

## Instructions:

Your task is to analyze and make inferences from a dataset that compares pupil diameter during emotion detection and control tasks. Below are step-by-step instructions for understanding the experimental design and conducting the analysis.

## Experiment Overview:

Main Experiment:

- Data was recorded in 3 blocks, each targeting a specific emotion (Happy, Angry, Neutral).
- 90 trials per block (30 Happy, 30 Angry, 30 Neutral).
- Each trial starts with a fixation (700 ms), followed by a face stimulus (70 ms) and a noise mask (50 ms).
- The task is a 2-alternative forced choice (2AFC), where participants report whether the target emotion (e.g., Happy) was presented.

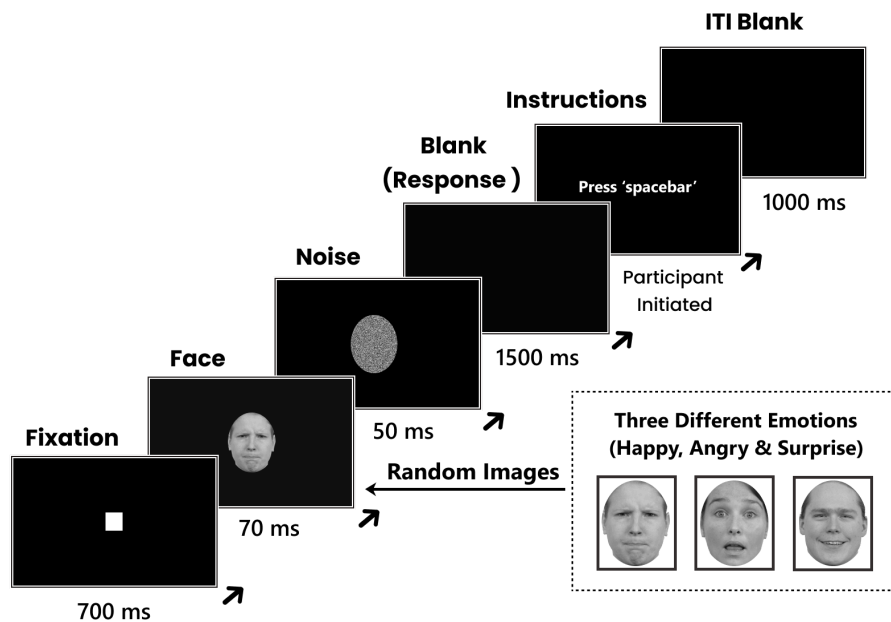


Figure 1: The study paradigm for the main experiment.

Control Experiment:

- The same stimuli and trial structure were used, but participants reported the position of a red dot on the face (left or right) instead of recognizing emotions.
- 120 trials in total (40 per emotion).

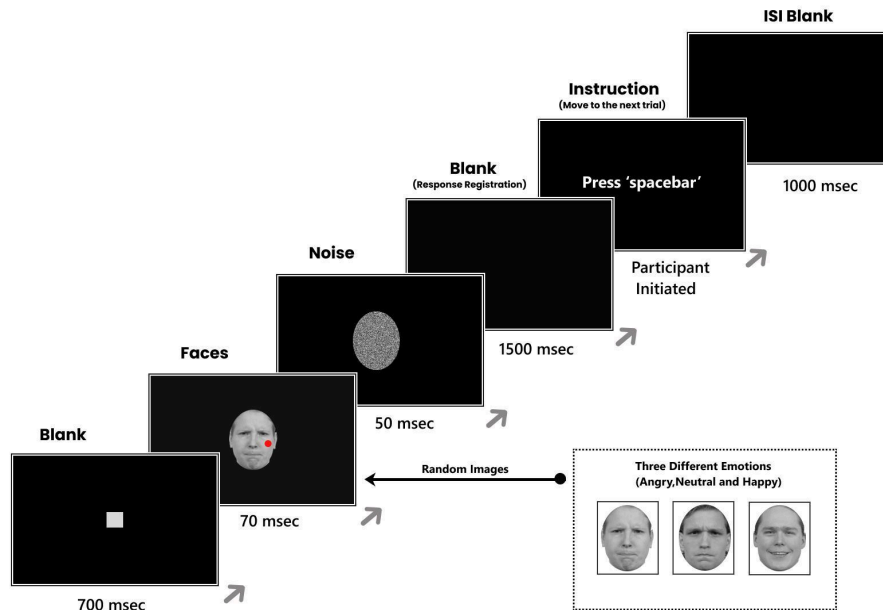


Figure 2: The study paradigm for the control experiment.

## Dataset Overview:

The dataset includes trials from two experiments:

- **Main Experiment:** Emotion detection task using three emotional expressions: Happy, Angry, and Neutral.
- **Control Experiment:** A control task where participants report the spatial location of a red dot overlaid on an emotional face.

The dataset provided to you contains data from an emotion recognition experiment, where participants were asked to identify specific emotions (Happy, Angry, or Neutral) across multiple trials. The data has been preprocessed and only includes trials where participants correctly identified the target emotion. Each experiment block focuses on a different target emotion, and the data is organized accordingly. Below is a detailed breakdown of the dataset structure and instructions on how to use it.

## Dataset Columns:

- **Column 1: Stimulus Name**
  - This column contains the name of the face stimulus presented during the trial.
- **Column 2: Reaction Time**
  - This column represents how long (in milliseconds) the participant took to respond after the presentation of the stimulus. This measures the participant's reaction time.
- **Column 3: Reaction Key**
  - This column indicates the key the participant pressed to register their response. For example, 'Left' or 'Right' keypresses could represent their decision.

- **Columns 4 onwards: Pupil Diameter (Time Series)**

- Each subsequent column contains pupil diameter measurements taken at intervals of **8 ms**. These measurements track the participant's pupil dilation during each trial, starting from the presentation of the fixation cross and continuing through the stimulus and response phases.
- The number of columns may vary across trials due to the task's nature and the trials' length. This means some trials have more pupil diameter data points than others.

### **Explanation of the Experimental Blocks:**

The dataset is divided into three experimental blocks, each representing trials where a specific emotion was the target:

1. **Block E1 (Happy Target)**

- In this block, the task was identifying and reporting "Happy" faces. The dataset contains only trials where participants correctly recognized Happy faces as Happy.

2. **Block E2 (Angry Target)**

- In this block, participants were asked to identify Angry faces. The dataset contains only the trials where Angry faces were correctly identified as Angry.

3. **Block E3 (Neutral Target)**

- In this block, participants were tasked with identifying Neutral faces. The dataset includes only trials where Neutral faces were correctly recognized as Neutral.

### **Important Note on Pupil Data:**

The first 87 columns of the pupil data correspond to the 700 ms fixation period before the stimulus was shown. For your analysis and plots, focus on the data from **column 87 onward**, representing the pupil responses after the stimulus was presented. Slice the dataset from column 87 to the end to analyze the relevant stimulus-response period.

## Folder Structure and Dataset Organization for Your Analysis

Each of you has been assigned a unique dataset for analysis. The dataset folders are labeled with codes like **D2-1**, **D3-11**, etc. Here's a detailed breakdown of how the folder structure is organized and how you should navigate it for your analysis.

**D2-1**, **D3-11**, etc., are the codes for the dataset folders. The first part (**D2**, **D3**, etc.) refers to the main folder that you can access from the link provided

(<https://drive.google.com/drive/folders/18zUUTFdsfd83hMcGY23tFLuGwxvsWcy-?usp=sharing> ). The second part (e.g., **1** in **D2-1**) refers to a subfolder inside the main folder. This subfolder contains the dataset specifically assigned to you.

**✗ Important: You are assigned a unique dataset. DO NOT use someone else's dataset for your analysis.**

***Stick to the folder assigned to you.***

Let's say your assigned folder is **D2-1**. Inside **D2-1**, you will find ten subfolders. Each subfolder contains the data for a single participant in the study. The participants' names are anonymized and encoded using three-letter codes (e.g., **SAN**, **JKT**, etc.).

**For each participant (e.g., **SAN**), you will find the following structure:**

**Main Folder:** This contains the data from the Main Experiment where participants were tasked with recognizing emotional expressions (Happy, Angry, or Neutral).

**Control Folder:** This contains the data from the Control Experiment, where participants were asked to detect the position of a red dot on emotional face stimuli instead of recognizing the emotion.

**Inside the **Main** and **Control** Folders: Each of these folders (**Main** and **Control**) contains three subfolders named:**

- **E1:** Corresponds to the block where the participant's task was to identify Happy faces (as described in the Dataset Overview).
- **E2:** Corresponds to the block where the participant's task was to identify Angry faces.
- **E3:** Corresponds to the block where the participant's task was identifying Neutral faces.

**Inside Each of the **E1**, **E2**, and **E3** Folders.** You will find a CSV file containing the data for that specific task block. This CSV file includes the pupil diameter measurements, reaction times, and other data for each trial in that block.

## Schematic folder structure for reference:

D2-1/

- └─ SAN/           # Participant folder
  - └─ Main/        # Main Experiment data
    - | └─ E1/        # Block 1 (Happy Target)
      - | └─ Copy of target.csv
    - | └─ E2/        # Block 2 (Angry Target)
      - | └─ Copy of target.csv
    - | └─ E3/        # Block 3 (Neutral Target)
      - | └─ Copy of target.csv
  - └─ Control/      # Control Experiment data
    - └─ E1/        # Block 1 (Happy Target)
      - | └─ Copy of target.csv
    - └─ E2/        # Block 2 (Angry Target)
      - | └─ Copy of target.csv
    - └─ E3/        # Block 3 (Neutral Target)
      - └─ Copy of target.csv

## **What do you all have to do?**

### **Data Understanding and Preprocessing:**

- Make sure you understand the structure of the data.
- Slice the data to focus on the pupil diameter columns from the 87th column onwards.

### **Pupil Analysis:**

- Analyze the pupil diameter data across trials (take column-wise averages across all the participants) to observe how pupil size changes in response to different emotional faces (Happy, Angry, Neutral).
- Compare the reaction times across the three blocks.

### **Visualization:**

- Create plots showing pupil trends over time for each emotion (Happy, Angry, Neutral) and compare the control blocks.

### **Inferences:**

- Make inferences about how different task blocks and emotions affect pupil diameter and reaction time.
- Are there any patterns present?

***Below are some points that may be used while interpreting the results. The students are encouraged to come up with their points and explanations.***

- Does pupil diameter change significantly in response to emotions (Happy, Angry, Neutral)?
- How does the pupil response vary between the **Main** and **Control** experiments?
- How does reaction time differ across the emotional blocks (E1, E2, E3).
- How does the data from the **Main** experiment (emotion recognition) differ from the **Control** experiment (red dot detection)?

## **★ Writing a Report and Presenting Your Analysis in a Viva Session**

As part of this assignment, you are required to produce two main components:

1. **A Written Report (Maximum 1500 Words):** This will involve presenting your results, findings, and conclusions based on the analysis of the provided dataset.

## **Rubrics:**

### **1. Plotting the Average Pupil Diameter (5 Marks)**

#### *Task:*

- You must create a **single plot** showing the average pupil diameter across all participants.
- The plot should include data for both the **Main** and **Control** experiments.
- Plot the data **separately but on the same graph for each experiment block (E1, E2, E3)**.

#### *Key Points:*

- Ensure that each block's average pupil diameter (E1, E2, E3) is distinguishable. You can use different colors or markers for the three blocks.
- Clearly label the plot with axes titles (e.g., Time in milliseconds, Average Pupil Diameter), legends, and an appropriate title.
- The Main and Control conditions should be easily compared on the same plot.

### **2. Plotting the Reaction Time (5 Marks)**

#### *Task:*

- Create a plot showing the **Reaction Time** for the **Main** and **Control** experiments.

#### *Key Points:*

- The plot should allow for an easy comparison of Reaction Time across the Main and Control experiments.
- Use appropriate visual distinctions (e.g., different colors or line styles) to differentiate between the Main and Control groups.
- Label your axes (e.g., Reaction Time in milliseconds, Number of Participants) and include a legend.

### **3. Supporting Plot (3 Marks)**

#### *Task:*

- You must create **any additional plot** that reasonably supports your inferences about the data.

*Key Points:*

- This plot could showcase trends, comparisons, or other insights supporting your analysis. For example, you could create a plot comparing the variation in pupil dilation across different emotions or reaction times across different stimulus types.
- The plot should add value to your report and provide further evidence to support your findings.
- It should be straightforward, well-labeled, and easy to interpret.

#### 4. Inferring Results from the Data (To be announced)

*Task:*

- You will need to **infer meaningful results** from your data analysis. This involves drawing conclusions based on the trends in pupil diameter, reaction time, or other plots.

*Key Points:*

- Your inferences should clearly explain the significance of the data.
- You should also relate your inferences to the aim of the task, which involves understanding how emotion and attention to a task modulate pupil diameter.
- The clarity of your inferences is essential—avoid vague or unsupported claims.

#### 5. Report Writing and Formatting (5 Marks)

*Task:*

- Your report should be **well-organized and formatted**, adhering to the word limit of **1500 words (excluding references)**.

*Key Points:*

- Structure your report with results, and conclusion.
- Ensure that the language is clear and concise and that your explanations are easy to follow.
- Include all necessary elements (figures, tables, and references) in the proper format.

#### Submission Requirements:

1. Project Report: The document should be a PDF and should be named with the data folder you are allotted. E.g. if you are allotted data “D2-1”, the your report should be submitted as “D2-1.pdf”
2. Submit codes also by the same name.
3. Generate an excel sheet sheet of average data used in your analysis submitted by the name of the folder as mentioned above.



