

CECS450 Data Visualization

Eye Gaze Data Visualization

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Goal

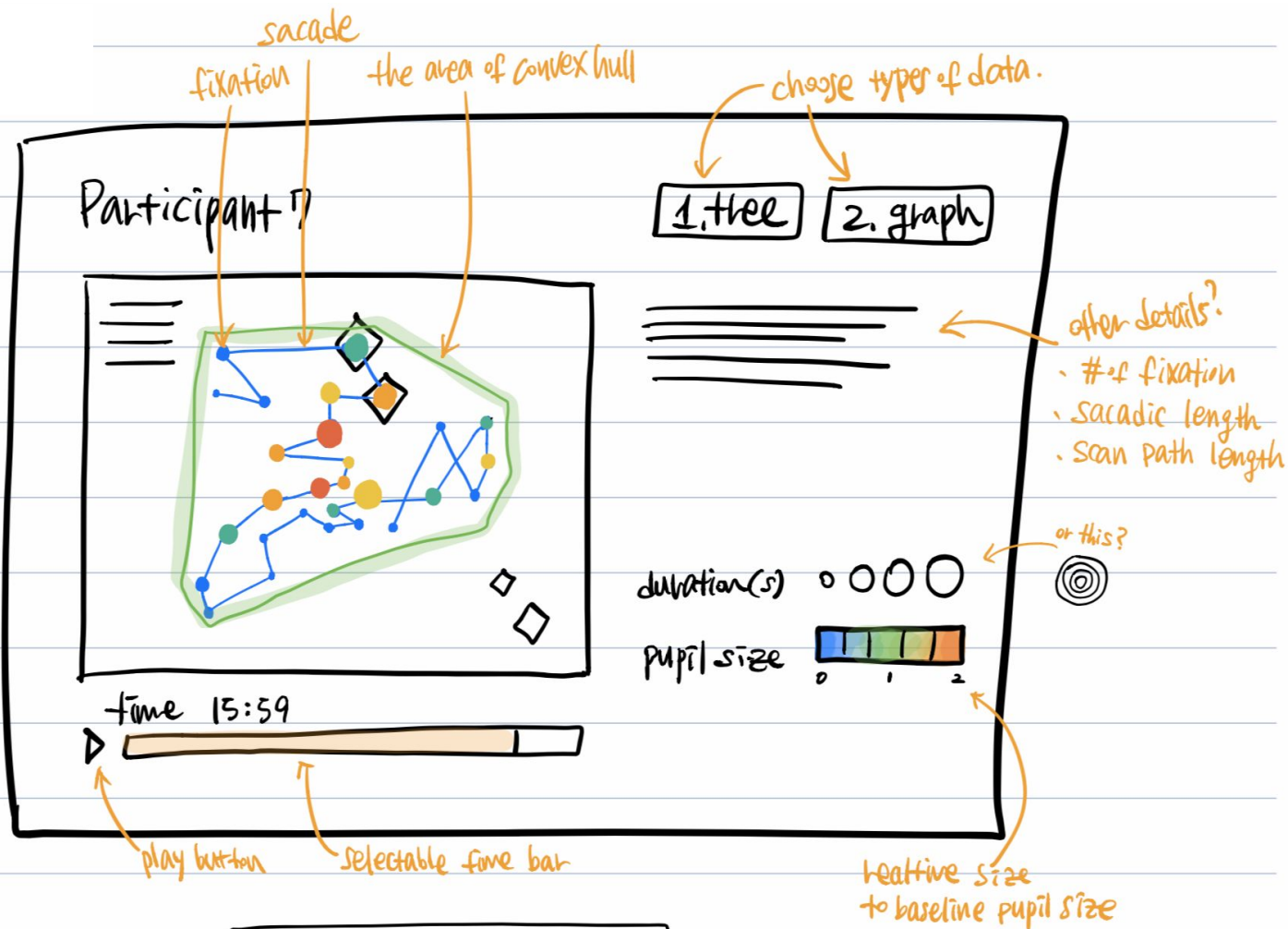
To provide **an overview**
with an **interactive** interface
to **explore** the eye gaze data

Questions we aim to answer

- How big was the area the participant needed to look to search information?
- How much stress did the participant have through time?
- Where did the participant have higher cognitive overload?
- How does the participant's gazes look throughout the task?
 - How sparse are the fixations?
 - Where are the fixations more concentrated?
 - Where was the participant looking at in respect of time?
- How long did it take to process information at a certain point?

Design

Idea Sketch



Visualization Type and Attributes

Type

Scatter Plot

**Attributes
& Features**

1	x axis	x coordinate of fixation
2	y axis	y coordinate of fixation
3	size	fixation duration
4	color	pupil dilation
5	time	timestamp of fixation

Interactions

Annotation 1. Label with details on mouseover

Filter 2. Filter by timestamp

Highlight 3. Highlight by fixation duration

4. Highlight by pupil dilation

Data Processing

with Python on Jupyter notebook

Exploratory Data Analysis

- Data cleaning and Data preprocessing
- Check for Data anomalies
- To check assumptions using statistical and graphical representations.
- Selecting the Datasets as per our needs.

Selecting

- p7.treeFXD.txt & p7.graphFXD.txt
 - Time, Duration, Screen_x, Screen_y
- p7.treeGZD.txt & p7.graphGZD.txt
 - Time, Duration, Pupil_left_eye, Pupil_right_eye, Code_left_eye, Code_right_eye
- p7GZD.text (Baseline Data)
 - Pupil_left_eye, Pupil_right_eye.

Cleaning

- Dropping unnecessary columns.
- Dropped invalid gaze data using validity code

Validity code

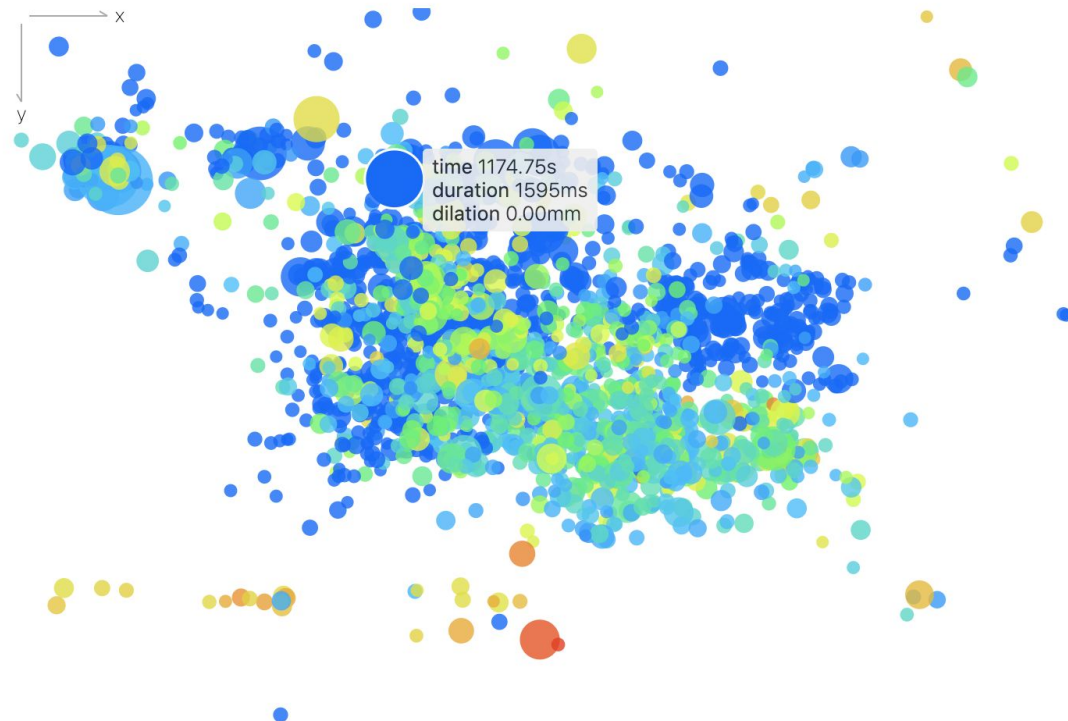
Left Validity	Right Validity	Result (Normal)	Result (Medium)	Result (High)
0	0	Both	Both	Both
4	0	Right	Right	None
0	4	Left	Left	None
3	1	Right	None	None
1	3	Left	None	None
2	2	None	None	None
4	4	None	None	None

Processing

- Calculating of **pupil dilation** from gaze data:
 - average left&right pupil size - average baseline left&right pupil size
- Integrating **pupil dilation** to each fixation point:
 - Total_duration = **time** + **duration** for every fixation.
 - Taking the maximum of dilation in the particular duration
- 11 Nan values of **avg_dilation** in tree fixation data
- 1073 Nan values of **avg_dilation** in graph fixation data

Implementation

Participant 7 eye-tracking data



Tree

Graph

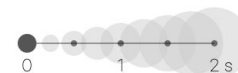
Details

time 1174.75s

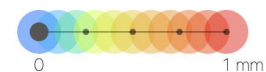
duration 1595ms

dilation 0.00mm

Fixation Duration



Pupil Dilation



20:06

clear filter

Demo on Github Page

sellabae.github.io/450EyeViz

How it meets our goal?

- 1. How big was the area the participant needed to look to search information?**

The area of scatter plot (convex hull)

- 2. Where the user is looking at the screen with respect to time?**

Filtering fixation points by time on the svg.

3. Where on the screen the user went through higher cognitive overload?

Pupil Dilation - measured by color of each point on scatter plot.

4. How long did it take to process information at a certain point?

Fixation Duration - Size of each point in scatter plot.

5. Where the fixations were more concentrated?

The scatter plot - shows at which part of the screen maximum fixations occurred.

Contribution

Data Processing

- **Monish** : EDA for Tree & Data Preprocessing
- **Adithya** : EDA for Graph & Data Preprocessing

Visualization

- **Amaan** : scatter plots, interaction
- **Sella** : design, interaction
- **Visaj** : html, interaction