INDIVIDUALLY TAILORED NEUROFEEDBACK

Sinan Uslu
University of Luxembourg
May 21, 2021

BACKGROUND

Previous studies on neurofeedback have demonstrated its efficacy in modulating electrocortical activity usually by applying training blocks with standardized feedback protocols. However, these effects are approximately observed in only two-third of participants. Research in the motor learning area suggests that different processes are involved when training in self or externally paced blocks. One approach to individually tailor neurofeedback is to apply self paced training.

In a current study, we are investigating the effect of self paced neurofeedback.

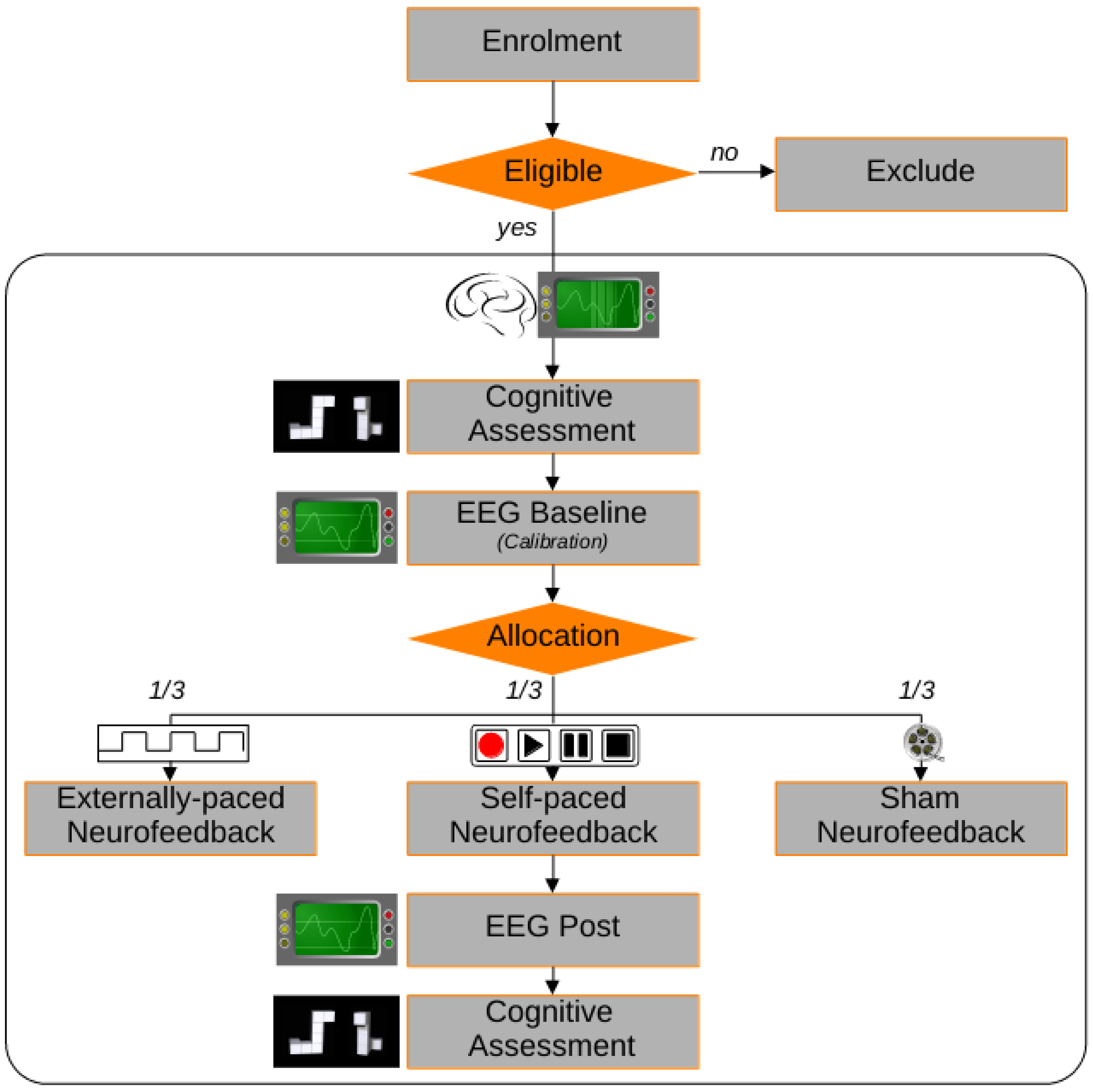
OBJECTIVES

To further validate the efficacy of individually tailored neurofeedback protocols, we plan to extend the current design by individualizing the measured feedback signal.

- classifying individual cognitive performance by means of electrocortical activity
- measuring the efficacy of neurofeedback with individually parametrized feedback

This approach takes into account individual features and aims to extend the efficacy of neurofeedback to more participants. By using individual electrocortical markers of cognitive performance, it becomes possible to investigate the specificity neurofeedback effect on cognitive outcomes.

FIGURE 1



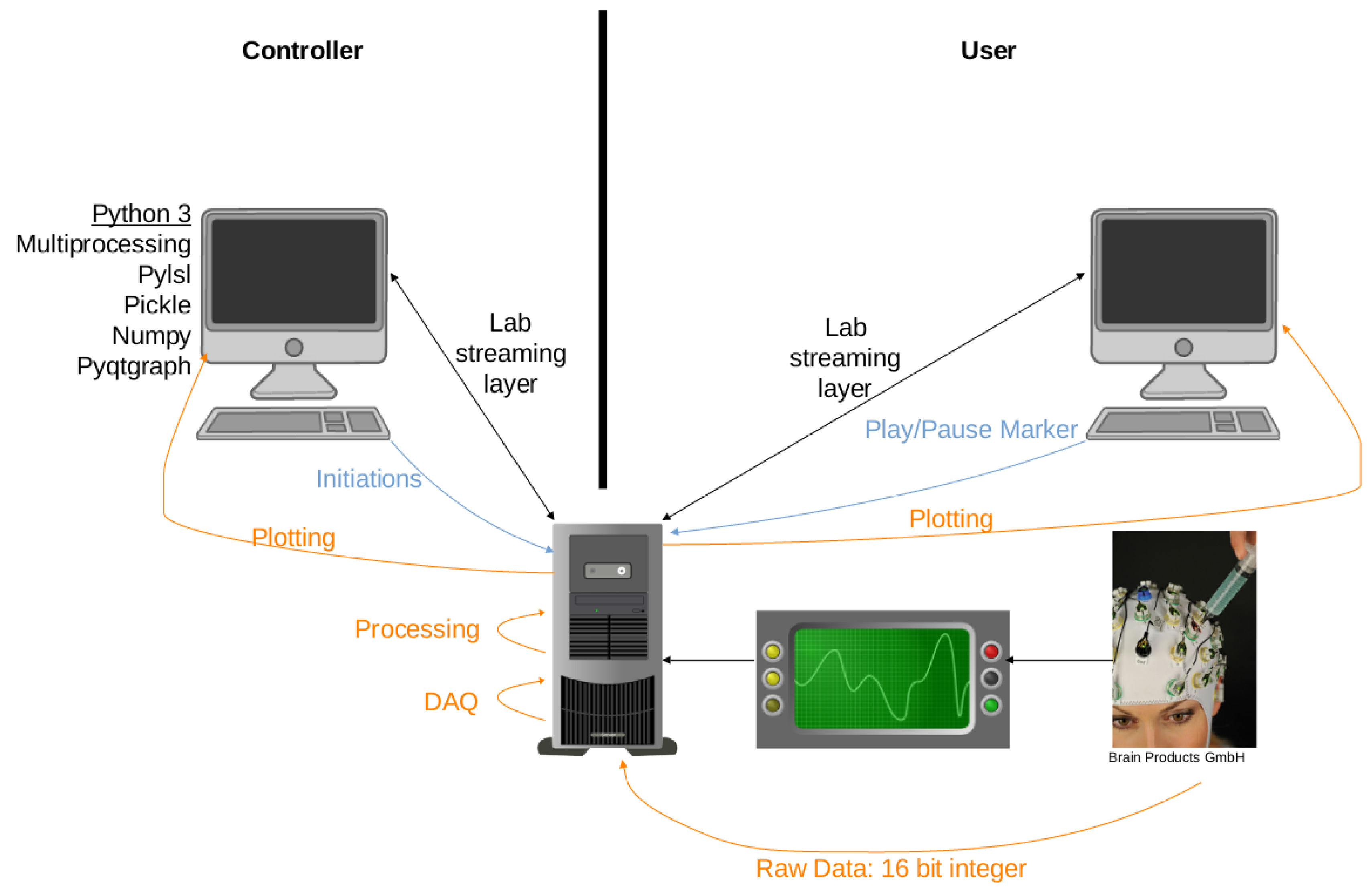
Study design.

METHODOLOGY

In this randomized controlled trial change scores (pre-post) will be compared between the groups receiving self, externally paced neurofeedback and the control group. All 60 participants will undergo the same procedure except for the type of neurofeedback. The single NF session consists of 30 minutes training and 4 rest periods. Participants in the self paced group will be able to distribute their training and rest periods themselves, whereas participants in the externally paced group will follow a fixed schedule consisting of alternating periods of 6 minutes training and 1 minute rest. All participants in the sham control group will receive the same (pre-)recorded feedback.

- 32 channel EEG recording at 1000 Hz
- individual upper alpha frequency training
- individually parametrized artefact detection algorithm

FIGURE 2



Hard- and software components used during data collection.

PRELIMINARY RESULTS

Initial analysis of the mental rotation task demonstrate that the task performance and reaction times depend on the rotation angle. With increasing angle, the reaction time increases and responses become more erroneous.

FIGURE 3

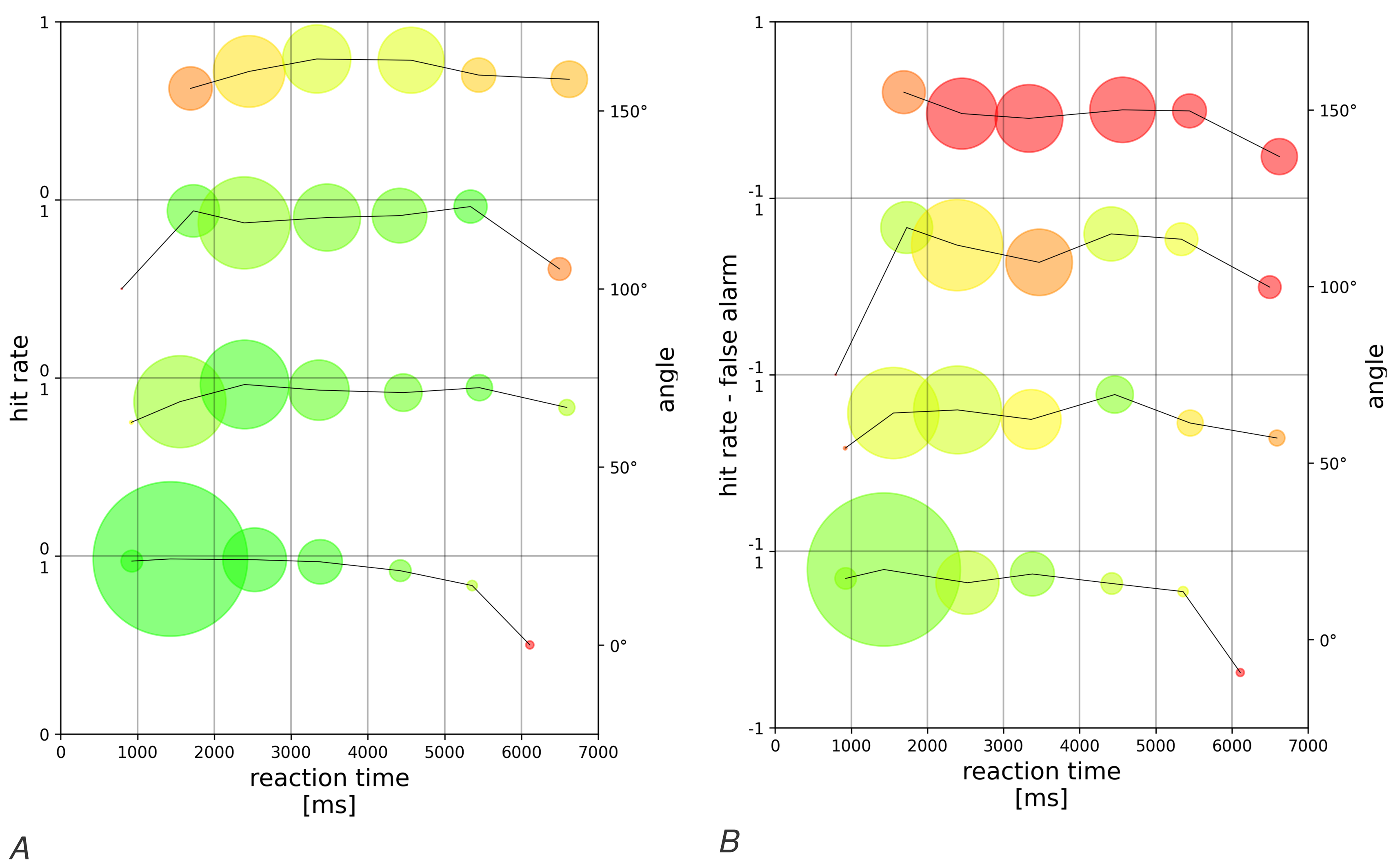


Figure 2A shows hit rates of varying reaction times and object angles. Figure 2B shows false alarm rates of varying reaction times and object angles. Circle sizes indicate the number of trials (total: 1135).

OUTLOOK

Based on the data from the mental rotation task, we plan to implement an algorithm that learns to classify the response as correct based on electrocortical activity recorded prior to the response. The most dominant electrocortical feature is to be used as the training frequency in a neurofeedback protocol.

ACKNOWLEDGEMENT

The Doctoral Training Unit **Data-driven computational modelling and applications** (DRIVEN) is funded by the Luxembourg National Research Fund under the PRIDE programme (PRIDE17/12252781). `https://driven.uni.lu`

SUPERVISION

Main supervision: Prof. Dr. Claus Vögele (University of Luxembourg)
Internal CET member: Prof. Dr. Stéphane Bordas (University of Luxembourg)
External CET member: Dr. Michael Tangermann (University of Freiburg)