Instructions

Thank you for participating in our experiment. This experiment will take a total of about 1 hour throughout which you will imagine moving your right or left hand (without actually moving it) to control the height of bars on the screen.
We will discuss the details later but let's first see what we mean by motor imagery! ☺

Imagining movement
We generally move our hands and limbs without really thinking about it. How does it actually *feel* to move your hand? The goal of this experiment is to imagine just that—without actually moving the hands. This may require some practice. Please do not imagine *seeing* the movement as if you are looking at yourself in the mirror, but imagine *feeling* it—as if you are really trying to move while still suppressing the actual movement. For example, you could:

- Imagine your hand rotating from the wrist.
- Imagine opening a door handle.
- Imagine squeezing a ball in your hand.

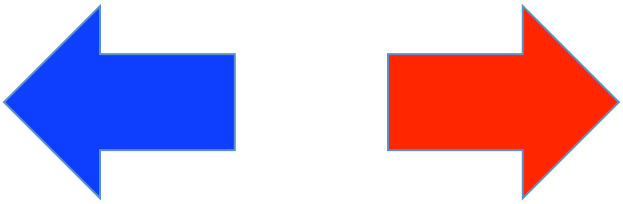
Or, any other hand movement of your choice. This is called ***motor imagery***.

Again, the purpose of this experiment is to *imagine* moving your right or left hand. Please make sure that you *do not make any actual movements*. Feel free to ask your experimenter about your movement of choice for each hand or any other questions you may have about motor imagery.

We will now give you instructions for the first phase. In this phase, you will gain some experience with motor imagery so later on you can use it in other contexts. You will learn to activate parts of your brain that you do not activate similarly on a daily basis but a paralyzed person who is unable to move her/his limbs could use this way to command a computer for various purposes.

Phase 1: <u>Let's practice some motor imagery!</u>

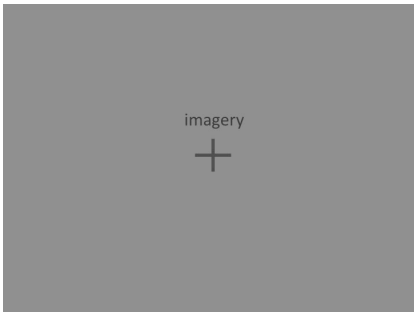
In the first phase, you will repeatedly see one of the following two arrows on the computer display.



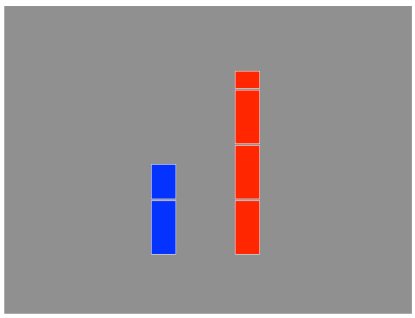
These two arrows represent two different instructions:
The blue arrow pointing to the left asks you to *imagine moving your left hand*.
The red arrow pointing to the right asks you to *imagine moving your right hand*.

However, do not start the imagination right away. After the arrow, a cross will appear in the middle of the screen. As long as you see the cross, please *attend to the cross*.

When the word "imagery" appears above the cross sign, begin the motor imagery (while fixating your eyes on the cross). Perform motor imagery (as instructed earlier) as long as the word "imagery" remains visible.



After the cross and the word disappear, you will see two bars representing the computer's interpretation of your motor imagery. Here is an example:

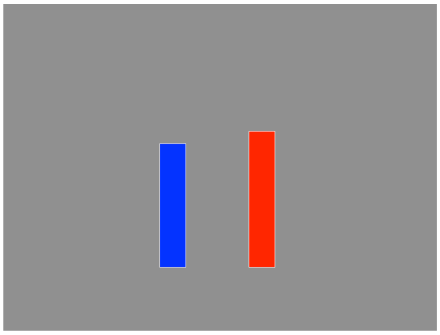


The higher bar represents the computer's *guess* for the side of the imagery (left or right). The difference in height of the two bars is a measure of the *confidence* of this guess. You are cooperating with the computer to make your motor imagery as recognizable as possible. Therefore, the height of the bar on the side of the imagery should be higher if you have performed the imagery correctly. Also, you should try to *maximize the difference* between the heights of the two bars such that detecting the side of the imagery can be done more confidently.

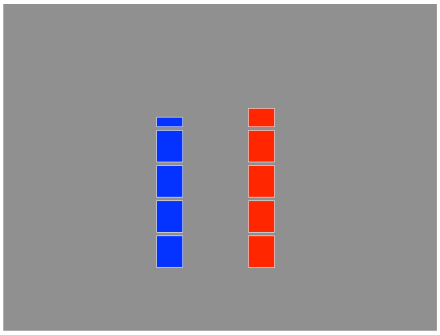
Note that when the height of the bars becomes higher than what would fit on the screen, the scale is adjusted to fit on the screen. You will be able to recognize this scaling because the bars become "squeezed" vertically. In the above figure: the power on the right side is three times the maximum height (that could be shown on the screen), plus a remainder value. The power on the left side is one times the maximum height plus a remainder.

Strategy

Note that the goal is to maximize the difference between the bar heights. However, what if the two bars have similar height? Well, it is possible that you are not focusing enough on "the side of imagery". Here are a couple of examples of where the bars do not look as good and some instructions as what to do in similar situations:



Both low: focus on the side of imagery

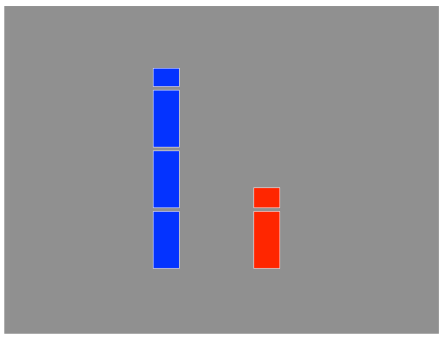


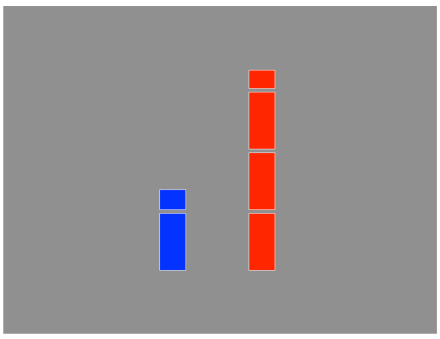
Both high: focus more on feeling the movement

If the bars are both low, make sure you are only imagining moving the instructed hand and not the other hand or both at the same time. That is, your imagined movement should be properly *lateralized*.

If the bars are both high, you should make more effort in imagining the movement more clearly by trying to *feel* it more as opposed to seeing yourself in the mirror.

Here are two more examples. If the computer has successfully detected which hand one was imagining to move, can you tell which side was the side of imagery?





To summarize, remember that the goal is to make the height of the bars maximally different and not to push both high (or low).

This phase takes about 10-15 minutes and consists of three blocks. In the first two blocks feel free to change your movement of choice to find what movement imagination works best for you. There will be a third block in which we ask you to pick whichever movement imagination has worked best for you and stick to it throughout this last block in this phase as well as the rest of the experiment phases.

A few points to remember:

1. Please minimize any muscle movements, including blinking, during the trials. The inter trial intervals are designed to give you a short break between each trial where you may blink or move as needed.
2. Please fixate your eyes on the "+" at all times and attend to the bars from your eye's periphery. This will minimize any potential saccade and help us have a higher quality data.