Who is Your Group?

In Table 1, you will find demographic information (age, gender, race, education, relationship status) about your group, their general health and how many participants were currently meditators. These values help you understand the characteristics of the participants who attended your event and completed the measures. It also helps you see if these demographic measures change from event to event.

Table 1. Participant's demographic information

Measure	Category	Average ± Standard Deviation	
Age	Years	42	
Education	Years	18.5 ± 3.5	
		Number of Participants	**Percent**
Gender	Male		
	Female	2	100
	Other		
Race	American Indian		
	Asian/Pacific Islander		
	Black or African American		
	Hispanic		
	White/Caucasian	1	50
	Other	1	50
Relationship	In a relationship		
	Not in a relationship	2	100
Overall Health	Poor		
	Fair		
	Good	1	50
	Very good	1	50
	Excellent		
Meditators	Yes	0	0

EEG

Overview

The brain is an enormously complex biological system that uses a multidimensional space for information processing, representation, and transfer. Cognitive functions (including perception, memory, language, emotions, behavior monitoring/control, and social cognition) are supported or implemented by the electrical activity from cortical neurons that "fire" together in networks. The resulting brain oscillations - or brain waves - reflect these electric fluctuations occurring in the brain and can be measured with the electroencephalography (EEG). These cognitive processes and their associated neural oscillations are fast, dynamic, and temporally sequenced. Therefore, high temporal-resolution techniques such as EEG are well-suited to capture this information. Furthermore, EEG is useful because it is more sensitive than behavioral measures such as introspective self-report. The most familiar classification of the brain waves is the frequency domain: such as:

- **Delta (0.5-4 Hz)** oscillations tends to be the highest in amplitude and the slowest waves. It is normal as the dominant rhythm in infants up to one year, in **deep sleep** stages, and in **motivational processes** (i.e. reward system).
- **Theta (4-8 Hz)** oscillations are often linked to **attention** (especially for the detection of objects in space during exploratory movements and spatial navigation)[11], **memory, drowsiness, emotional regulation, and meditation**.
- **Alpha (8-13 Hz)** oscillations are usually best seen in the back of the brain (i.e. occipital lobe) with eyes closed and relaxed, but they also are highly involved in inhibitory mechanisms and high brain functions such as **attention, perception, working memory (i.e. short-term memory), mental representations of objects and events.**
- **Beta (13-32 Hz)** oscillations are most commonly observed in relation to **sensorimotor** behavior by decreasing during the preparation and execution of **voluntary movements**, and bursting after the termination of the act.[12] The brain responds the same way when one observes or imagines the movement, even when it is not accompanied by any muscular.[13] That is how it becomes possible to control a robotic hand using mere imagination. While it is strongly established that alpha band activity plays an important role in attentive behavior, studies have also shown that beta band activity also serves as a carrier for **attentional activation** by facilitating **alertness** or **arousal** that allows us to perceive stimuli, even when they are presented very briefly.[14]
- **Gamma (32-50 Hz or higher)** oscillations are associated with the construction of **object representation**. It entails the binding of separate parts of the same object through bottom-up processes, and the activation, retrieval, or rehearsal of an internal representation through top-down process.[15] Because the power in gamma band increases during complex and attention-demanding tasks, induced gamma activity is often interpreted as the neural substrate of **cognitive processes**. It is known that different properties of objects or events are encoded and processed in different parts of the brain, and it may be thanks to gamma oscillations that we perceive **coherent representations**. It has also been related to the integration of sensory and motor processes during movement. [15] Furthermore, **meditation** induces synchronization and increased amplitude in gamma band activity.[16] [17]

Sharifa Channeling Results

Overall EEG

For Sharifa, we collected EEG during two conditions: no-channeling and channeling. Table 7 shows the EEG power averages for the whole scalp for each frequency band. There were statistically significant differences in the EEG power for the delta and theta frequency bands when comparing the no-channeling to the channeling state. Theta and delta was slightly lower during channeling state.

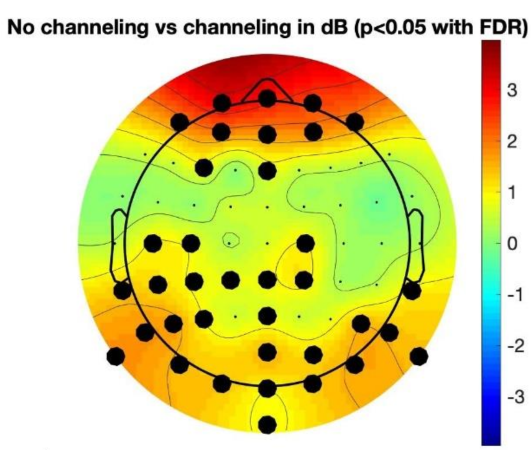
Table 7. Sharifa EEG results

	No-Channeling*	Channeling*	P-value
Delta (0.5-4 Hz)	49.5	48.7	0.0001
Theta (4-8 Hz)	49.9	49.1	0.003
Alpha (8-13 Hz)	51.5	51.3	ns
Beta (12-32 Hz)	37.7	37.5	0.06
Gamma (32-higher Hz)	29.8	30.0	0.08

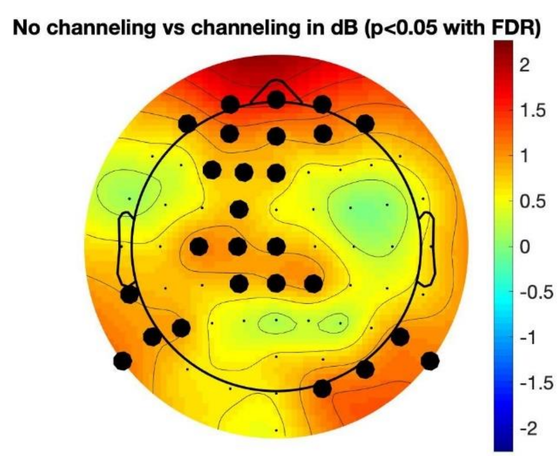
* Average of EEG Power; ns = not significant

EEG by Location

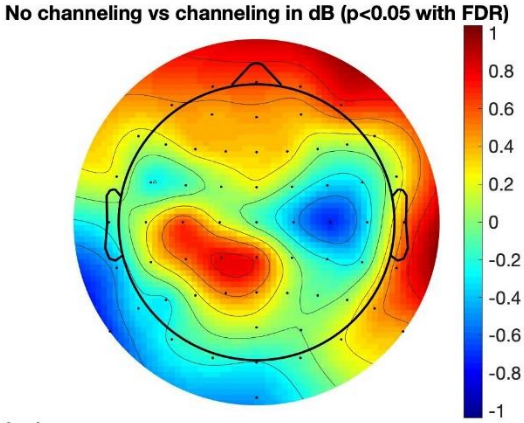
The following figures show the differences between the channeling and no-channeling condition for each of the EEG frequency bands. The large black dots show the specific areas of the scalp that were significantly different statistically using a correction method called False Discovery Rate. All but the alpha frequency band showed location differences comparing no-channeling to the channeling state.



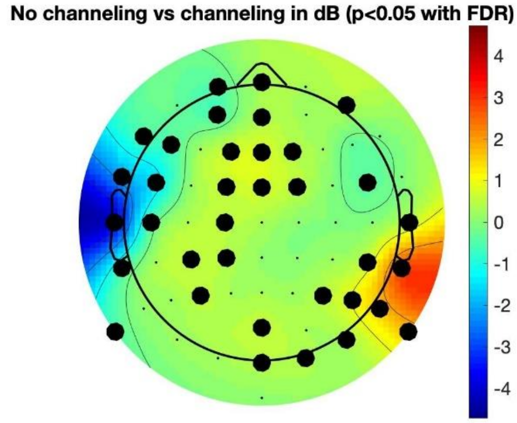
Delta



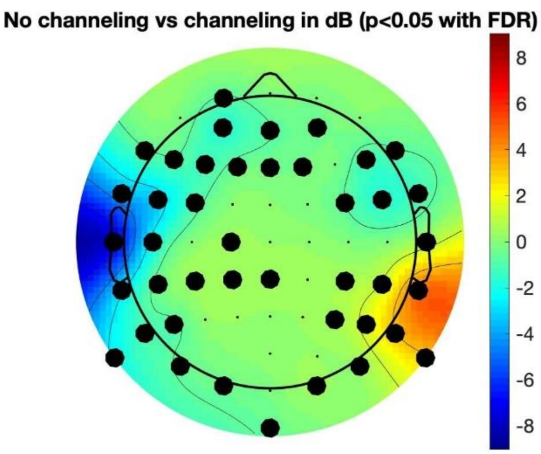
Theta



Alpha



Beta



Gamma

Lubna Channeling Results

Overall EEG

For Lubna, we collected EEG during multipe conditions: 1) mind-wandering eyes closed; 2) mind-wandering eyes open; 3) Divine channel eyes open and talking; 4) Divine channel eyes closed and silent; 5) Jesus channel eyes closed; 6) Jesus channel eyes closed and silent but less intensity; 7) Divine channel silent and eyes open.

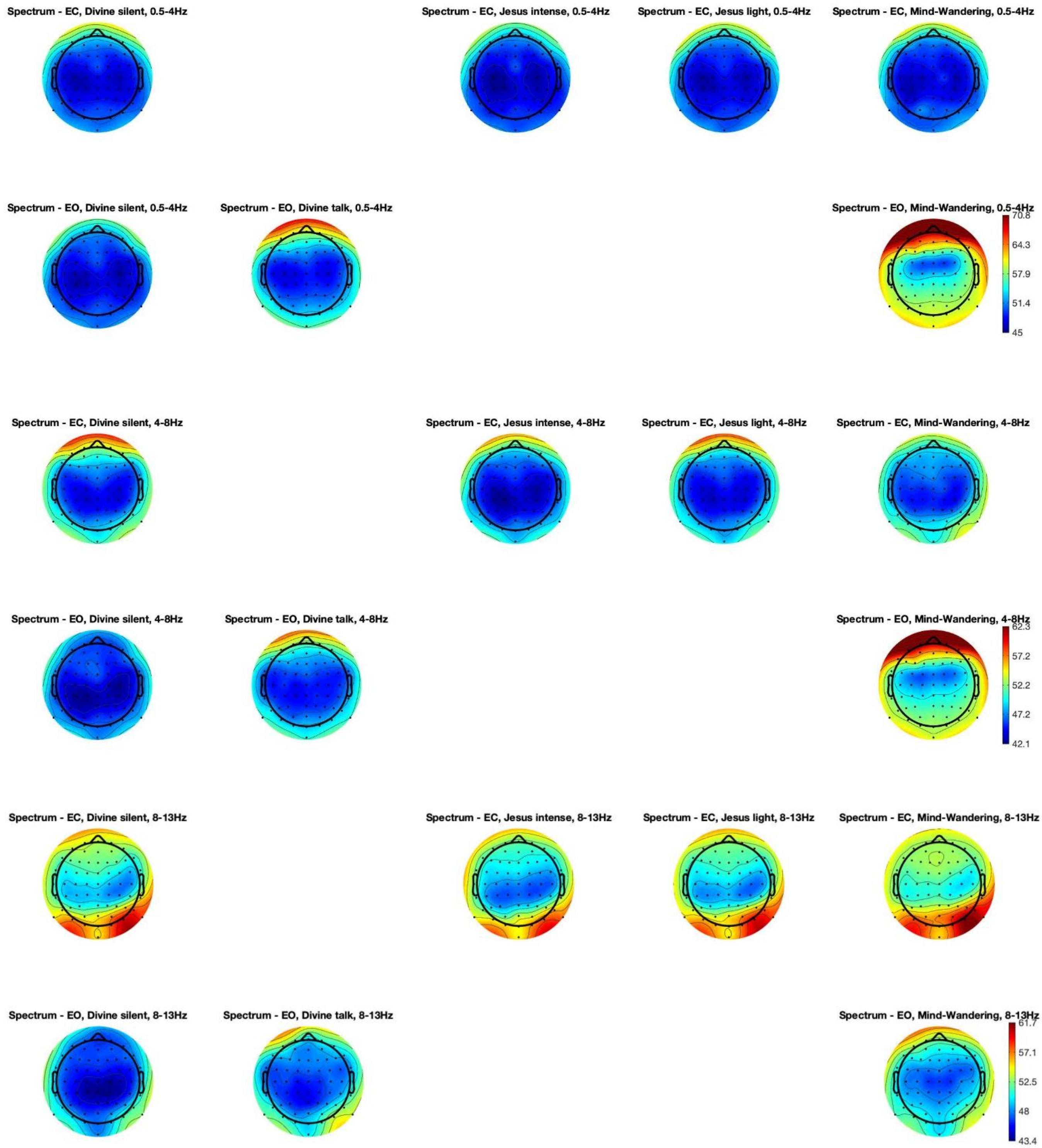
Table 8 shows the EEG power averages for the whole scalp for each frequency band during Divine Silent and Mind-Wandering and Eyes Closed and Eyes Open with statistical tests for each comparison. There were clear differences in the EEG signal between channeling and no-channeling conditions in this exploratory study. When comparing Divine Silent with Mind-wandering for the whole scalp, there were significant differences for delta, theta, alpha, beta and gamma, with all bands having lower power during the channeling state compared to no-channeling except for gamma. Eyes closed and eyes open states were also significantly different for all bands as expected. The p-value interaction column shows the statistical test looking at the interaction between the eye state (closed or open) and the channeling state (Divine silent or mind-wandering). This relationship was significant for all but the alpha frequency band. This basically means that whether the eyes were open or closed made a difference in the EEG signal which we would normally expect.

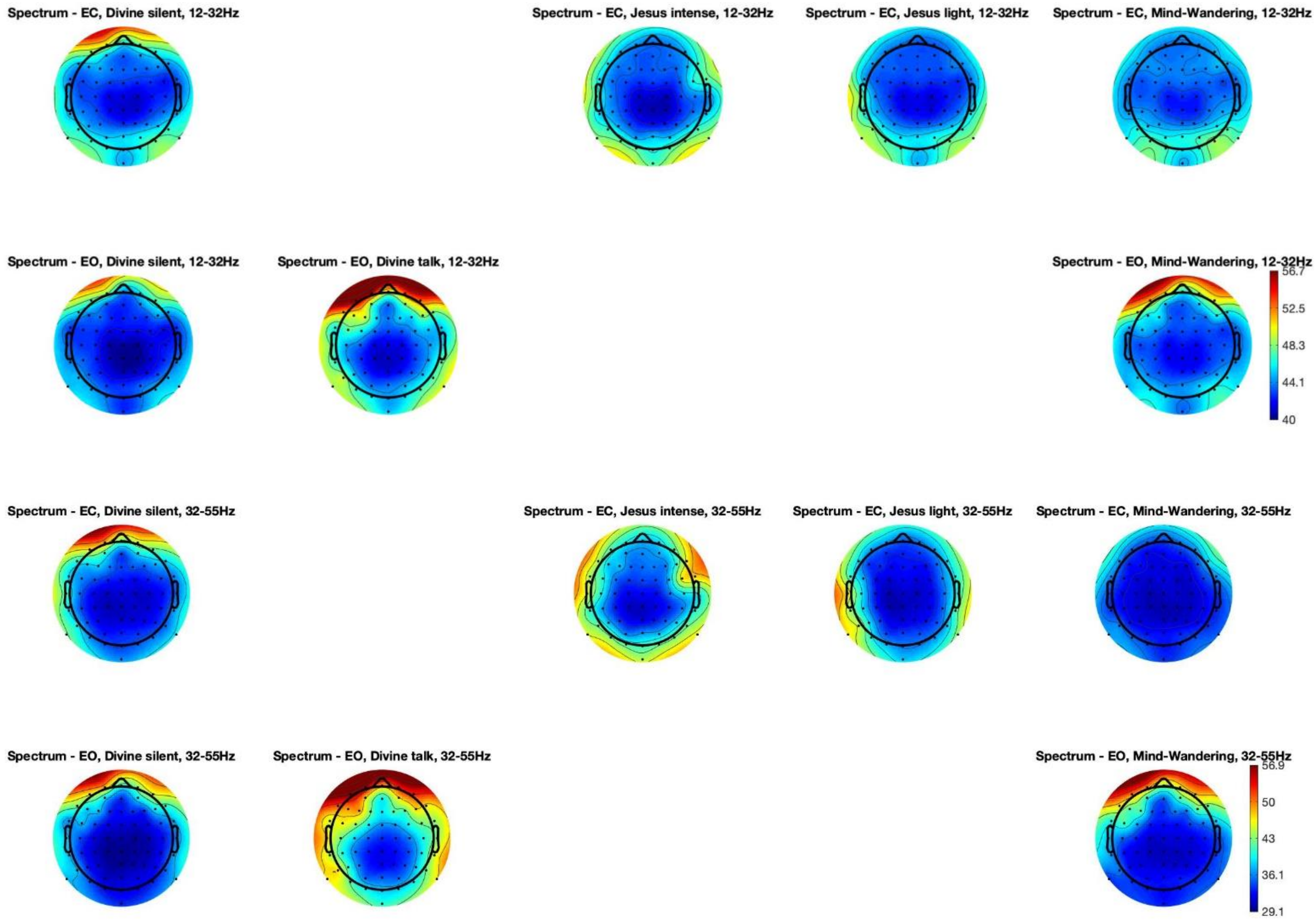
Table 8. Lubna EEG results

Frequency Band	Mind Wandering	Divine Silent	P-value	Eyes Closed	Eyes Open	P-value	P-value Interaction
Delta (0.5-4 Hz)	49.8	46.8	<0.000005	47.0	49.7	<0.000005	<0.000005
Theta (4.0-8 Hz)	46.0	43.6	0.03250	44.6	45.0	<0.000005	<0.000005
Alpha (8.0-13 Hz)	48.0	46.2	<0.000005	49.1	45.1	<0.000005	0.42860
Beta (12.0-32 Hz)	41.5	40.7	<0.000005	41.4	40.8	<0.000005	0.00977
Gamma (32.0-55 Hz)	30.7	31.2	<0.000005	30.7	31.2	<0.000005	<0.000005

EEG by Channeling Condition

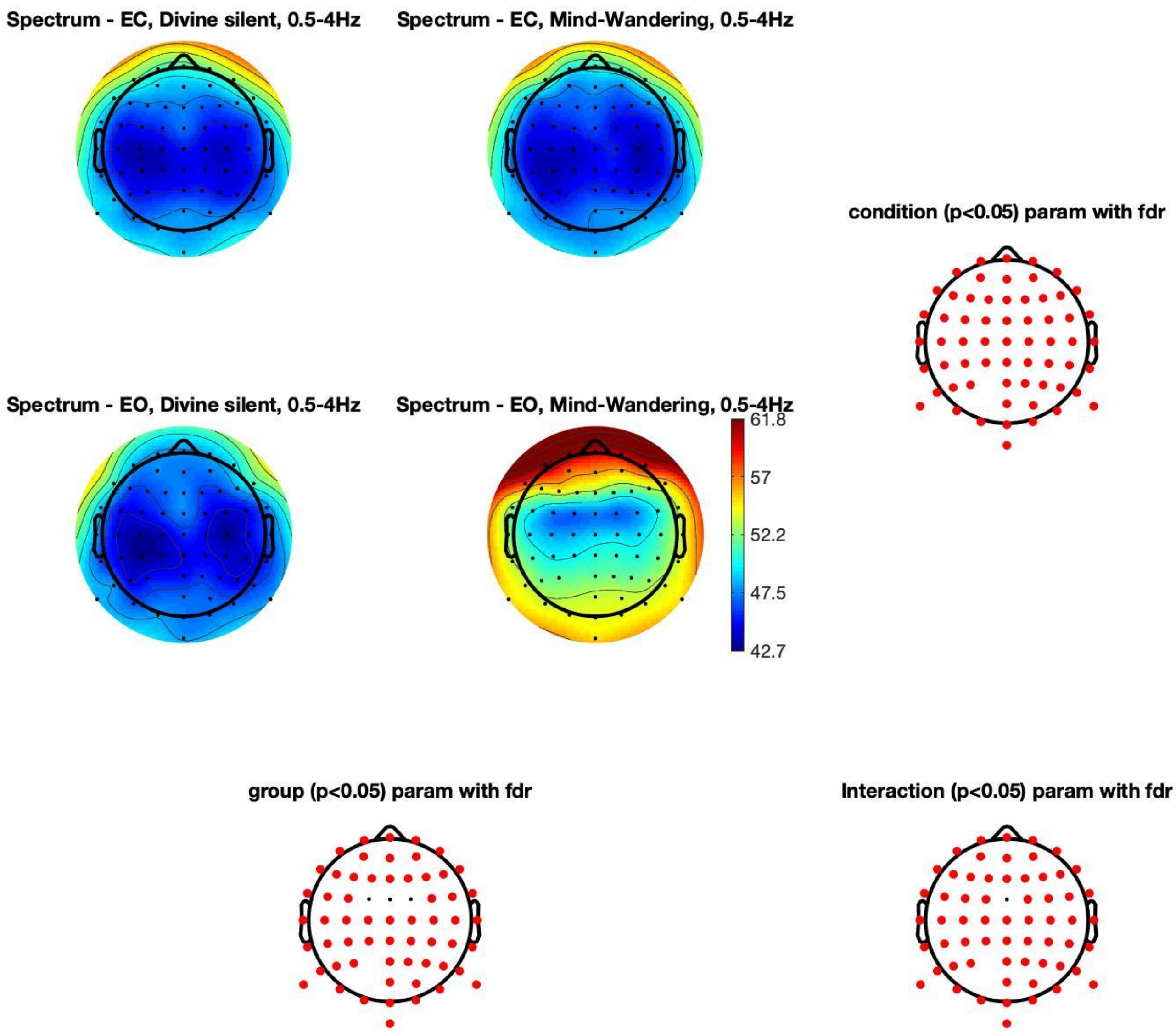
The following figures show the power spectrum for all seven conditions by frequency band. The legend on the lower right of the figure shows how to read the scalp maps with red being greater power and blue being lower power. You will notice that all of the channeling conditions were not different from each other. The eyes open Divine talking was slightly different but likely because of the facial muscle movement during the talking periods. There were however differences between the channeling and mind-wandering states, especially in the alpha and theta bands.

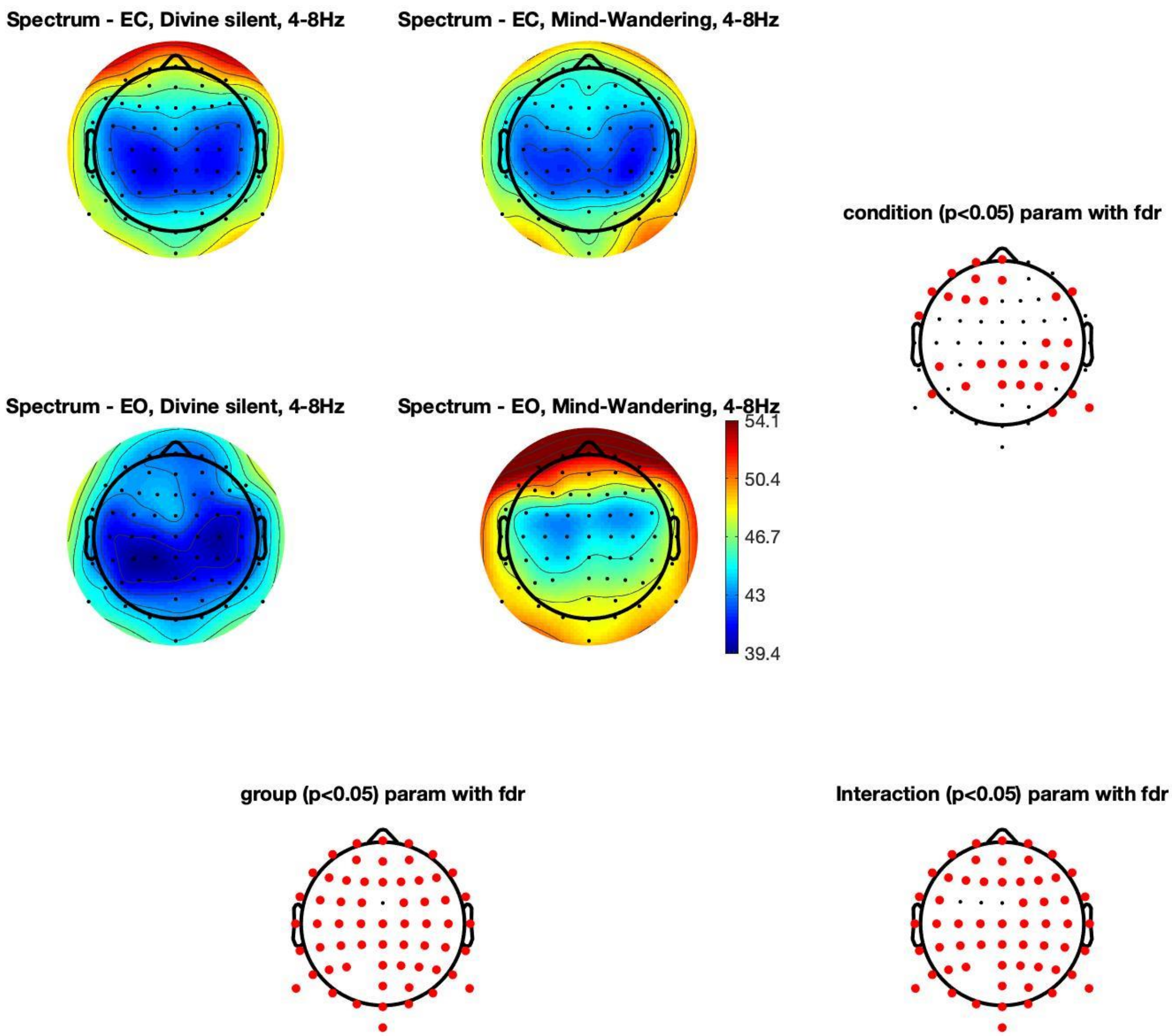

Spectrum - EC, Divine silent, 0.5-4Hz
Spectrum - EC, Jesus intense, 0.5-4Hz
Spectrum - EC, Jesus light, 0.5-4Hz
Spectrum - EC, Mind-Wandering, 0.5-4Hz
Spectrum - EO, Divine silent, 0.5-4Hz
Spectrum - EO, Divine talk, 0.5-4Hz
Spectrum - EO, Mind-Wandering, 0.5-4Hz
70.8
64.3
57.9
51.4
45
Spectrum - EC, Divine silent, 4-8Hz
Spectrum - EC, Jesus intense, 4-8Hz
Spectrum - EC, Jesus light, 4-8Hz
Spectrum - EC, Mind-Wandering, 4-8Hz
Spectrum - EO, Divine silent, 4-8Hz
Spectrum - EO, Divine talk, 4-8Hz
Spectrum - EO, Mind-Wandering, 4-8Hz
62.3
57.2
52.2
47.2
42.1
Spectrum - EC, Divine silent, 8-13Hz
Spectrum - EC, Jesus intense, 8-13Hz
Spectrum - EC, Jesus light, 8-13Hz
Spectrum - EC, Mind-Wandering, 8-13Hz
Spectrum - EO, Divine silent, 8-13Hz
Spectrum - EO, Divine talk, 8-13Hz
Spectrum - EO, Mind-Wandering, 8-13Hz
61.7
57.1
52.5
48
43.4

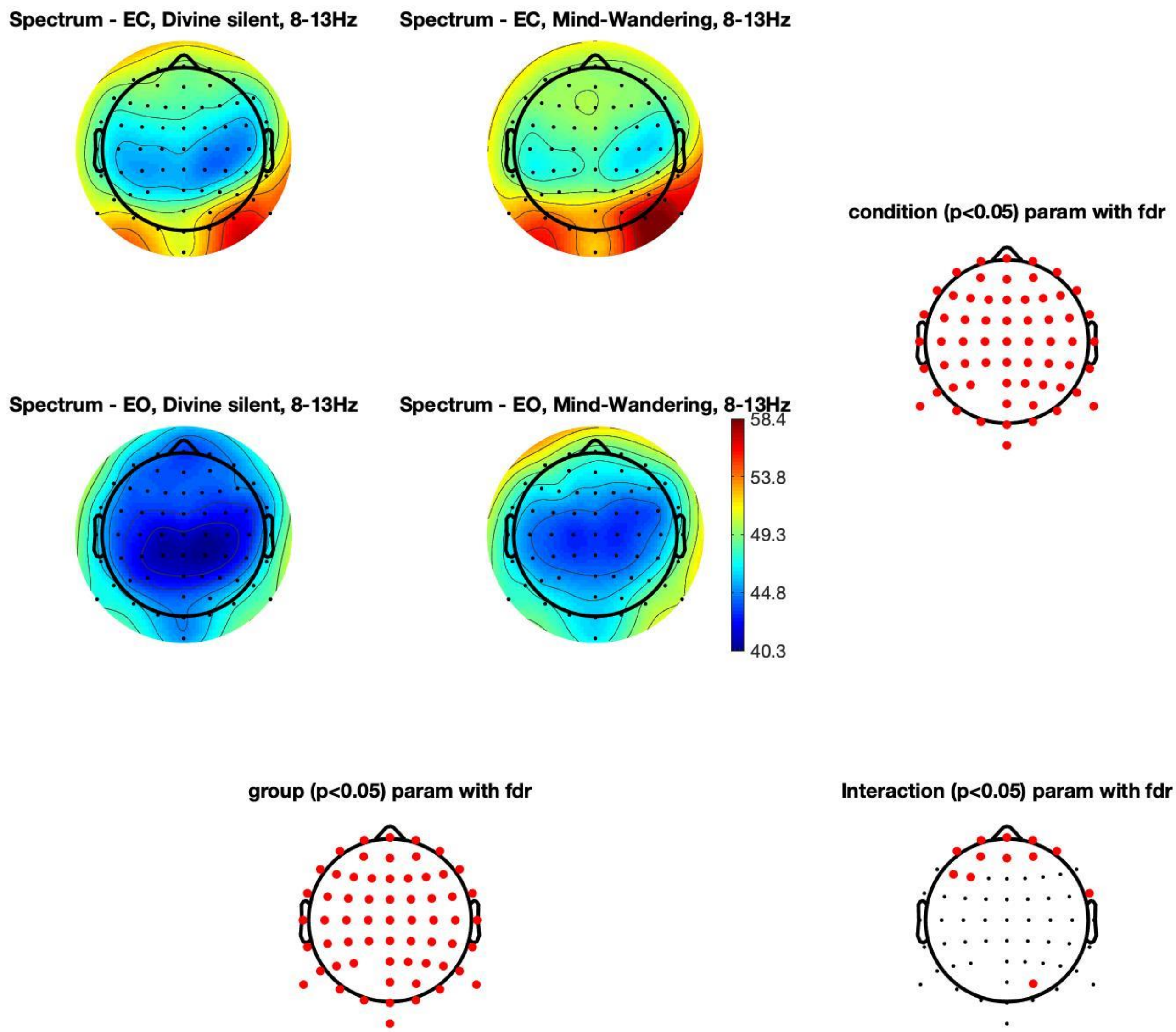


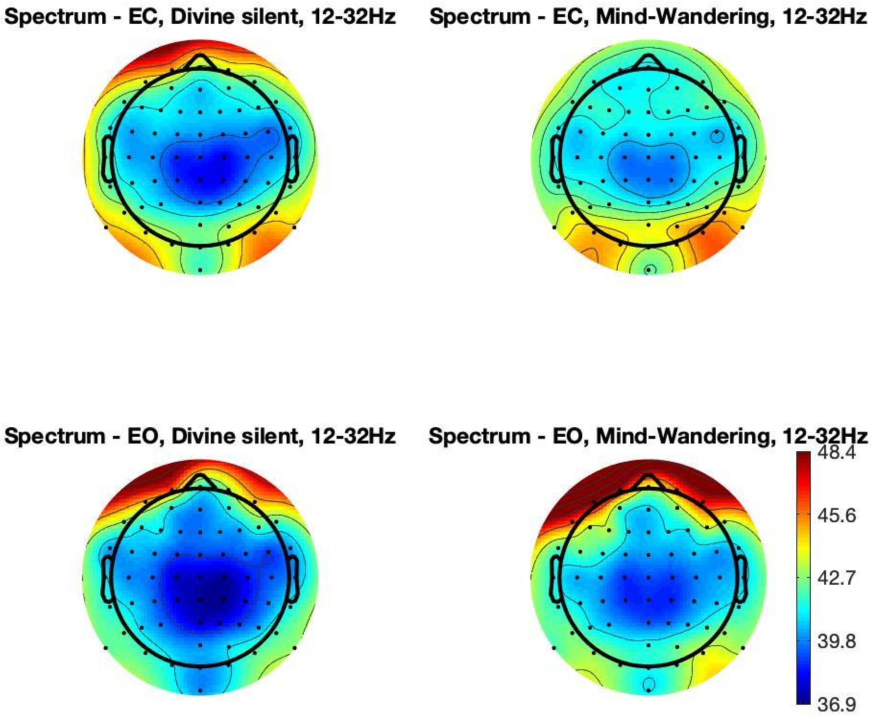
<u>EEG by Location</u>

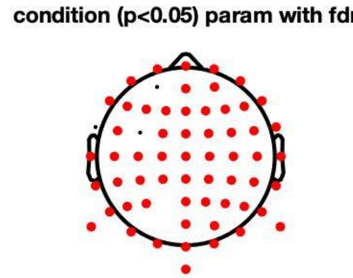
The following figures show the statistical differences between the channeling and no-channeling condition for each of the EEG frequency bands. On the right side, the scalp map labelled "condition (p<0.05) param with fdr" shows the scalp locations that are statistically different between the channeling and mind-wandering conditions marked with red dots. At the bottom, the scalp map labelled "group (p<0.05) param with fdr" shows the scalp locations that are statistically different between the eyes closed and eyes open conditions marked with red dots. At the bottom right, the scalp map labelled "interaction (p<0.05) param with fdr" shows the scalp locations that are statistically significant interactions between the channeling conditions and eye conditions marked with red dots. There were signficant differences at multiple scalp locations comparing Divine silent with mind-wandering in the delta, theta, alpha, beta, and gamma frequency bands. Eyes closed and open were different at all frequency bands as well. There were also multiple locations and bands that showed interactions between channeling condition and eye state. The theta frequency had especially interesting results with increased left frontal electrodes and right posterior electrodes which is a common pattern in meditation studies.

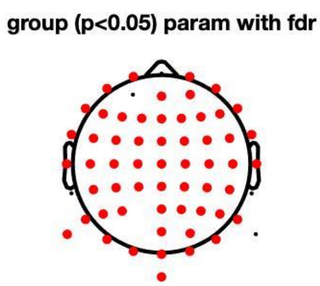

Spectrum - EC, Divine silent, 0.5-4Hz
Spectrum - EC, Mind-Wandering, 0.5-4Hz
condition (p<0.05) param with fdr
Spectrum - EO, Divine silent, 0.5-4Hz
Spectrum - EO, Mind-Wandering, 0.5-4Hz
61.8
57
52.2
47.5
42.7
group (p<0.05) param with fdr
Interaction (p<0.05) param with fdr

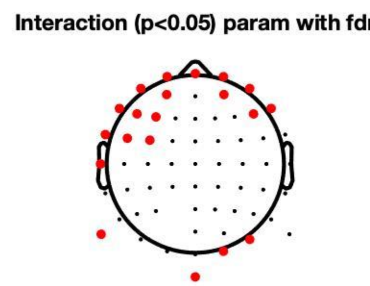

Spectrum - EC, Divine silent, 4-8Hz
Spectrum - EC, Mind-Wandering, 4-8Hz
condition (p<0.05) param with fdr
Spectrum - EO, Divine silent, 4-8Hz
Spectrum - EO, Mind-Wandering, 4-8Hz
54.1
50.4
46.7
43
39.4
group (p<0.05) param with fdr
Interaction (p<0.05) param with fdr

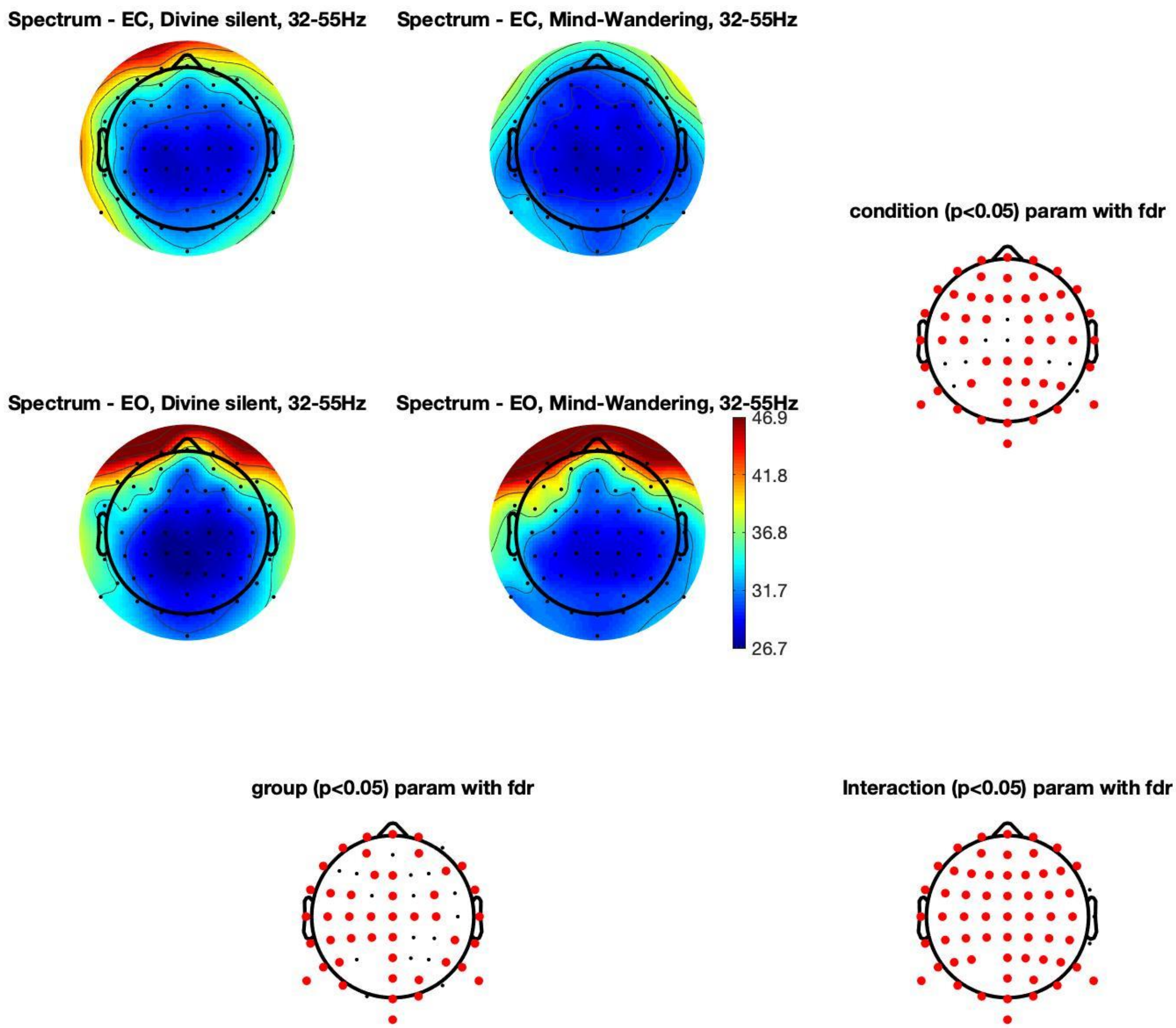

Spectrum - EC, Divine silent, 8-13Hz
Spectrum - EC, Mind-Wandering, 8-13Hz
condition (p<0.05) param with fdr
Spectrum - EO, Divine silent, 8-13Hz
Spectrum - EO, Mind-Wandering, 8-13Hz
58.4
53.8
49.3
44.8
40.3
group (p<0.05) param with fdr
Interaction (p<0.05) param with fdr


Spectrum - EC, Divine silent, 12-32Hz
Spectrum - EC, Mind-Wandering, 12-32Hz
Spectrum - EO, Divine silent, 12-32Hz
Spectrum - EO, Mind-Wandering, 12-32Hz
48.4
45.6
42.7
39.8
36.9


condition (p<0.05) param with fdr


group (p<0.05) param with fdr


Interaction (p<0.05) param with fdr



<u>EEG Conclusions and Recommendations</u>

This exploratory pilot study showed clear differences in the EEG signal between the channeling and mind-wandering no-channeling state. For any future studies, we would recommend doing one channeling condition (eyes closed) rather than doing multiple different channeling types. We would also recommend doing multiple sessions either on the same day or on different days. This would help increase the power of the statistics. It would also include multiple channelers with the same conditions (e.g. Divine silent vs mind-wandering for multiple channelers).

Heart Rate Variability (HRV)

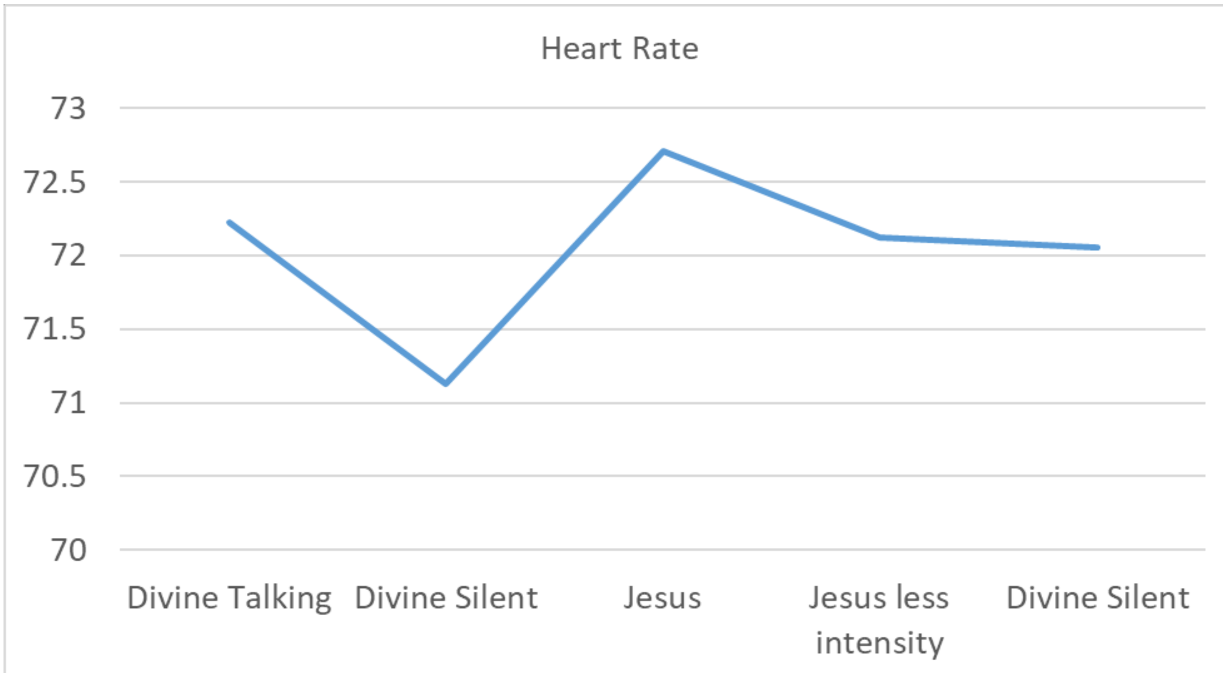
Heart rate variability is the change in the time intervals between adjacent heartbeats that may be used to predict future health outcomes. It is the primary measure used to assess physiological or personal coherence. Reduced HRV has been correlated with disease onset and mortality as it reflects reduced regulatory capacity of the body to adaptively respond to challenges like exercise or stressors. The most commonly used HRV analysis methods are done in the frequency domain (i.e. power spectrums) or in the time domain (i.e. statistical measures of variance in the interbeat intervals). Importantly, McCraty (2017) observed that specific emotional states are reflected in HRV rhythm patterns as opposed to changes in variability. Emotions such as appreciation or compassion are associated with a more coherent rhythm, as opposed to emotions such as anxiety, frustration or impatience (McCraty 2017). Self-induced positive emotions increase the coherence in bodily processes, which is reflected in the pattern of the heart's rhythm. This shift in the heart rhythm plays in turn an important role in facilitating higher cognitive functions, creating emotional stability and facilitating states of calm. Over time, this establishes a new inner-baseline reference that organizes perception, feelings, and behavior.

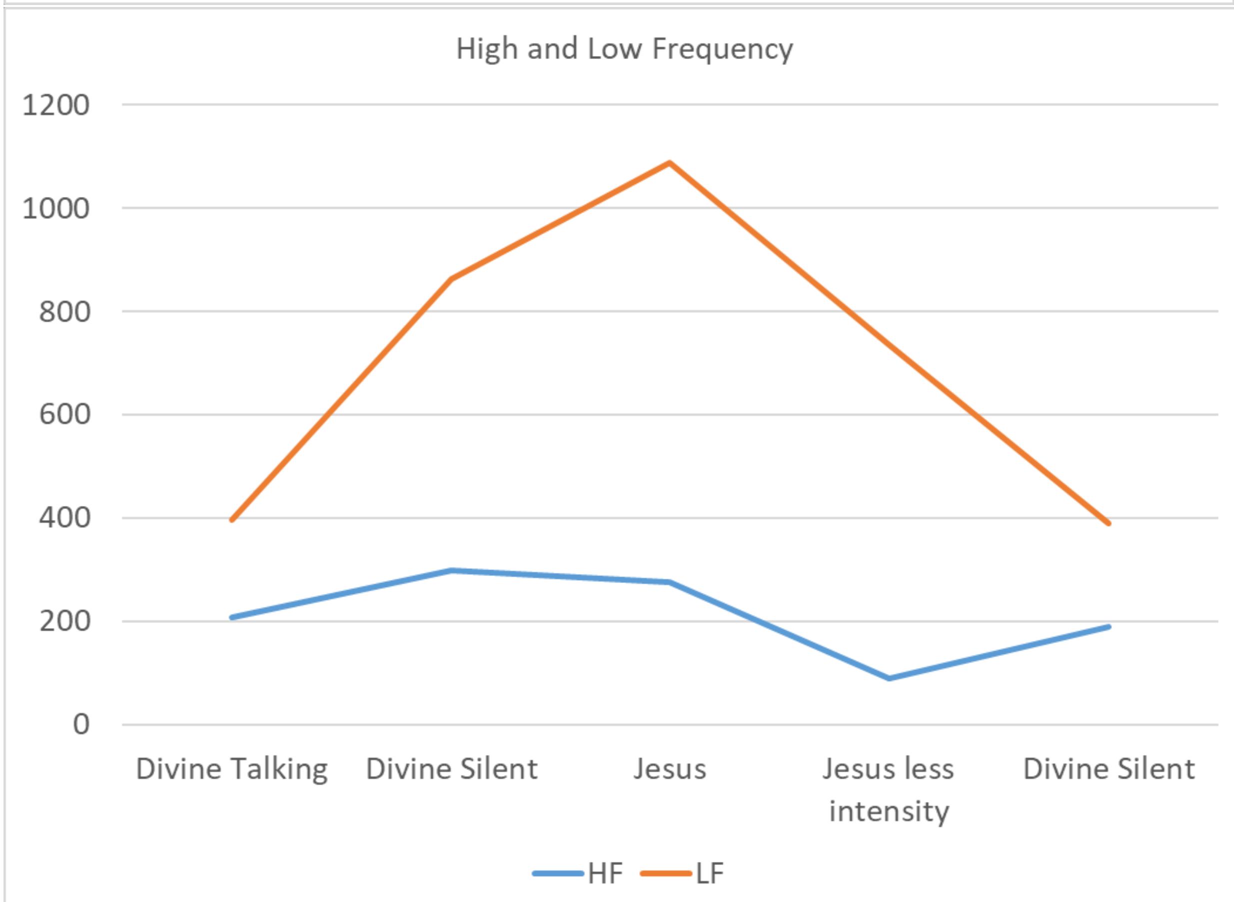
The heart rate variability measures are listed in Table 8. Heart rate is measured in beats per minute. The values shown are the average beats per minute and the standard deviation for the recording period. High frequency heart rate variability reflects parasympathetic activity and is called the respiratory band because it corresponds to the heart rate variations related to the respiratory cycle. Low frequency heart rate variability band reflects baroreceptor activity during resting conditions. In general, LF/HF ratio reflects the balance of parasympathetic and sympathetic nervous system activity. In this model, a low LF/HF ratio reflects parasympathetic dominance. This is seen when we conserve energy and engage in tend-and-befriend behaviors. In contrast, a high LF/HF ratio indicates sympathetic dominance, which occurs when we engage in fight-or-flight behaviors or parasympathetic withdrawal. Also listed is the p-value for the statistical test comparing one condition with the other. P-values less than 0.05 are considered statistically significant. The values listed in Table 8 are averages of Lubna and Sharifa's no-channeling and channeling sessions. For example, in Lubna's case, we averaged all the channeling sessions and the two no-channeling sessions. We then averaged these with Sharifa's and ran the statistical tests.

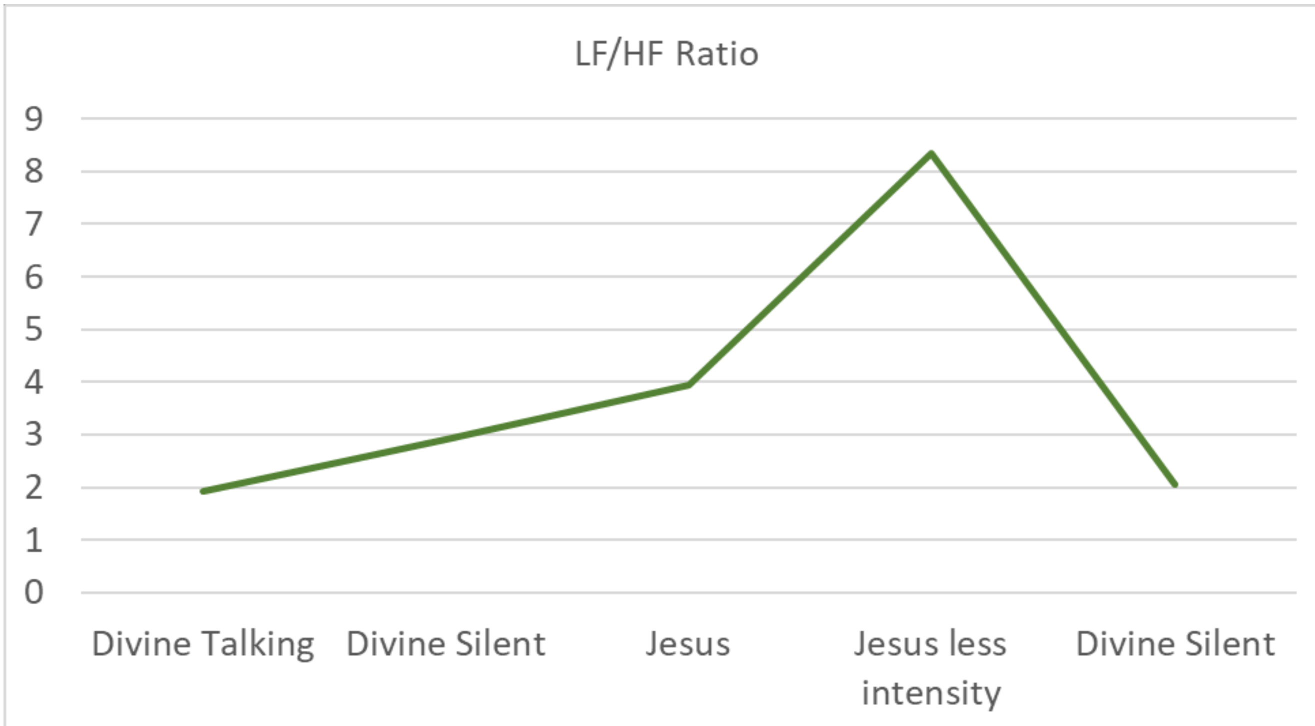
Table 8. HRV results

Measure	**No-Channeling Mean ± SD**	**Channeling Mean ± SD**	**P-value**
Heart Rate	72.3 ± 1.5	72.9 ± 1.1	0.26
High Frequency (HF)	324.6 ± 97.4	350.0 ± 196.0	0.78
Low Frequency (LF)	427.9 ± 216.8	729.0 ± 49.0	0.24
LF/HF Ratio	1.3 ± 0.19	2.7 ± 1.6	0.48

The figures below show the changes in mean values for heart rate, high frequency, low frequency, and high frequency/low frequency ratios for Lubna's different channeling sessions. Because this was done for only one person, we did not conduct statistical tests to evaluate differences.


Heart Rate
73
72.5
72
71.5
71
70.5
70
Divine Talking
Divine Silent
Jesus
Jesus less intensity
Divine Silent


High and Low Frequency
1200
1000
800
600
400
200
0
Divine Talking
Divine Silent
Jesus
Jesus less intensity
Divine Silent
HF
LF



ECG Conclusions and Recommendations

In this exploratory study, we did not see any significant differences in heart rate and basic heart rate variability measures comparing the channeling and no-channeling states. While the graphs appear to have some variability, these differences between the unique channeling states are small. At this point, it is more likely that the lack of statistical difference is more due to the small number of participants (except for heart rate which had a very small difference in raw values). Future studies would include a much larger number of participants to explore whether this is true.

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