



Published in A Beginner's Guide to Brain-Computer Interfaces

This is your **last** free member-only story this month.
[Sign up for Medium and get an extra one](#)



Tim de Boer

Follow

Aug 8, 2022 · 4 min read · ✨ ·  Listen



Save

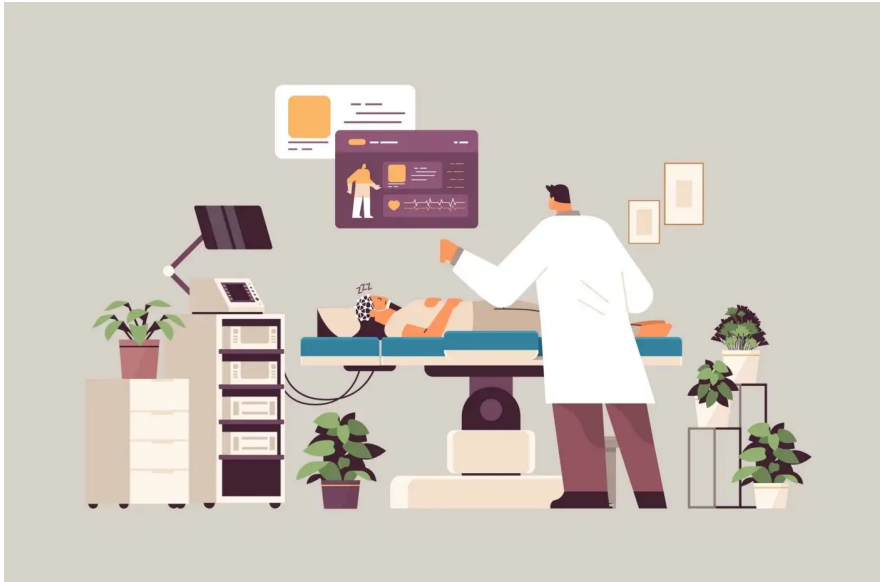


How To Collect EEG Brain Signal Data

A Guide Into Conducting BCI Experiments --
A Beginner's Guide to Brain-Computer
Interfaces (part 3)

*"The most important and unpredictable side of technology
will always be ... human."*

— Khira Allen, *Songbird Ascension*



A BCI project will always start with you. The user.

As you may know, the brain is an incredibly complex organ. When you think about it, the fact that we are able to develop a BCI which can classify your mental state, is insane.

However, designing an experiment for this classification is not as easy as putting the EEG cap on your head and press play.

The basis of each BCI is a well thought out experiment design.

Although future goals are to use BCIs in everyday life, right now they just do not work good enough, and factors which can influence the performance should be limited.

Distraction. Fatigue. Noise.

A good design tries to avoid this.

So, how do BCI experiments look like? Let's go over the design of my own BCI experiment design of my master thesis for motor imagery classification.

An overview

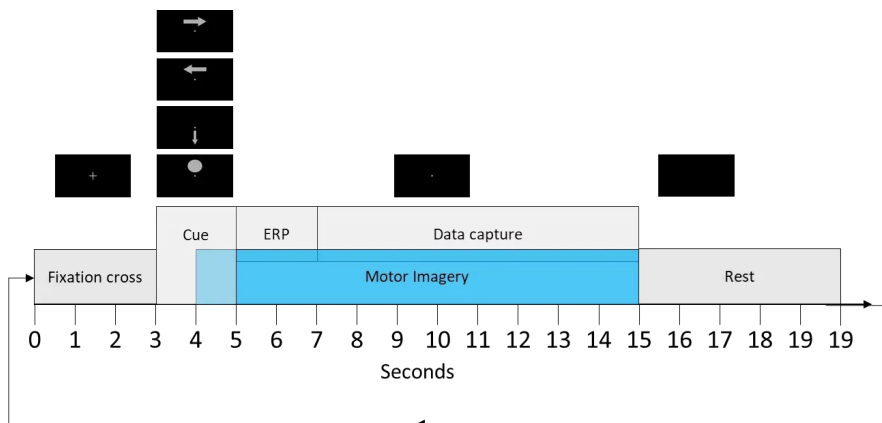


Figure 1: An overview of a motor imagery experiment.

Above figure gives an overview of 1 loop of 1 trial in an experiment is given in Figure 1. We captured data of right arm motor imagery (the right arrow), left arm motor imagery (left arrow), legs motor imagery (bottom arrow), and just relaxing (the circle). Per trial, we had 8 loops. Per experiment, we had 10 trials.

Now, let's go over each roadblock we tried to avoid with the setup of these experiments.

Distraction

We implemented multiple things to avoid distraction. One thing not visible in the overview above, but most important, is to have an empty table, with only the monitor showing the experiment. No external distractions. Next, at the start of each loop, a cross is presented, meant to signal to the user that a new task is coming up, and letting them focus on the screen with distraction.

Fatigue

Motor imagery can be hard. Especially when doing it for a prolonged time. Therefore, we limited the trials to 8 loops (3 minutes) and between each loop we had a 2 minute break. We added 5 seconds of rest after each loop. The 4 tasks were presented randomly, but never

more than 2 times the same task in a row, to prevent the fatigue of doing the same thing over and over again.

--

Open in app ↗

Sign up

Sign In



This is an abbreviation of ‘event related potential’, a characteristic number of peaks in your brain activity as a direct result of a sensory, cognitive, or motor event. In our experiments, an ERP could be initiated due to the start of the task (cognitive and motor), and the disappearance of the cue (sensory). An ERP lasts around 1 second. In our experiments, we weren’t interested in the ERP, but in the motor imagery signal. Thus, to be sure that we avoid having ERPs in our data, we skipped the first 2 seconds of the motor imagery task.

Another cause of noise is due to muscle movement. More specifically, blinking your eyes, moving your eyes, clenching your teeth, or swallowing. Therefore, the subject was instructed to blink as little as possible from the moment the cue appeared until the end of the task. Additionally, the subject was

instructed to avoid jaw clenching, sudden eye movements, and swallowing during the task. To help the user avoid sudden eye movement, we would have a cross or a dot on screen, meant as a focus point for the subject during the task. 5 seconds of rest, the subject was allowed to do any of the above.

Especially blinking was encouraged to avoid dry eyes, which could later maybe force the subject to blink a lot during a task.

Conclusion

When setting up your BCI experiment, the design can improve the outcome a lot! Even when you're trying the experiment only for yourself, or your flat mates, consider above advice. It may improve your project a lot!

If this post was helpful, check out the [publication page](#), where more practical BCI tutorials like this one will be posted in the future, and give me a follow to be notified for further posts!

Enjoy the read? Reward the writer. ^{Beta}

Your tip will go to Tim de Boer through a third-party platform of their choice, letting them know you appreciate their story.

Give a tip

Get an email whenever Tim de Boer publishes.

Your email



Subscribe

By signing up, you will create a Medium account if you don't already have one. Review our [Privacy Policy](#) for more information about our privacy practices.

Get the Medium app

