P300 experiment guide for Heart and Brain SpikerBox

- Download latest Spike Recorder software from Spike Recorder page on our website:

https://backyardbrains.com/products/spikerecorder

- Download and install free Arduino IDE software on your computer:

https://www.arduino.cc/en/main/software

- Copy P300 Arduino code made for Heart and Brains SpikerBox from our GitHub:

https://raw.githubusercontent.com/BackyardBrains/Heart-and-Brain-SpikerBox/master/V0_62/Experiments/P300/P300.ino

and upload the code to the board.

(Please note that if you want to return to the original/production code for Heart and Brain SpikerBox you can upload back this code: https://raw.githubusercontent.com/BackyardBrains/Heart-and-Brain-SpikerBox/master/V0_62/Heart-and-Brain-SpikerBox/Heart-and-Brain-SpikerBox.ino)

- Connect small speaker to pins D9 and GND on expansion port like in the image below:
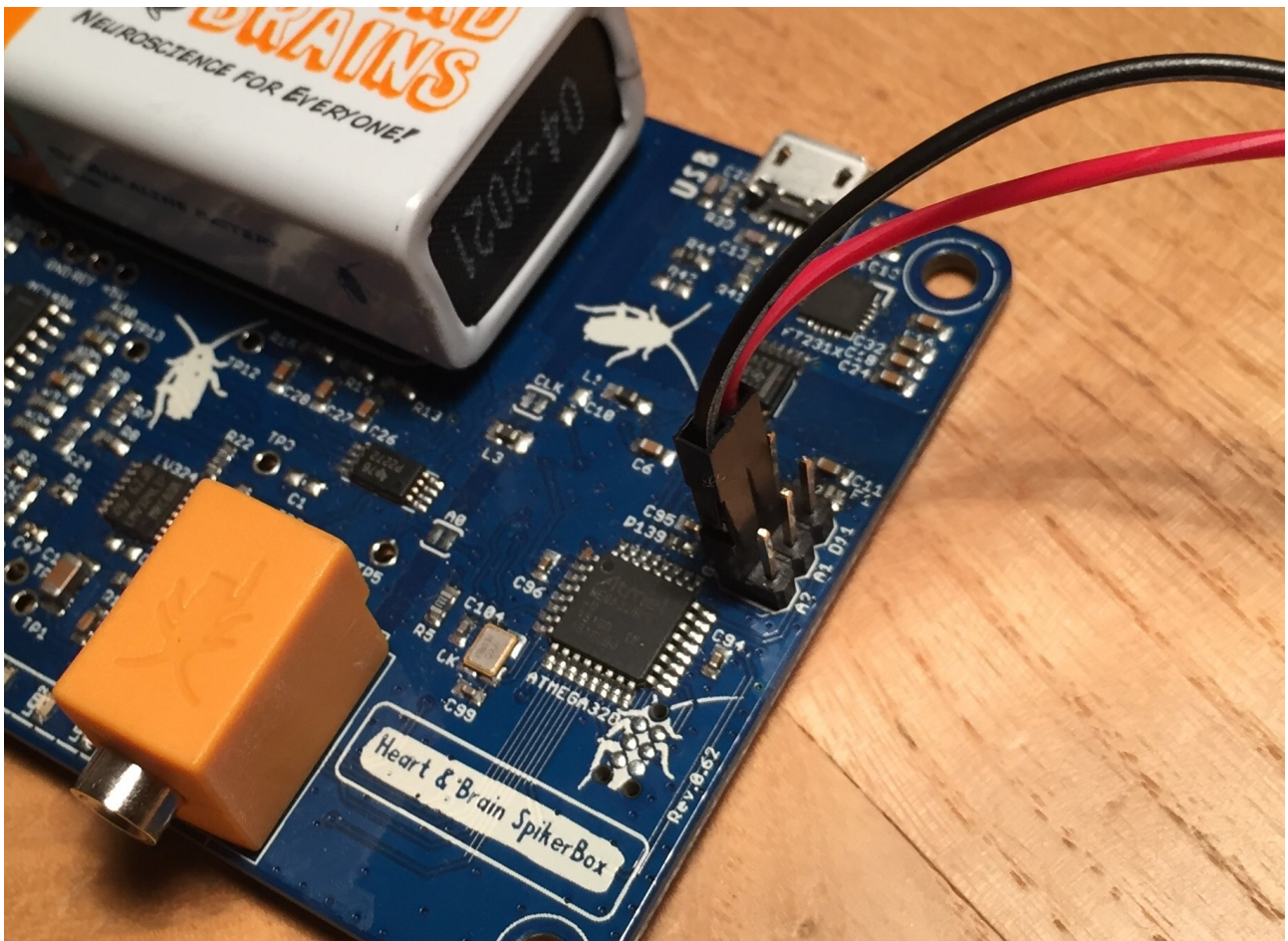
- Make sure that you have fresh 9V battery in SpikerBox

- Turn ON the SpikerBox. You should hear tones from the speaker generated every 2 seconds.

- Connect SpikerBox to your computer

- Open Spike Recorder and wait for 20 seconds

- You should see USB icon button appearing on the top of the Spike Recorder window.

- Click on the USB icon button to connect to Heart and Brains SpikerBox

- You should see one channel signal from the SpikerBox along with markers that mark onset of the tone on the speaker.

- Disconnect speaker for a second just to set up electrodes on the subject.

- Make sure the subject is comfortably seated and equipped with a piece of paper and writing utensil.

- Add globs of electrode gel underneath the metal button electrodes at the top of the headband. Make sure that there is as little hair as possible between the metal and their skin.

- Add a ground to the mastoid process behind the ear.

- With your orange electrode cable, clip the two red alligator clips to the metal buttons on the top of the head, and the black alligator clip to the ground behind the ear.

- Plug the other end of the orange electrode cable into the Heart and Brain SpikerBox.

- As with the previous EEG experiments, this amplifier's filter settings are right in the sweet spot of house electrical systems, so you will have to be very vigilant of noise in this experiment. Have your laptop and SpikerBox far from any electrical outlets, away from any fluorescent lights, etc. Also have your laptop running on battery power alone. If the signal seems excessively noisy and unstable, add more conductive gel between the headband electrodes and your scalp.

- On our SpikeRecorder software, turn on the 50Hz (Europe, South America) or the 60Hz (United States, United Kingdom) notch filters to reduce the electrical noise and slide the digital filters to 1-100 Hz.

- Hold still and relax while you are attempting to record EEGs (muscle movements from the jaw and forehead can be picked up very easily, which causes interference with your EEG reading)

- Test the legitimacy of the signal - have the subject open and close his/her eyes, alternating every ten seconds. If alpha waves as described in the EEG experiment appear when eyes are closed and disappear after the eyes are open, you are most likely recording a real EEG signal. Hurray!. You may continue to the next step. If not, try the following: make sure the electrode area has contact with the scalp, and make sure your wires are all connected correctly.

Oddball Task

1. Connect speaker back to Heart and Brain SpikerBox and you will become hearing the normal and oddball tones.

2. Start recording data on the Spike Recorder software.

3.The subject will mark each oddball tone that they hear on the piece of paper (and keep track of the total) until they've tallied fifty. At this point, we end the recording.

When you finish recording the experiment you should have two new files generated by Spike Recorder.

One WAV file that has EEG data and one .txt file that has events in experiment. They should have the same name just event file should have "-events.txt" extension. For example:
BYB_Recording_2019-11-04_14.wav
BYB_Recording_2019-11-04_14-events.txt

You will need both of those files for later post-processing of data with Matlab.

- Download updated Matlab script made for Heart and Brains SpikerBox from our GitHub:

https://github.com/BackyardBrains/Heart-and-Brain-SpikerBox/raw/master/V0_62/Experiments/P300/P300%20-%20Matlab.zip

- Unpack the archive with Matlab code

- Copy recording files of the experiment (both files .wav and .txt) to the same folder where Matlab code is.

- Open Matlab, navigate to the directory with P300 Matlab code and run runP300.m file