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Emotional Awareness During Bug Fixes – A Pilot Study

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Problem Context

- This study examines the effects of a programmer's emotional awareness on progress while fixing bugs.
- The goal of the study is to capitalize on emotional awareness to ultimately increase progress made during software development. This process could result in improved software maintenance.

Research Question

Can we determine emotional state of a developer using biometric sensors during debugging?

Data Sources

Tobii X3-120 Eye Tracker

Affectiva

:) Affectiva

Shimmer GSR

Study Environment

iTrace infrastructure (*www.i-trace.org*) was modified to capture gazes within the Eclipse IDE from all three data sources.

A server/client application was written to synchronize events between each data source and output biometric data and typed interactions including window focus events.

iTrace

Tasks and Participants

- 3 bug tasks were chosen from an open source repository – JabRef
- JabRef is a reference management system
- 3 students were piloted in Computer Science.

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Task Description and Prompt

Review bug report and fix bug in code.
```
Bug 2: No comma added to separate keywords
When adding a keyword via the content selector, nocomma is
added before the keyword.I have set "When adding/removing
keywords separate themby:" to ", " in the Preferences >
Groups panel. But keywords still get separated by a space
only.
---------------------------
Answer the following questions after you are done with the
task.
Difficulty: Easy | Avg | Difficult
Confidence: Low | Medium | High
Short description of your solution (classes/methods
affected):
```
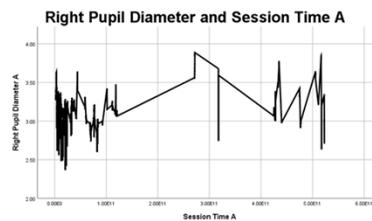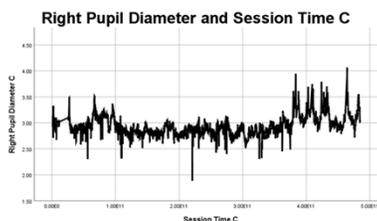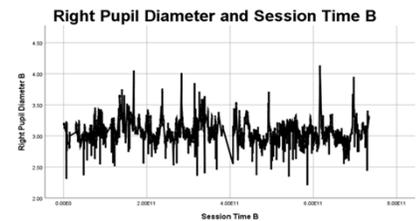
Results: Right Pupil Dilation in Time

Right Pupil Diameter and Session Time A


Right Pupil Diameter and Session Time B

- **During session time A there was a small increase with pupil size from the beginning towards the halfway point of the trial. Then a decline was seen towards the end.**

- **In Trial B there was a significant increase in the amount of pupil dilation change as well as a steadier diameter change in the amplitude.**

Right Pupil Diameter and Session Time C

Right Pupil Diameter and Session Time D

- **In Trial C we saw a smaller amount of change in the amplitude of the diameter change and an increase at the end of the session time.**
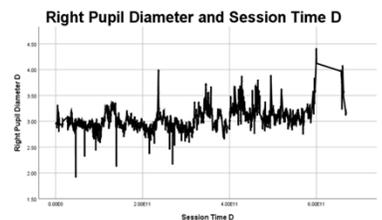
- **Trial D showed a similar start as Trial C but an earlier increase in the median diameter of the right pupil.**

Conclusions

- There is a connection between pupil dilation and emotional arousal as task progresses.
- GSR did not show too much difference but this could be due to placement of electrodes.
- We have some promising evidence that biometric sensors can be used to determine emotional state during bug fixes.

Ongoing Work

- Lessons learned include changing the placement of the electrodes for the GSR sensor due to typing. The sensors will now be placed on shoulder and not palm.
- Analyze webcam data from Affectiva.
- Conduct the study on a larger sample.