We Know it Before You Do

Finding Recognition Patterns in Brain Activity

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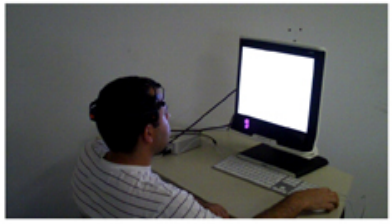
Previous work in HCI has utilized eye tracking and electroencephalography (or EEG) in isolation. We sought to combine these two recording methods into a single study. By utilizing cutting-edge technologies and writing code to support their combined use, we have collected data which might help computers to anticipate our reactions.

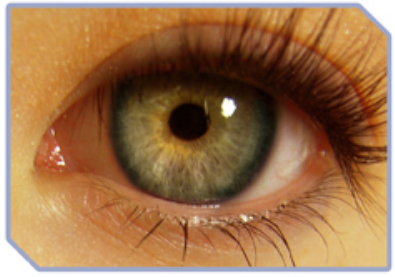
OUTPUT: Code

In order to prompt recognition patterns, we chose to ask participants to find errors (or "bugs") in computer code. This task suited our needs because bugs are not immediately apparent and require critical thinking to recognize. We defined three distinct types of errors to insert into our code: **lexical** (i.e. misspelled variables or functions), **syntactical** (i.e. missing parenthesis or invalid characters), and **logical** (errors which result in syntactically correct code but which do not serve the intended purpose).



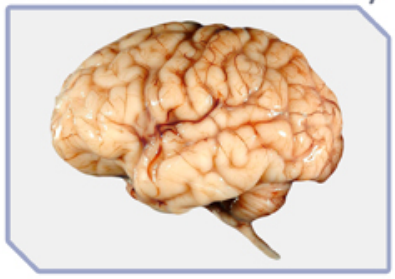
Collecting data as a participant searches for errors in computer code. Each participant completed a total of 27 debugging tasks.

INPUT: Gaze



In order to measure and record gaze information (or where the experiment participant is looking), we utilized eye tracking technology by Tobii. This allowed us to monitor the focus of the participant's eyes as he or she scanned the provided images.

INPUT: Brain Activity



To measure cognitive activity, we used the EPOC Headset distributed by Emotiv. This device rests is worn on the head and has fourteen sensors to acquire neurological signals. The sensors make readings at an average of 150 samples per second.

INPUT: Mouse Clicks

When combined,

this data tells a story about how participants perceived and responded to the bugs in the code. Using the **gaze position**, we are able to pinpoint the moment that a bug was encountered visually. The following **EEG data** reflects the internal process of recognition. The time of the **mouse click** tells us when the participant was able to physically react to this recognition. We hope to find patterns in the EEG data during the "recognition" phase. Such patterns could have far-reaching impact on human-computer interaction, where the computer is able to respond to our thoughts sooner than we can translate them into external commands.