Assignment 1: Learning and Memory PSY 306 (Winter 2021)

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Instructions: Please write your own responses and do not copy or lift text/code from any source, including the attached paper. If you are referring to credible external sources other than the attached paper for your answers, please cite those sources (within the body of text and the provide a reference list at the end) in the APA citation format (https://www.mendeley.com/guides/apa-citation-guide). Word limits given are indicative and less than the indicated numbers may also be used.

Please download this MS word question-cum-response template to TYPE your answers and feel free to add sheets as required. Convert this document to a PDF and rename the file: name_roll no. before submitting. Please note that answers in this template only will be evaluated and hand-written or scanned answer sheets will not be evaluated.

[Strict deadline for submission: 26 February, 11 PM]

Q1) Please read the attached article by Guiraud et.al.2011 and answer the following [Total word limit ~ 500 words]

A) What were the hypotheses of the study and what was the basis for those hypotheses? [2 + 3 point]

They hypothesized that the children with high risk of autism will have low neural habituation which may cause hyposensitivity and hypersensitivity. They hypothesized this on previous research studies and on the thought that it might be possible that due to low habituation the organism starts reacting less to the overloaded stimulus in the environment causing hyporeactivity, and this indeed can cause hyperactivity too. Which might explain a few characteristics of autism.

B) Describe the auditory oddball paradigm as used by the researchers? What is the cognitive basis for performing correctly on this paradigm? What does a reduced performance on this paradigm indicate about the stimulus as processed by the organism? [3 + 1 +1 points]

Auditory oddball is an experiment in which we give repetitive same auditory stimuli to the subject and inbetween give auditory different stimuli(oddball). we record the reaction to this different stimulus and check our hypothesis.
Reaction to stimulus and information processing are the cognitive basis to perform correctly on this paradigm.
The reduced performance means that the organism is unable to get habituated to the stimulus easily.

C) What is the P150 component in the experiment? Which aspect of learning is being studied using P150 in the experiment and how? [1+1+3 points]

The P150 component refers to the amplitude of the wave signal at 150 milliseconds(calculated as average) which gets recorded just after the stimulus is given to the organism.
Using P150 we are trying to study the memory aspect of the learning, as when we give the same stimulus to the organism, we expect the organism to get habituated to the signal(for which memory is an important aspect). To measure the response by the brain we measure the P150 whose amplitude is directly proportional to the activity of the brain, hence to the responsiveness.

D) On what basis statistically did the experimenters reach the salient findings? Based on the findings, how does a leaning mechanism lead to certain behavioural traits in autism spectrum disorders as proposed by the experimenters? [2 + 3 points]

We saw the data of P150 value, We can see that there was a clear difference(for standard and oddman stimuli reaction) in the amplitude value of P150 for infants with low autism risk, while the infants with high autism risk were having similar value of P150. This statistically confirmed our hypothesis. According to the experimenters, if the subject is having problems with learning then it will be difficult for it to get habituated for anything. Hence for the subject the stimulus from the environment will be overloaded, so the subject might start reacting less to most of the stimuli resulting in hyporeactivity or more resulting in hyperactivity.

Q2) Please do the following for this question:

- **Register on PsyToolkit (https://www.psytoolkit.org/) & log in. References** *Ref-1,Stoet, G. (2010). PsyToolkit - A software package for programming psychological experiments using Linux. Behavior Research Methods, 42(4), 1096-1104. Ref-2,Stoet, G. (2017). PsyToolkit: A novel web-based method for running online questionnaires and reaction-time experiments. Teaching of Psychology, 44(1), 24-31.*
- **Click on ' Get from Library' on the left-hand side panel of the screen.**
- **On the central panel of the screen click on ' Official PsyToolkit experiment library' (https://www.psytoolkit.org/experiment-library/)**
- **Scroll down and click on 'N-back Task (2 back)'.**
- **Scroll down on this page (https://www.psytoolkit.org/experiment-library/nback2.html) & click under Download on 'The PsyToolkit code zip file'.**
- **Follow the instructions in this video to compile the experiment from the downloaded zip file in the previous step : https://www.youtube.com/watch?v=VIf-UuLbi3Y&feature=youtu.be .**
- **Read the documentation of the experiment and the detailed instructions of running the experiment and the output data structure (https://www.psytoolkit.org/experiment-library/nback2.html).**
- **Run the experiment either 'in the browser' or download the compiled experiment offline by clicking on 'Download for Running Offline'**
- **PLEASE CARRY OUT ALL 75 TEST TRIALS given in three blocks of 25 trials each .**
- **At the end, a table of results will be displayed and the column headers of the results table are here** https://www.psytoolkit.org/experiment-library/nback2.html **under 'Data output file'.**
- **Download the results table (75 rows x 12 columns) text file ('.txt') and then answer the following…**

Insert a figure (wherever required) and paste the MATLAB/Python code for the same. The datasheet generated from the test trials may also be pasted on this sheet at appropriate places. If a GUI based software is used, insert the screenshots of the steps that led to the figures/calculations. All figures should be properly labelled and should have accompanying captions/legends to provide all information necessary to interpret the figures…

A) Which cognitive process does the test measure and how? [0.5 +0.5]

It tests *memory* by asking the subject to remember the letter for a few moments after the stimulus.

B) How much duration of the above cognitive process is being tested in this experiment, assuming that time is measured from stimulus onset? [1]

it is measured for 9000 milliseconds(3X3000 millisecond). As we wait for 3000 milliseconds for the subject to respond for one letter, we want to see the response for the 3rd letter for 2 back tests.

C) Plot two simple bar diagrams showing the average reaction times and the standard deviations (error bars) across all 75 trials, of the 'match' trials and the 'false alarm' trials respectively. [2.5+2.5]

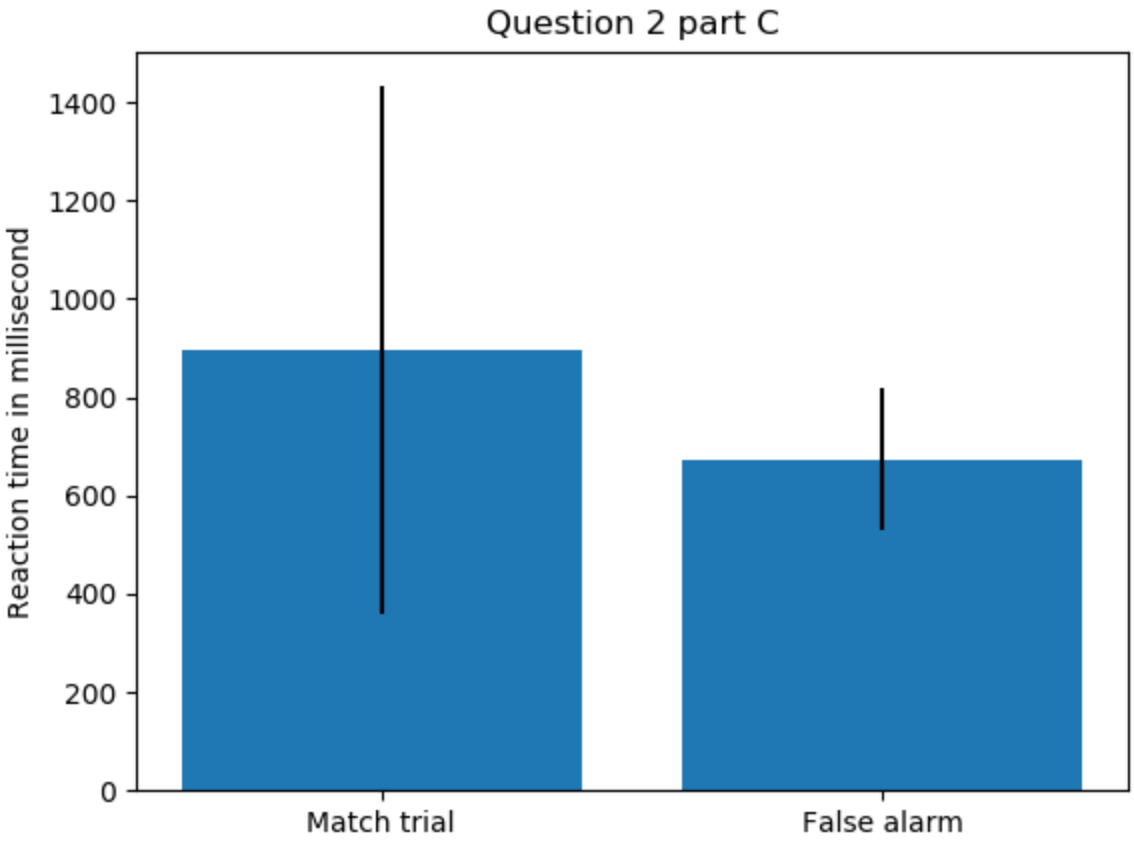
Part of the text file generated:

nback2.data.2021-02-21--17-57 - Notepad

File Edit Format View Help

```
1 1 0 1 0 0 0 3000 2 11 11 0
1 2 0 1 0 0 0 3000 1 4 4 11
1 3 1 0 0 1 0 3000 1 11 11 4
1 4 0 1 0 0 0 3000 3 9 9 11
1 5 0 1 0 0 0 3000 2 2 2 9
1 6 0 1 0 0 0 3000 2 3 3 2
1 7 0 1 0 0 0 3000 3 11 11 3
1 8 0 1 0 0 0 3000 2 7 7 11
1 9 0 1 0 0 0 3000 3 7 7 7
1 10 0 1 0 0 0 3000 2 9 9 7
1 11 1 1 1 0 0 549 1 7 7 9
1 12 1 1 1 0 0 1261 1 9 9 7
1 13 1 1 1 0 0 504 1 7 7 9
1 14 0 1 0 0 0 3000 3 13 13 7
1 15 0 1 0 0 0 3000 2 4 4 13
1 16 0 0 0 0 1 659 2 9 9 4
```

Solution Bar Plot figure:



The python code used to get the graph

```
import pandas as pd
from statistics import stdev
from statistics import mean
from statistics import median
import numpy as np
import matplotlib.pyplot as plt

data = pd.read_csv('nback2.data.2021-02-21--17-57.txt',sep='\s+',header=None)
data = pd.DataFrame(data)

matchdata=data[4].to_numpy()
falsedata=data[6].to_numpy()
reactiontime=data[7].to_numpy()

#---------part 3 of question----------

reacttime1=[]
reacttime2=[]
for i in range(len(matchdata)):
  if(matchdata[i]==1):
     reacttime1.append(data[7][i])
  if(falsedata[i]==1):
     reacttime2.append(data[7][i])

x=['Match trial', 'False alarm']
```

```
y=[mean(reacttime1),  mean(reacttime2)]
z=[stdev(reacttime1), stdev(reacttime2)]
plt.bar(x, y, yerr=z)
plt.ylabel("Reaction time in millisecond")
plt.title("Question 2 part C")
plt.show()
```

D) Calculate the median reaction time of all 75 trials. Calculate the % of 'match' trials in the first half of trials with reaction time less than or equal to the median reaction time. Next, calculate the % of 'match' trials in the second half of trials with reaction time greater than the median reaction time. Based on a comparison of the two 'match' percentages what can be guessed about the relation between the 'match' % and reaction time in your experimental data? [2+1]

Percentage of match trials in First half of median of reaction time : 69.23076923076923
Percentage of match trials in Second half of median of reaction time : 75.0

The Python program used(it is continuation of the previous code) :

```
#---------part 4 of question----------

FH, SH=0 , 0
FHm, SHm=0 , 0
retime=[]
#here we are not considerign reactiontime with 3000 as it is the case when the subject didn't respond anything
for i in range(len(reactiontime)):
  if(reactiontime[i]!=3000):
     retime.append(reactiontime[i])


medR=median(retime)
#we know that for reactiontime of 3000 match value is 0 always
for i in range(len(reactiontime)):
  if(reactiontime[i]!=3000):
     if(reactiontime[i] <= medR):
        FH+=1
        if(matchdata[i]==1):
           FHm+=1
     else:
        SH += 1
        if (matchdata[i] == 1):
           SHm += 1
print("Percentage of match trials in First half of median of reaction time :",FHm/FH*100)
print("Percentage of match trials in Second half of median of reaction time :",SHm/SH*100)
```

From the above result we can see that the match percentage is less in the first half, which means if we take less time to answer the test, then there is less chance of answering the question correctly.
Hence we can conclude that the accuracy increases if we take more time to answer the test.