PSY310 - Lab in Psychology

Group_14

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Learning Contingency through Stroop task

Abstract:

We present a learning contingency through stroop task, where one (participant) has to respond the colour of the english text (which is the stimulus) and Roman english (Hindi) is used as bilingual distractors along with color being a distractor. The experiment was designed in a such a way that it was arranged in random and sequential order.The aim of our study is to compare the reaction time of the sequential task and random task.The experimenters predicted longer reaction times for the random trial sets since they had less time to understand the relationship between stimuli and response. On the other hand, considering the chance to learn the stimulus-pairing connections after closely viewing the few first trial sets, it was expected that the sequential trial set would show lower reaction times (RTs). The assumptions of experimenters are justified.

Introduction:

Learning refers to the process of acquisition of actions and behaviors after observation or practice. In this study we try to evaluate, whether we can confer a difference between reaction times, in a complex task, when provided with previously sequenced stimuli presentation compared to random stimuli presentations. While participants are unaware of such difference between the patterns of trials. The study provides a task identical to the Stroop Task (identifying the colour of text, when presented with different names of colours, however the name of colour and the colour of text may be congruent or incongruent), however this study compares reaction times for random trials and sequential trial patterns.The hypothesis assumes that reaction time taken for sequential tasks would be less compared, to reaction time for random tasks. The experiment has been designed in a manner that while the task replicates stroop study, the evaluation is based on finding the relationship between learning and contingency, meaning that likelihood of occurrence of events would enhance the learning, because through stroop task, participants are more likely to focus on the colour and hence attention would be diverted to the colours and words, and hence learning outcomes would come up more unbiased.

Hypothesis: The reaction time for sequential tasks would be less compared to the reaction time for random tasks.

Method

In this experiment, the task refers to the stroop task with bilingual interference of distractors. The participant will be presented with two words one after another, one in English and the other in Roman English(Hindi), where the Roman English word would act as a distractor. Both the words would be names of the colors in the respective languages, while the color of the text would be congruent or incongruent to the names of colour. The participant will have to pay attention to the text colour of the English word, and after the two words are reflected, the participants can respond to the text colour of the English word. The participant is supposed to press the key ‘r’ if text colour is Red, press the key ‘b’ if text colour is Blue, press the key ‘o’ if text colour is Orange and press the key ‘y’ if text colour is Yellow. Both the words would reflect one after the other, one would be stimulus word and other word would be the distractor, the order of these words remains random throughout all the trials, first word would reflect for 1.5 seconds and then second word would reflect for 1.5 seconds, after that participants will be given 3 seconds to respond.

The experiment consists of four loops, each loop consisting of 64 trials, so total no of trials being 256, per participant. Out of four loops, two consists of random pattern and two of sequential pattern, the order of these loops are as follows,
Loop1: random
Loop2: sequential
Loop 3: random
Loop 4: sequential.

The participants are unaware of these different patterns or loops in experiment, participants are instructed to pay attention to the text color of english word. A total of 306 trials were recorded in the study.
Note: The random and sequential patterns are in regards to the “text color” order and not regarding the order of stimulus and distractor words. They come in random order only throughout the experiment.

Results

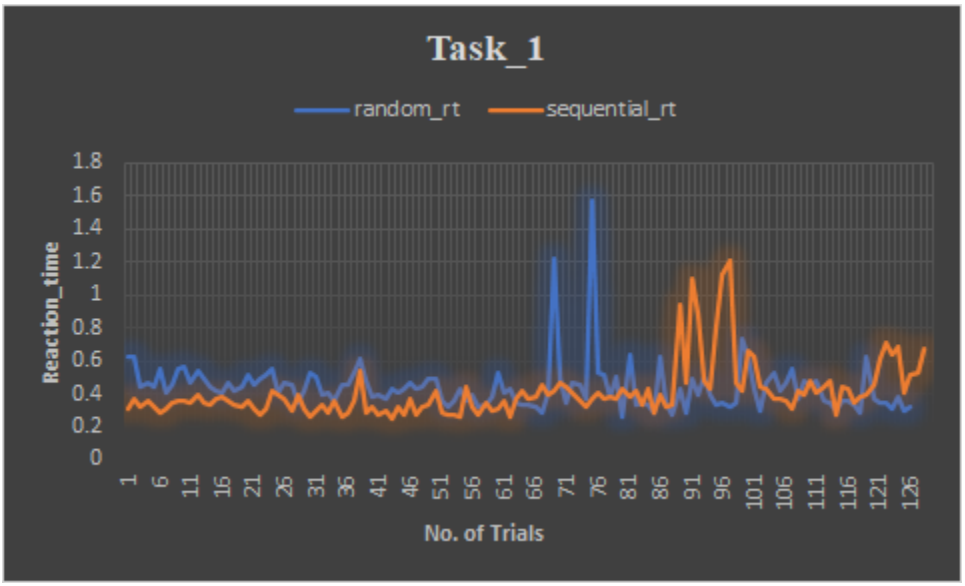

Fig 1.1: Change in Individual Reaction time observed across sequential and random trial routines

Random recation time mean _1 = 0.425033
Sequential reaction time mean_1 = 0.387181

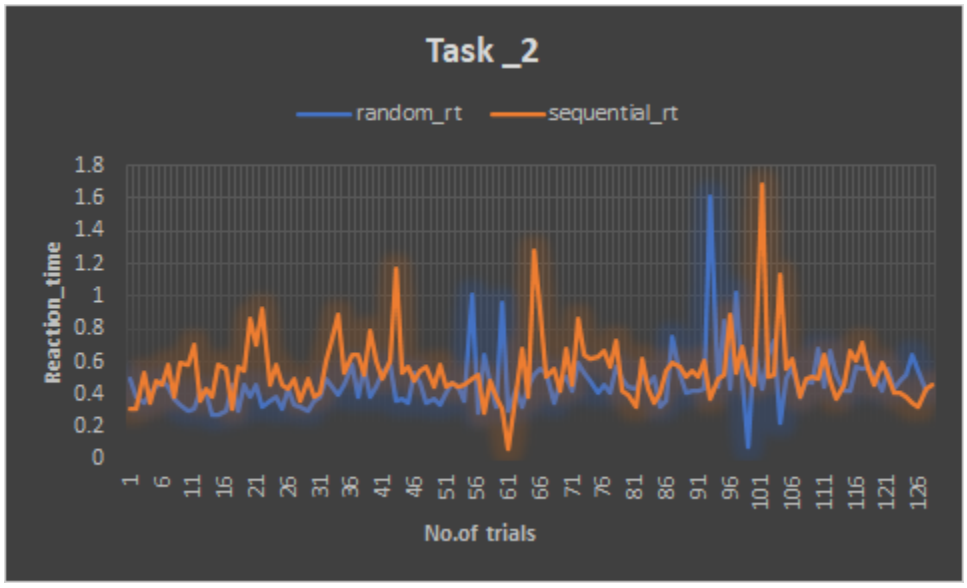

Fig 1.2: Change in Individual Reaction time observed across sequential and random trial routines

Random recation time mean _2 = 0.44668
Sequential reaction time mean_2 = 0.516121

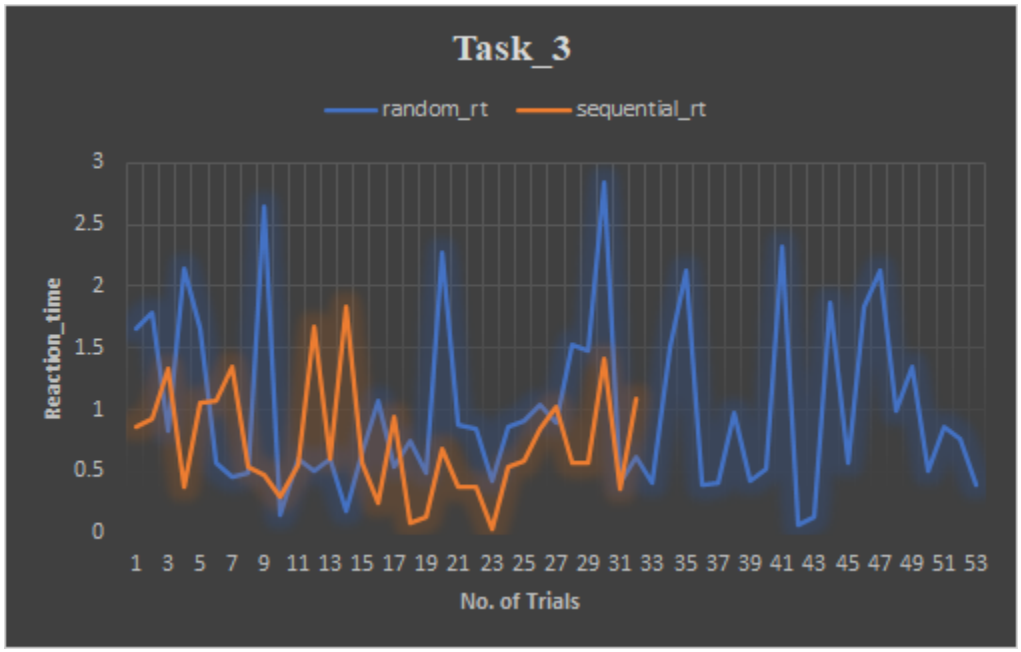

Fig 1.3: Change in Individual Reaction time observed across sequential and random trial routines

Random recation time mean _3 = 0.775967
Sequential reaction time mean_3 = 0.570088

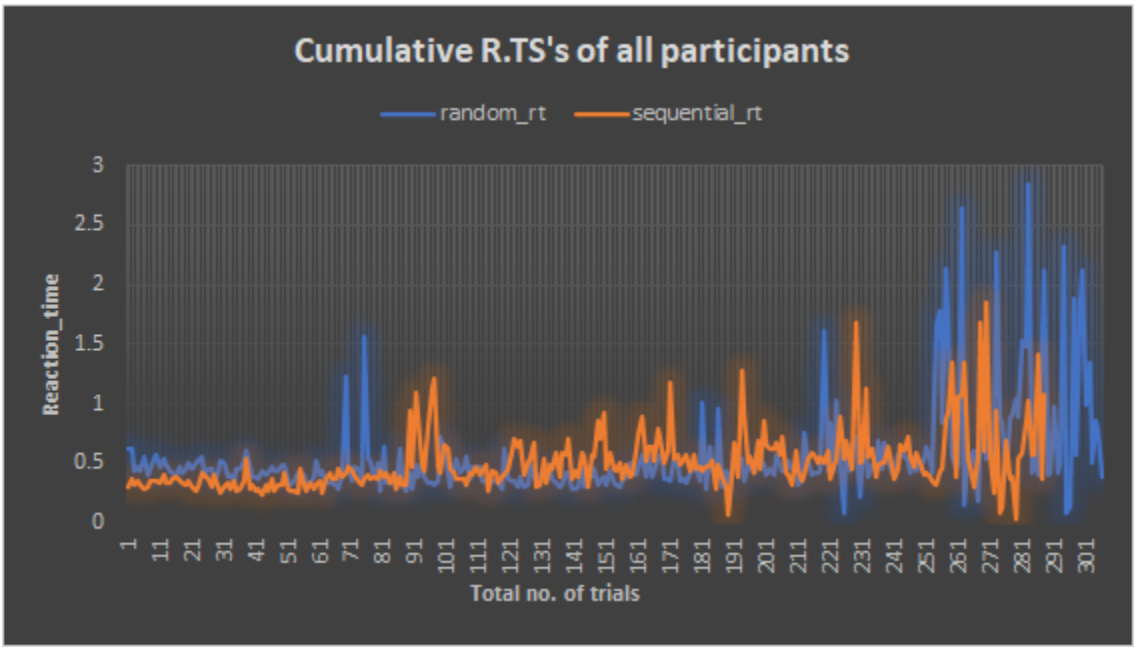

Fig. 2: Combined Reaction times of All Participants for sequential and random trial routines

Random reaction time mean = 0.481565
Sequential reaction time mean = 0.459269

The graphical representations presented above correspond to the correlation observed between the reaction time (RT) of the participant in two typical experimental conditions of sequential as well as random trial routines along with that of the total number of trials run on participants in the given experiment. The x-axis corresponds to the reaction time (RT) that was recorded as a result of the participant responding to the detection/identification of the coloured text stimulus in each trial of the experiment. The y-axis corresponds to the total number of trials that were run throughout the experiment on each participant.

Therefore, based on the above diagrams, it can be inferred that there is a direct relationship between reaction time (RT) of the participant and the type of trial routine (sequential or random) employed in an experiment. The higher the reaction time (RT) of the participant in an

experiment, the higher is the difficulty level of the experiment, in reference to the trial routine employed in it. Alternatively, it could also be suggested that the sequential trial routine in an experiment, makes it easier for the participant to identify/detect the concerned stimulus (coloured text in English) in the experiment, among other distractors (Roman Hindi coloured texts) that are presented in the experiment, since there is a fixed sequential synchrony involved in the presentation of each stimulus and the distractor and therefore after a few initial trials, the participant can easily predict the subsequent stimulus and accurately press the key in order to respond to its identification.
On the other hand, in a random trial routine, there is no specific involvement of a chronological order in reference to the presentation of the stimulus and the distractor, and therefore each trial is completely unique in its presentational format, thereby making it difficult for the participant to memorize/learn the order of the presentation of the stimulus and respond to it accordingly. Therefore, in a random trial routine in the experiment, the reaction time (RT) is comparatively larger and higher in intensity in contrast to the reaction time (RT) observed in a sequential trial routine, where there is a memorization of the order of the stimulus and distractor presentation. Therefore, in the above presented graphs, the orange toned line corresponds to the reaction times recorded for each participant in the experiment in a sequential trial routine set, making it less intense in overall frequency as well as a comparatively less steep slope due to well-memorized stimulus-response associations. On the other hand, the blue toned line in each graph corresponds to the reaction times recorded for each participant in the experiment in a random trial routine set, making its slope appear relatively steeper than the sequential trial routine reaction time slope and it also appears more intense in frequency due to the higher amount of time each participant had to allocate to the detection of the stimulus in each trial. This also suggests that the participant had to employ multiple attentional resources in a random trial routine in order to accurately detect and respond to the stimulus due to the absence of learning of stimulus-response associations in the experiment as opposed to the sequential trial routine, where the learnt stimulus-response associations indicated comparatively lesser attention allocation to the task, even in the presence of distractors.

The mean of the reaction times recorded for the random trial routine set for all participants is 0.481565 and the mean of the reaction times recorded for the sequential trial routine set for all participants is 0.459269. Therefore, the mean difference of the reaction times for all participants is 0.022296, suggesting the higher reaction time involved while performing the random trial routine as opposed to the sequential trial routine.

Discussion

The results of the experiment tend to incline towards the anticipated results of the study since there was a specific aim of differentially evaluating the reaction times (RTs) emerging as a result of performing sequential and randomized trials in the experiment. The expected outcome assumed by the experimenters was that of observing higher reaction time for the random trial sets, due to the deprived opportunity of learning the stimulus-response association. On the other hand, for the sequential trial set, an expected outcome was that of observing lesser

reaction times (RTs), considering the opportunity to learn the stimulus-pairing associations after closely observing the few initial trial sets. The results that were obtained after running approximately 320 trials on six participants, inclined directly with the expected outcomes of the experiment, since the overall reaction time for all sequential trial sets was 0.459269 and the overall reaction time for all random trial sets was 0.481565. Thereby proving the assumption that the greater the reaction time, the greater is the difficulty level of the experiment and the lesser is the learning involved in the experiment.

The findings of this experiment which combine the principles of the stroop task and the visual search experiments, can be compared with that of the stroop task experiment wherein there is an inclusion of the coloured texts as stimuli that are presented one after the other. The specific aim that is assigned to that task involves the measurement of congruence and incongruence of a specific trial routine, based on whow rapidly the participant responded to the text colour when the text colour and its meaning was the same as opposed to when the text colour and the meaning of the text was different, which implied greater attention to be allocated on recognizing the colour of the text, since it differed from that of the meaning of the text. But this experiment looks at the reaction times of the participant upon including two different trial routines of the random and the sequential sets, which can easily help the experimenter evaluate the ability to allocate attention towards detecting the correct stimulus in the presence of multiple distractors and the presence of different coloured tasks that might potentially lead to confusing the participant regarding the correct response for the concerned trial amidst multiple distractors present in the experiment along with the stroop task stimuli in it.

Conclusion

Based on the results of the current study, some developmental changes can be recommended for the future study of such a colour discrimination stroop task experiment.
Since the primary focus is upon correlating the reaction time (RT) of the respondent and the number of trials in the sequential and random trial routines, a future study of this experiment could perhaps emphasize upon the specific errors the participant makes by wrongly detecting the stimulus by providing incorrect responses. It could analyze the number of misses and hits under the theory of signal detection in psychophysics. In addition, the future study of this experiment can employ a higher number of sequential trial routines, in order to potentially witness a significant reduction in the reaction time of the participant and once there is a significant reduction in the reaction time of the participant, a subsequent employment of a random trial routine would help the experimenter understand the learning patterns in a more enhanced manner.
Another recommendation would be to employ a between-subjects design in the experiment, where the participants are divided randomly into the two set trial routines in order to avoid practice of the tasks and subsequent manipulation of responses based on prior learning. A between-subjects design would retain the purpose of the experiment by minimising learning and fatigue experienced by the participants in a within-subjects design.

GitHub Links:

1. Repository link:

https://github.com/tanishqua-dave/Group_14.git

2. Experiment file link:
   Experiment
   Conditions file
3. Raw data link:
   001
   002
   003
   004
   005
   006
4. Secondary data link:
   https://github.com/tanishqua-dave/Group_14/blob/main/secondary_data.xlsx