**Lab 7 Report**

***Experiment 2***

**Report: What do you observe?**

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| --- | --- |
| Cutting 1 second | Cutting the first 10 second for the 35Hz trials but not for 40Hz (smoothed below) |
|  |  |

* 1031 and 1107 are both 35Hz done on different days.
* After cutting the first 10 seconds I observe the signal ranges from 0.5 to ~1.7 and the signals are relatively similar
* I then applied a smoothing function to the signal to see if I could better understand the results. It seemed like the 40Hz was highest around the 100-200 time point.

**Report the average EEG spectral energy at 40 Hz (amplitude of the envelope) from 100 - 300 seconds after the onset of the experiment. (2 pts)**

| Spectral energies | Average energy at 40Hz and 35 Hz from 100-300s |
| --- | --- |
|  |  |

**Report: What is the difference between the average value of the EEG spectral energy at 35Hz versus 40Hz?**

* We can find the average EEG spectral energy difference by finding the difference of the average at 35 Hz ((0.8186 + 0.7550) / 2 = 0.7868 and the spectral energy at 40Hz (0.6209) which we got 0.1669.

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| --- | --- |

**Why do you find different frequencies of the spectral energy for each experimental condition?**

* Different experimental conditions, such as attending to different tones (e.g., left or right ear, or focused attention vs. divided attention), can modulate the brain's neural activity differently. This leads to variability in how strongly the brain locks onto specific modulation frequencies (35 Hz and 40 Hz).
* When participants are more engaged or attending to a specific stimulus, the brain's steady-state response to the modulation frequency (e.g., 40 Hz or 35 Hz) is enhanced. In cases of divided attention or lack of focus, the responses may weaken, leading to differences between conditions.
* EEG contains natural oscillatory activity (e.g., alpha, beta, and gamma rhythms), which may overlap with the target modulation frequencies. The extent of overlap can vary by condition, introducing variability in the spectral energy.

**Which condition produces greater magnitude?**

* We observed that at 35Hz the EEG spectral energy was higher.

**Does this finding match your observation from the previous experiment? (4 pts)**

* In Experiment 1 I observed that the 35Hz frequencies tended to be greater than the 40Hz so this would be consistent with our previous results.

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| --- | --- |
| Experiment 2 Results | Experiment 1 Results |

***Experiment 3-***

Report: Explain the calculation of your threshold.

* I divided the data into 60-second intervals, with the first 60 seconds excluded to account for initialization or unsteady data. Since each interval represented a specific attention condition (e.g., left or right ear) for each interval, the ratio of spectral energy at the modulator frequencies for the left ear (40 Hz) to the right ear (35 Hz) was computed. The ratios of left and right ear were then averaged respectively. They were found as 0.933 and 0.959, not a lot of difference.
* The final threshold was computed as the mean of all the average ratios of each side. This threshold value (e.g., 0.946) represents the decision boundary between left and right ear attention. The ratios above the threshold correspond to left ear attention, and the ratios below the threshold correspond to right ear attention.

Can you use it to show which ear the subject is attending to in real-time?

* I don’t think this is a reliable way to show which ear the subject is attending to. The differences between the spectral energy at 40 Hz and 35 Hz may not be large enough to reliably reflect attention shifts.
* The data might not show strong neural entrainment to the attended ear, making the ratio less predictive. The spectral energy might be influenced by noise, movement artifacts, or other external factors rather than attention modulation alone.
* A single threshold might also not capture the complexity of attention dynamics. A more nuanced model (e.g., incorporating time history or additional features) would probably be more successful!

Include plots of the ratio between left and right and screenshots of the signal when the subject is attending to different ears. (4 pts)

|  | Left    Right |  |
| --- | --- | --- |
| I don’t think the data show a strong threshold value that can consistently classify left and right year because of so much fluctuation. | | |