about the type of interference from experimental data.

1 Introduction

The history of prior action in the human motor system is known to influence not only future performance through memory, but also the capacity for future learning. Interference and savings are two oppositely-directed phenomena that produce this effect. Interference describes the ability of one task to impair the learning of another, while savings describes the ability of previous learning to enhance future learning. In certain cases, after initial learning and subsequent washout of a particular task, relearning is faster than the initial learning, even if the performance levels of the learner at the onset of learning and relearning are identical.

1.1 Types of Interference

1.1.1 Retrograde Interference

Retrograde interference occurs when newly learned information interferes with and impedes the recall of previously learned information. Retrograde interference is a result of decreased recall of the primary studied functions due to the learning and recall of succeeding functions. The phenomenon of retroactive interference is highly significant in the study of memory as it has sparked a historical and ongoing debate in regards to whether the process of forgetting is due to the interference of other competing stimuli, or rather the unlearning of the forgotten material. The important conclusion one may gain from RI is that "forgetting is not simply a failure or weakness of the memory system" but rather an integral part of our stored knowledge repertoire.

Figure 1: A Leap 3D motion and gesture controller

1.1.2 Anterograde Interference

Anterograde interference is the "forgetting [of information] due to interference from the traces of events or learning that occurred prior to the materials to be remembered. "Anterograde interference occurs when in any given context, past memories inhibit an individual's full potential to retain new memories. It has been hypothesized that forgetting working memorieswould be non-existent if not for proactive interference. In short, anterograde interference occurs when past memories inhibit an individual's full potential to retain new memories.

2 Methods

2.1 Participants

Ten right handed adult males in the age between 19 and 21 were selected as subjects.

2.2 Experiment

The experiment is divided into 3 tasks. In task A participants were instructed to use the Leap Motion 3D motion and gesture controller to position a cursor in a target circle which appeared in one of the any 6 locations on the screen. The feedback display was rotated clockwise about the center start position by 30°. Participants were instructed prior to the initiation of each block which hand (dominant or non-dominant) would be used for the duration of that block.Since all the participants were right handed, all of the participants were instructed to use their right hand for the experiment. Sample spatial trajectories for a

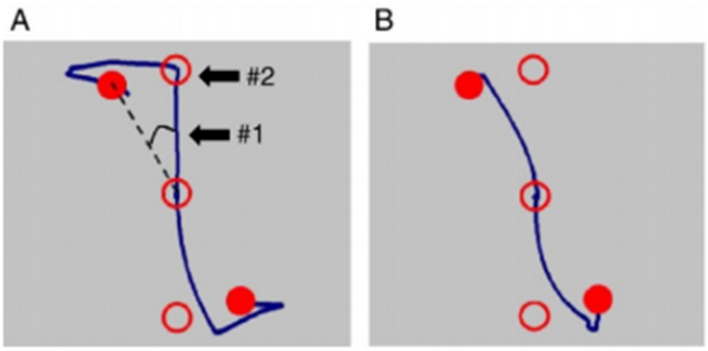


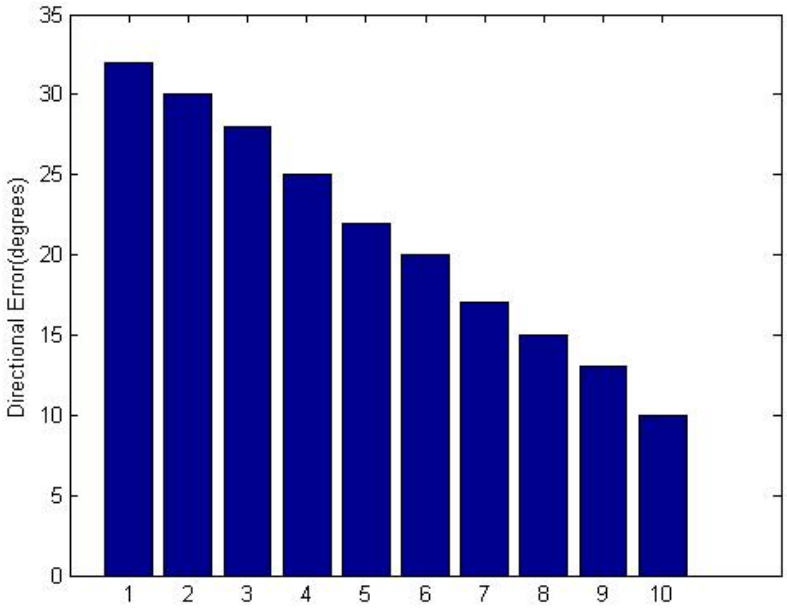
Figure 2: Data from a representative participant during adaptation. Panel A depicts single trial spatial trajectories for two trials under the 30°feedback rotation condition early in adaptation. The open circles represent target location in visual space, while the filled circles represent the target locations in Leap motion 3D controller space. The spatial trajectory is presented in Leap motion 3D controller coordinates as well (participants would view the cursor moving along this path in real time, rotated clockwise by 30°). Panel B depicts single trial spatial trajectories from the same participant performing under the 30°rotation late in adaptation. Learning is evidenced by the straighter trajectories compared to panel A.The arrow labeled 1# in panel A indicates where direction error (DE) is calculated, and refers to the point along the spatial trajectory at which peak velocity was achieved. DE is the angle between the dashed line from the start to the target position, and a straight line from the start to the position at peak velocity. The arrow labeled 2# indicates where initial endpoint error (IEE) is calculated, which is at the endpoint of the initial ballistic movement towards the target. IEE is the distance from this spatial location to the target.

single participant are depicted in Fig. 2 at the early stages of adaptation (panel A) and late in adaptation (panel B).In this figure, the open circles represent the location of the targets as viewed by the participant in real time, while the closed circles represent the shifted location of the targets. This is repeated for 10 blocks with an interval of 5 seconds in between.

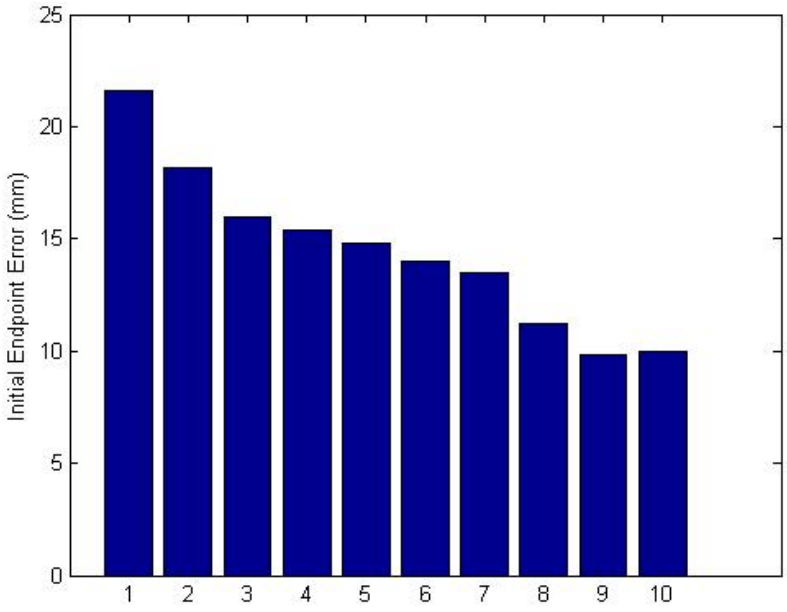
The Participants were then asked to perform the task B which is the same task with the opposite visual perturbation(30°anticlockwise) after an interval of 5 minutes.The Participants were then asked to do task A_2 which is to re-perform the original first task 5 minutes after the completion of second task.

3 Experimental Results

It is noted that the learning of task B is a little slower compared to task A. The task A_2 is relearned at a quicker rate compared to the original task A or task B.

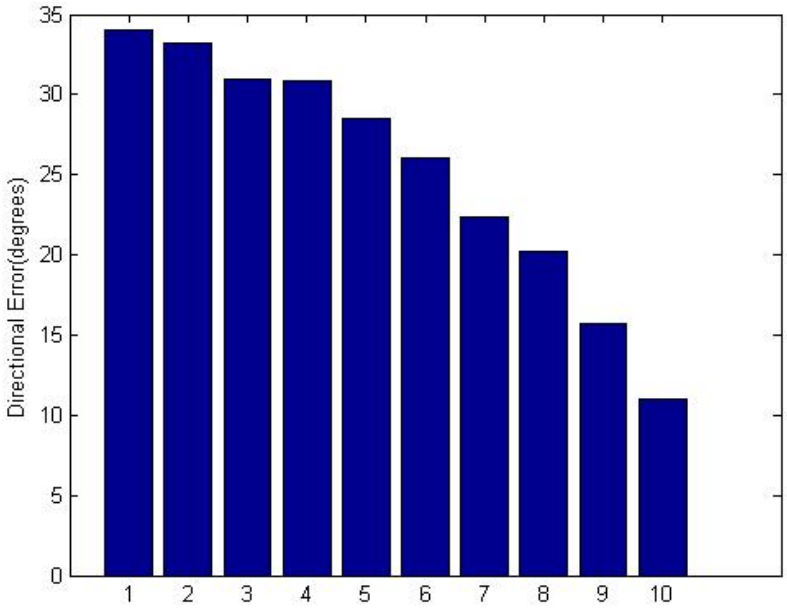


(a) Directional Error for Task A

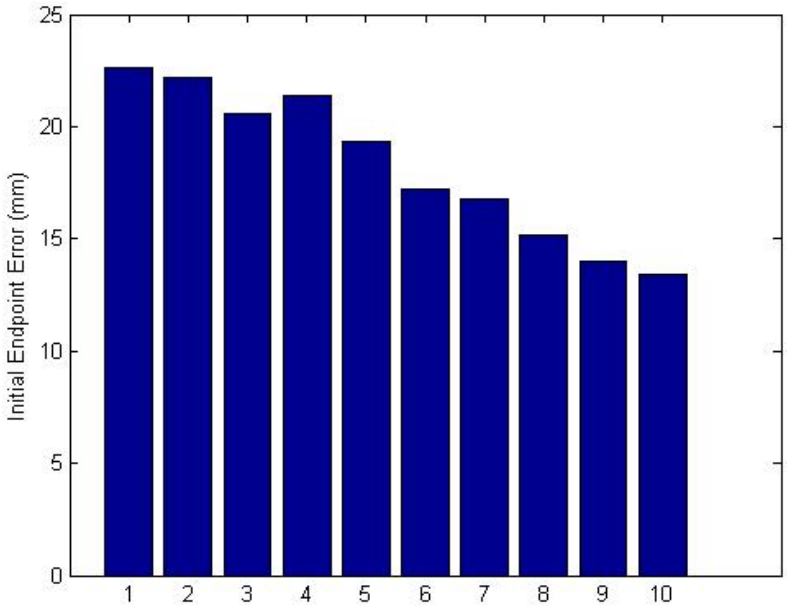


(b) Initial End-point Error for Task A

Figure 3: Task A

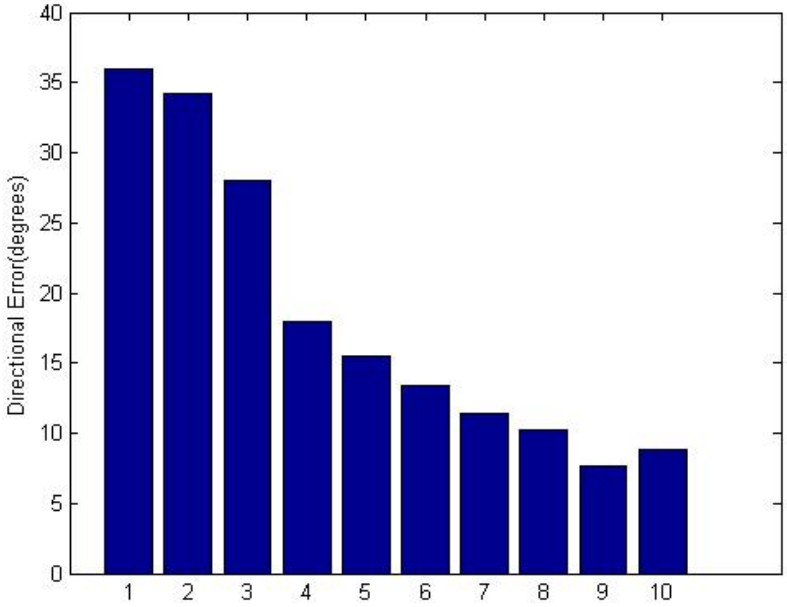


(a) Directional Error for Task B

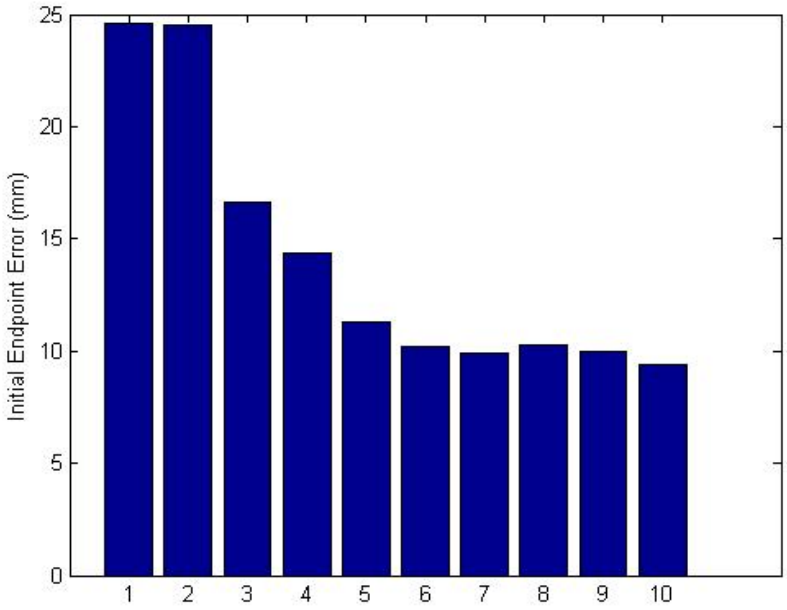


(b) Initial End-point Error for Task B

Figure 4: Task B



(a) Directional Error for Task A_2



(b) Initial End-point Error for Task A_2

Figure 5: Task A_2

4 Conclusion

It is noted that the learning of task B is a little slower compared to task A. The presence of anterograde interference is evident in the learning of task B. Because of which task B is learnt at a slower rate.

The task A_2 is relearned at very fast rate which would not have been possible had the memory of task A be modified by task B. There is little evidence of retroactive interference. The presece of retroactive interference remains inconclusive in this experiment.

5 Acknowledgement

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6 References

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