PSY 305: ATTENTION AND PERCEPTION
ASSIGNMENT-2
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I. WHAT'S THE PROBLEM STATEMENT?

In this assignment, I need to analyze pupil diameter and reaction time data during a spatial emotion detection experiment i.e. modified Posner cueing paradigm. The goal is to understand how different emotions (Happy, Angry, Neutral) and conditions (Cued vs. Uncued) influence pupil diameter and reaction times across varying eccentricities (0°, 4°, 8°, 16°).

II. MY APPROACH TO SOLVING THE PROBLEM

I was allotted folder 'D1-16' for the dataset. There were total 10 participants but due to missing files in E3 folder of participants ASR, I have analysed 9 participants. I notified the TA via email about this. In the code files submitted, i made 2 different files i.e merge.py and plots.py to divide the work easily.

Firstly, let me give overview for merge.py file:

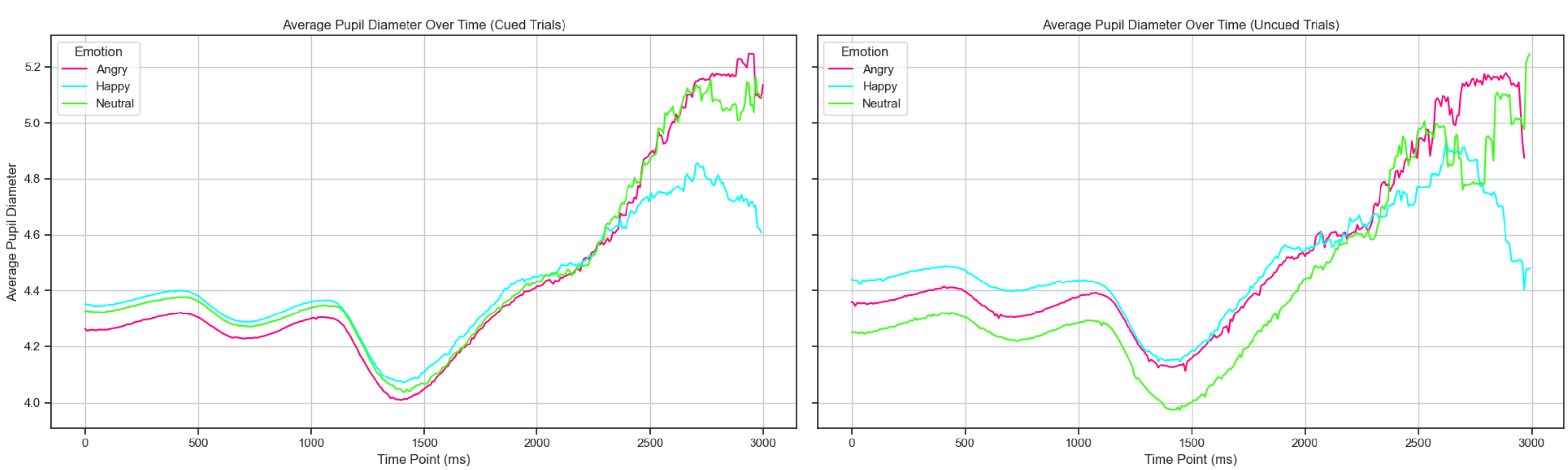
1. **Libraries used**: os, matplotlib, seaborn, pandas and numpy
2. I defined a **dictionary** (emoblo) mapping blocks (E1, E2, E3) to emotions (Happy, Angry, Neutral) and created (allmerge) to store merged data by block and the conditions (Cued/Uncued).
3. **Iterating** (for loops) through participant folders, blocks, and runs (1, 2) using os.listdir and os.path.join. For each participant, I read target_cued.csv and target_uncued.csv files, adding columns for Participant, Emotion, and Validity and then concatenated runs within blocks. I saved the final merges across participants as E1_final_merged_cued.csv, etc. The second script sliced data using a **'slicer' function**, extracting columns from **"t87"** onward (pupil diameter post-fixation) along with "response_time," "location," and "cue_location," saving cleaned files as (e.g., E1-clean-cued.csv). For 't87' i used try block function meaning, it will find 't87' "named" column then start slicing.

Now, the overview of second file which does the main analysis and plots is plots.py:

1. It uses the same libraries (os, pandas, numpy, matplotlib, and seaborn). Firstly, I've defined the storage path (f_path = "C:/Users/Anya/Downloads/D1-16/") where the cleaned CSV files (E1-clean-cued.csv, etc.) are stored.
2. A file_info dictionary maps these files to their respective experiment labels (e.g., "E1 Cued"). The script reads each file into a dataframe, adds an "Experiment" column, and concatenates them into a single dataframe (df) using pd.concat command.
3. "Propd" my main function for pupil diameter , it processes by identifying columns starting with "t" (representing time points) and then in function flattens the wide-format time series into a long format meaning it changes this structure into a single column of pupil diameter values, where each row represents one time point for a trial so, for each row in the dataframe "propd" iterates over these "t" columns, creating a new entry for each time point. The resulting data frame is saved as processed_pupil_diameter_data.csv, I've submitted this too.
4. For reaction time analysis, the script groups data by mean and median using "groupby" across "Experiment," "Emotion," "Validity," and "Eccentricity," resetting the index for a clean structure. Pupil diameter is grouped by mean over "Time Point," "Emotion," and "Validity." The code then separates cued and uncued trials for plotting.so, plots are created using "seaborn.lineplot"

III. MY INFERENCES FROM THE PLOTS

PLOT-1: Average Pupil Diameter



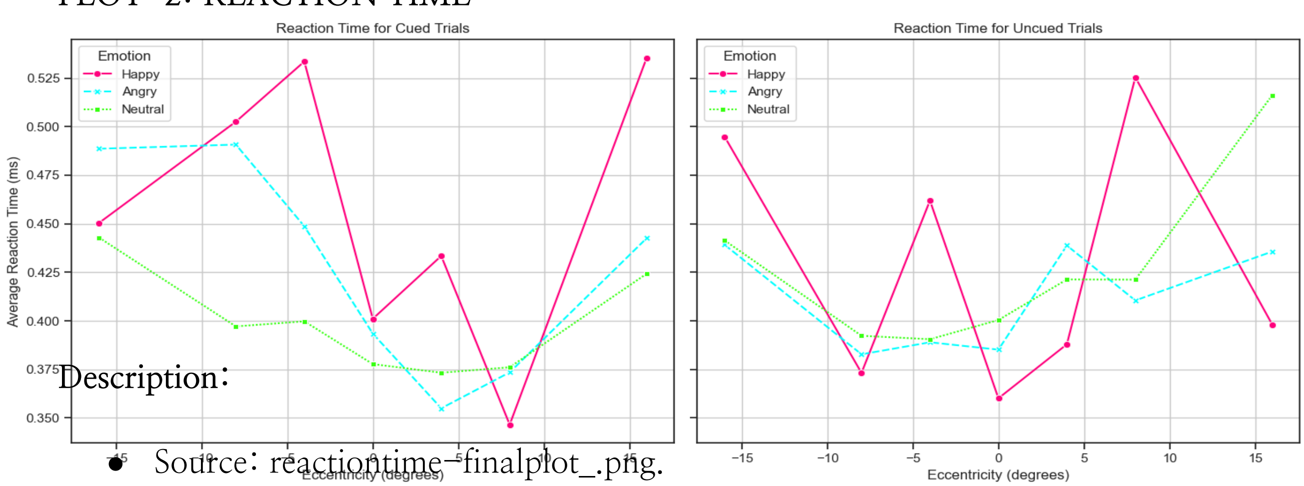
Description:

- Filename: pd-finalplot.png.
- Y-axis: Average pupil diameter (range~~4.2 – 5.2 units)
- X-axis: Time points (0 – 3000 ms);fixation (0 – 700 ms);cue given (700 – 850 ms), blank (850 – 1350 ms); stimulus onset (~1400 ms).
- Colors: Angry (neon pink), Happy (neon blue), Neutral (neon green)

Inferences:

- Angry's highest peak in cued trials indicates greatest emotional arousal like being surprised/focused to see it suddenly or maybe cognitive load
- Delayed rise in uncued trials (Neutral is mostly affected) suggests invalid cues/wrong cues make people work harder to pay attention + increasing processing time hence RT longer time.
- Pupil dilation ∝ emotional intensity (Angry > Neutral > Happy) reflecting how participants allocated their attentional resources i.e. Bigger the pupil size then stronger feelings (Angry > Neutral > Happy) showing how much attention is needed.
- Implication: In clinical psychology, this could aid in diagnosing anxiety or like anxiety based disorders. In ui/ux design or human computer interaction, designers can design interfaces/programs that adjust cues to avoid overwhelming users with information

PLOT-2: REACTION TIME



Description:

- Source: reactiontime-finalplot_.png.
- Format: Two line plots side by side.

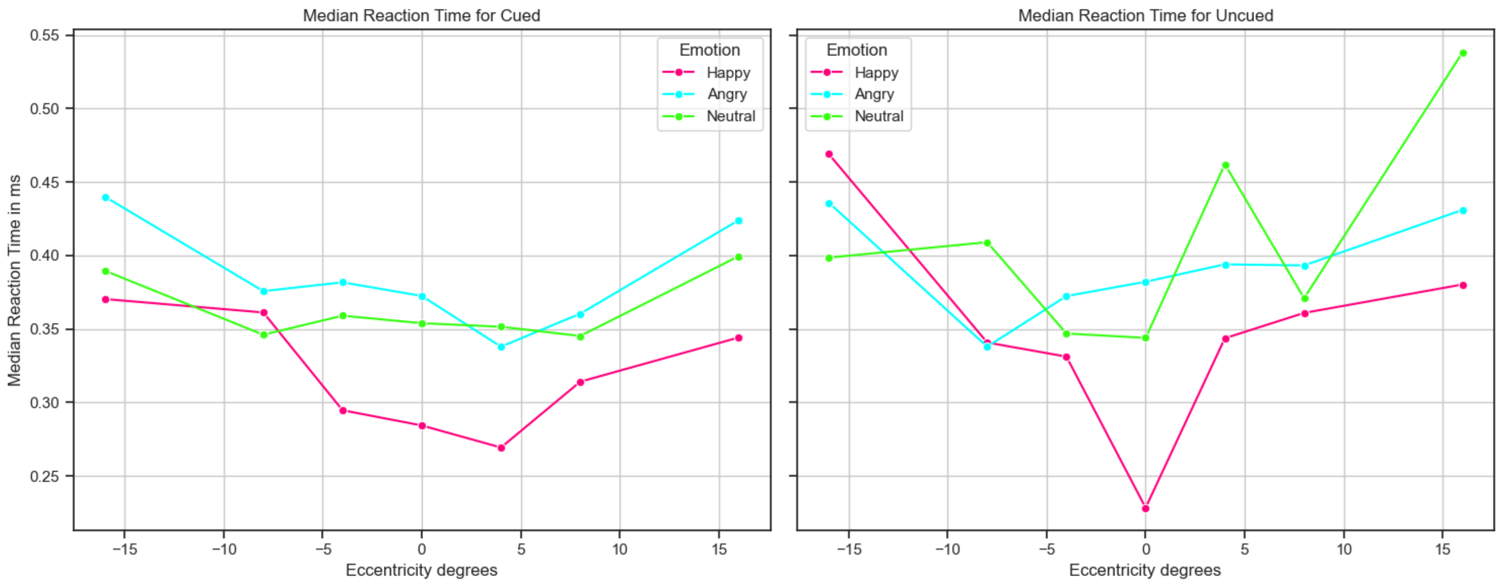
- Y–axis: Average reaction time (0.375 to 0.525 milliseconds).
- X–axis: Eccentricity (–15° to 15°).
- Colors: Angry (neon blue), Happy (neon pink), Neutral (neon green),

Inferences:

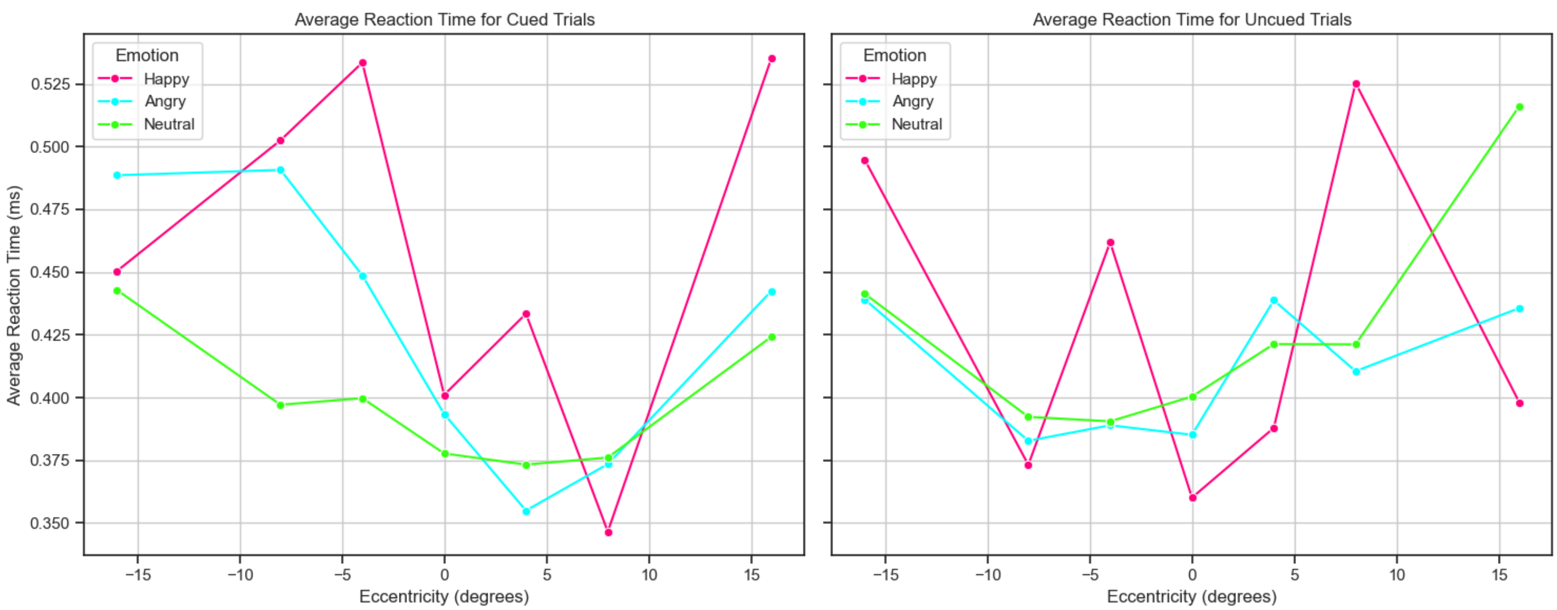
- Cued trials stay more balanced; less spiky showing right cues help people focus better (Happy easily detected; fastest RT).
- In the absence of cues i.e. the uncued condition, the pattern is noisier and more variable—participants likely found it harder to focus attention, especially at extreme angles.
- Uncued trials get slower (Neutral and Angry at 15°), meaning wrong cues make it harder; slower RT means less accuracy, so RT goes up as accuracy goes down (RT $\propto$ 1/accuracy).
- Angry faces are processed more quickly and consistently I believe because we as humans have threat detection advantage like we tend detect negative pattern/ behaviours around us rapidly.
- Neutral faces are more variable, especially in uncued conditions, possibly because they are harder to interpret and require more cognitive effort.
- Angry gets slower in uncued trials, showing feelings get in the way when attention shifts.
- Reaction times increase significantly especially at higher eccentricities.

PLOT –3: SUPPORTING PLOT (Median Reaction Time Vs. Average Reaction Time)

For Median RT:



For average RT:



So, the Variables used are:

- X-axis: Eccentricity (in degrees).
- Y-axis: Reaction Time (in milliseconds).
- Colors: Happy (neon pink), Angry (neon blue), Neutral (neon green)

So, I'm comparing RT median and average RT because during class the prof had pointed out that different statistical measures can yield different patterns of results and thus shape our interpretation of the data. So, I decided to take the median.

Inferences

1. Cued Condition

- In the average RT plot, the Happy line shows sharp increases at both ends (±16°). This means reaction times were slower there—but this could be because a few people responded very slowly and pulled the average up.

- In the median RT plot, the Happy line is smoother, and it doesn't spike so much at the edges. This suggests that most people still responded quickly, and only a few slow responses made the average look worse.

- Angry and Neutral expressions look similar in both average and median plots, though again the average plot is a bit more "jumpy."

2. Uncued Condition

- In the average RT plot, the *Neutral* expression shows a big spike at +16°. But in the median plot, this spike is much smaller.

- This tells us again that a few very slow responses made the average higher, but the median shows that most people responded faster than it looks from the average.

What This Means: The average is affected by extreme values (slow responses), so it can make things look more dramatic. I believe the median RT side gives a more realistic idea of what most people did.