Motor Sequence Learning
PSY310: Lab in Psychology

11th October 2024
Saanchi Umesh Bhatt
AU2220151

GitHub Link:
https://github.com/SaanchiBhatt13/Psy310/tree/Motor_Sequence_Learning_Task

Introduction

Learning is a complex procedure through which individuals acquire new information, abilities, attitudes, behaviors, etc. A person's abilities can be refined by incorporating these new experiences into their cognitive framework. Put more simply, it might alter the ones that already exist or acquire new behaviors through experience.

The term "skill learning" describes the process of becoming proficient at a task. It is a crucial cognitive skill that helps us become skilled at daily tasks. The time it takes for an individual to learn a new skill is highly subjective and depends on various factors, including the task's difficulty, the amount of time required, and an individual's cognitive ability. Developing skillful motor behaviors performed effectively with practice is called "motor skill learning." To complete these tasks with skillful ease, a thorough planning, selection, and execution process must be followed.

The relation between an action and the outcomes is known as contingency. The basic idea is that the rewards and punishments that follow actions significantly impact their accuracy and strength. Additionally, contingency provides a feedback mechanism by alerting learners to the results of their actions. This could encourage them to refrain from engaging in behaviors with adverse effects and to repeat those with positive ones. This mechanism is crucial in the motor sequence learning task because it teaches participants to repeat the responses, which results in successful outcomes. Trial and error is how they learn whether their attempts were successful.

Another consequence of contingency that applies to motor learning tasks is the transfer of learning. Understanding the underlying principles, for example, can assist someone who learns a sequence on a simulator in applying those skills to real-world scenarios. Additionally, adding variation to practice improves comprehension of how various circumstances impact performance, resulting in more thorough learning. For example, shifting the trial types between sequential and random can establish greater learning by ensuring good performance on average across trials.

Contingencies offer essential direction and feedback that significantly improve motor learning.

Method

The participant, age 20, was an Ahmedabad University undergraduate majoring in psychology. Before the experiment began, she was informed about the aim and methodology of the study, and her consent was acquired. A 14.5" laptop screen and PsychoPy-2024.1.5 software were used to create the experimental setup.

The experiment slide was displayed on a screen dimension of 1000 x 1000. It begins with a fixation of size (10x10) appearing at the center of the screen for a duration of 1 second before each trial. It is followed by an array of 4 lines labeled Line1, Line2, Line3, and Line4 on the screen. The lines are equidistant from one another, with a distance of 100 pixels between each line. The following are the properties of these lines:

- Shape: Rectangle
- Size (w,h): (100, 10)
- Orientation: 90 degrees (vertical)
- Fill and border-color: white
- Contrast: 1

These attributes remain constant throughout the experiment. A probe appears after 1 second of the four lines displayed on the screen. It is a triangle of size (10,10) anchored toward the center, set to be positioned on top of any one of the lines. The participant is supposed to identify the line that has the probe displayed over it and respond with the key assigned to each line - Line1 (z), Line2 (x), Line3 (c), Line4 (v).

The experiment has 400 trials, with 200 trials set to repeat sequentially and another loop for 200 trials being set to repeat randomly. The response accuracy and reaction time data for all the trials are recorded in an Excel sheet in CSV (comma-delimited) format. Inaccurate trials are removed from the data and segregated into sequential and random trials. It is then analyzed to evaluate the differences between the MeanRTs of the two task types and their implications.

(Fig 1. Image of participant screen for the Visual Search Task Experiment)

Results

Mean of SequentialRT = **0.46 seconds**
Mean of RandomRT = **0.65 seconds**
Mean difference between Sequential and Random RTs = 0.19 seconds

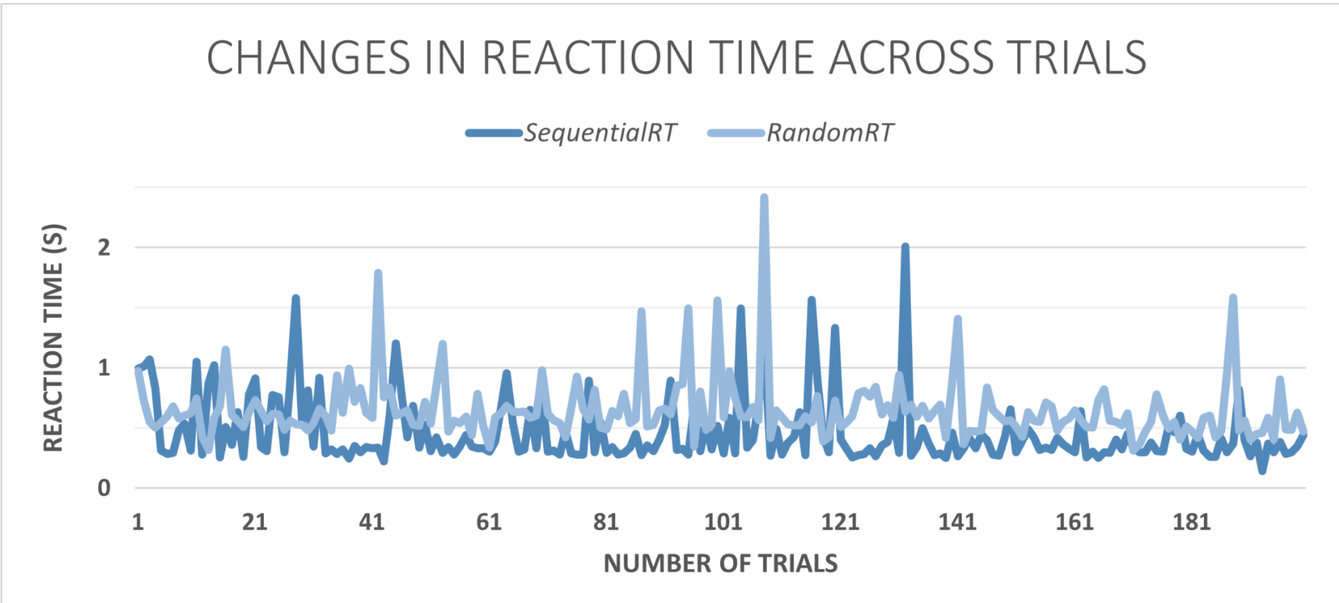

Fig 2: Line plot showcasing the changes in the Reaction time (in seconds) across trials.

Discussion

It can be seen that there is a difference of 0.19 seconds in the MeanRTs of the sequential and random trials. This difference can be because some learning is happening in the sequential trials. The participant learns a set pattern over time, and their responses may be more based on the learned pattern than the detection of the probe. In the random trials, there is an actual evaluation of the participant's ability to detect, process, and respond to the task accurately and in a shorter reaction time.

However, it is crucial to consider that a practice effect may influence the participant. This means that across 400 trials, there is a high chance that the participant has gotten used to how the task will be performed. In other words, there is a learning process, which may result in a reduced reaction time compared to if the participant was new to performing it.

This effect can be mitigated by counterbalancing the random and sequential trial conditions. Counterbalancing involves arranging the various trial conditions at equal intervals. This helps minimize the order effects so that the performance is based solely on the nature of the task and not the order of the trials. As discussed above, reducing the practice effect (since the trials jump from sequential to random at regular intervals) removes the influence of familiarity, focusing the evaluation solely on the ability to acquire the skill. Furthermore, counterbalancing makes the task more applicable to varied participants to assess the difference in responses due to the efficient isolation of all effects associated with motor learning. There is uniformity, increasing the applicability of the study across diverse populations and settings.

Overall, counterbalancing contributes to the validity and reliability of study outcomes.

Citations

1. Bera, K., Shukla, A., & Bapi, R. S. (2021). Motor Chunking in Internally Guided Sequencing. *Brain sciences*, *11*(3), 292. https://doi.org/10.3390/brainsci11030292
2. Schmidt, J.R. (2012). Human Contingency Learning. In: Seel, N.M. (eds) Encyclopedia of the Sciences of Learning. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_646