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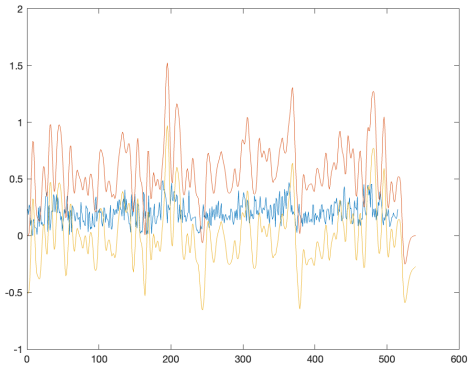
2022121001
26 April 2023

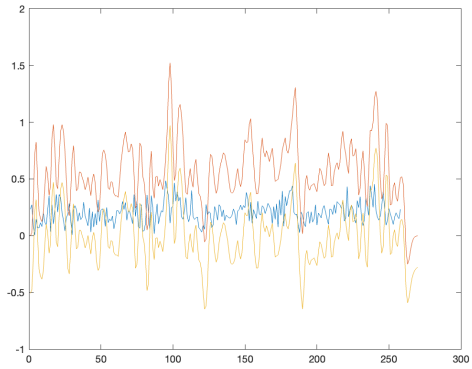
Neuroscience

Assignment - 4

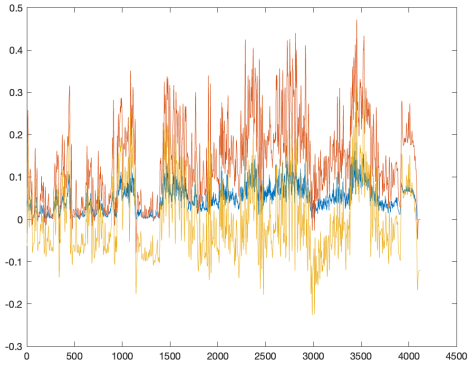
1. Processing Acoustic features



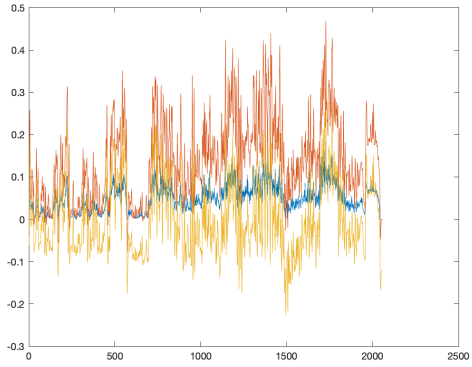
Plotting unconvoluted, convoluted and detrended pulse clarity



After downsampling



Plotting unconvoluted, convoluted and detrended root mean square (RMS)



After downsampling

Pulse clarity refers to the degree to which the rhythmic pattern of a musical performance can be perceived or understood. It is a measure of the clarity and distinctness of the individual pulses or beats in a musical piece. Pulse clarity is affected by factors such as tempo, instrumentation, and rhythmic complexity.

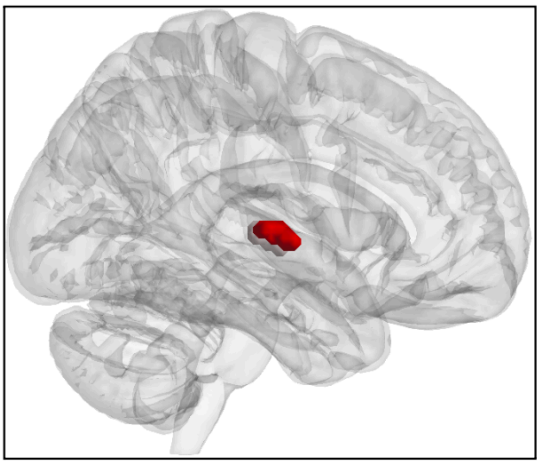
After listening to the song at the moments of peaks and valleys, we can hear that the beats and pulses of the music were clear and distinctive at the peaks. At the same time, during the valleys the peaks were not so distinguishable from others. This is because the melody is smooth and slow. The feature is perceptually relevant or not depending on the impact it has on the listener. For me pulse clarity is perceptually relevant because it is easily perceivable and the difference is easily noticeable in the peaks and the valleys.

RMS, on the other hand, is a measure of the overall energy level or amplitude of a sound signal. It is calculated by taking the square root of the mean of the squared values of the signal over a specific time period. RMS is commonly used to describe the volume or loudness of a sound signal, and is also used in the analysis of musical signals to determine the overall energy or power of the music piece.

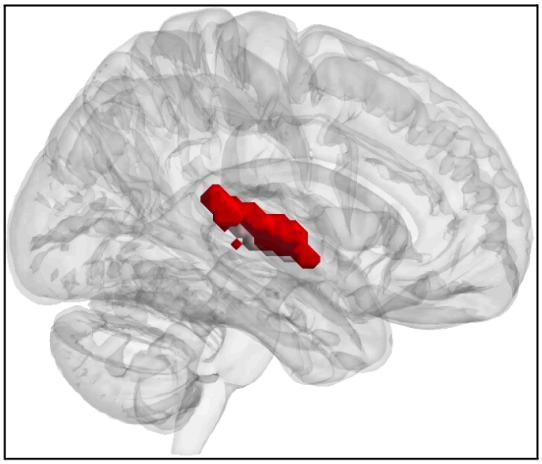
In the context of musical features, RMS is often used to describe the dynamic range of a piece of music. A high RMS value indicates that the music has a relatively consistent volume level, while a low RMS value indicates that the music has a wider range of volume levels.

After listening to the music piece at the peaks and the valleys, we can see some parts have low loudness and some with high loudness. These sections of the music piece represent the peaks (high loudness) and valleys(low loudness). So since I could hear the sections with different loudness in the music piece, I can say that the feature is perceptually relevant. The perceived loudness of the piece can also vary due to individual differences.

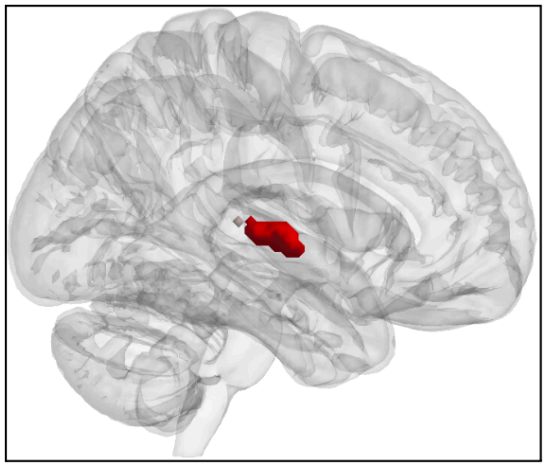
2. Musician & Non-Muscian - (A) Mean ISC



Mean intersubject correlation for non-musician > 0.3



Mean intersubject correlation for non-musician > 0.2



Mean intersubject correlation for musician > 0.2

We can see that when we show the mean inter-subject correlation for musicians and non-musicians, the auditory cortex regions of the brain are active.

These correlations have been made by combinations of participants in the group. Total of 10 combinations are possible because there are 5 participants in a group. The mean of these is taken to plot the mean intersubject correlation.

I have shown the most significant correlations by keeping the threshold as 0.2

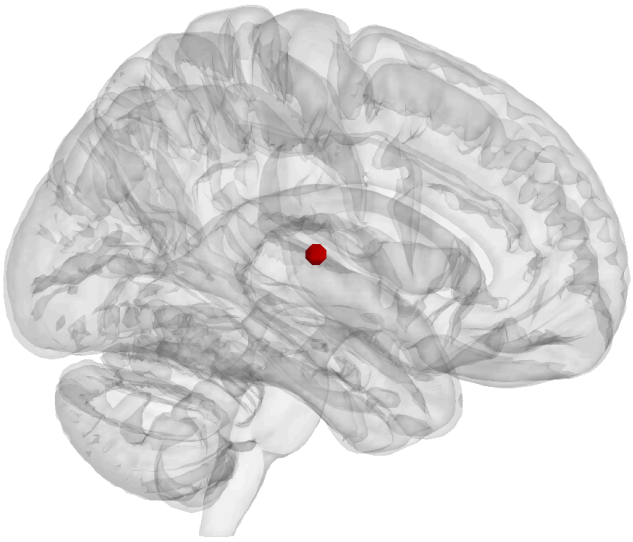
If we decrease the threshold, then more regions with correlation will be visible.

Here we want regions with highest mean intersubject correlation hence, we have increased the threshold to 0.2

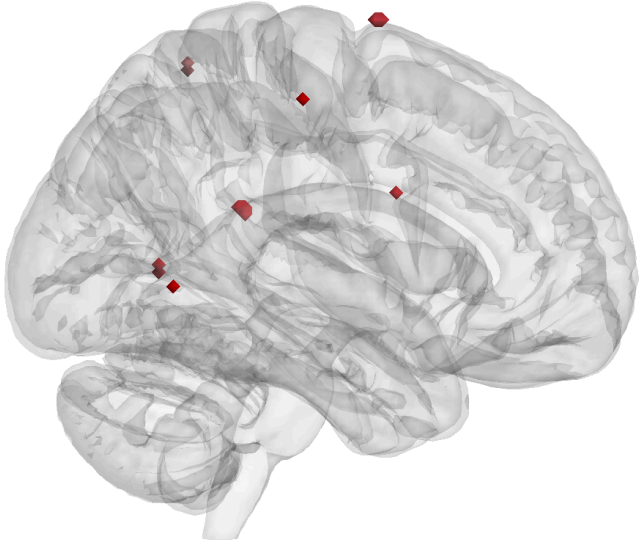
From the above plots we can clearly see that the regions with highest mean intersubject correlations are the auditory cortices.

2. Musician & Non-Muscian - (B) Neural correlates of acoustic features

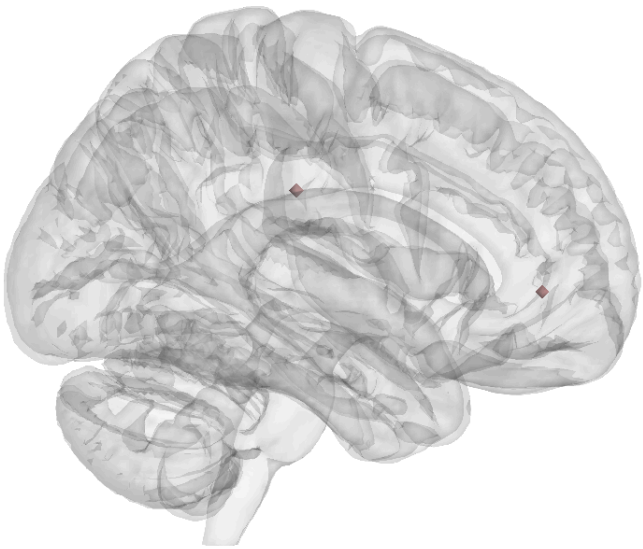
Musician 16



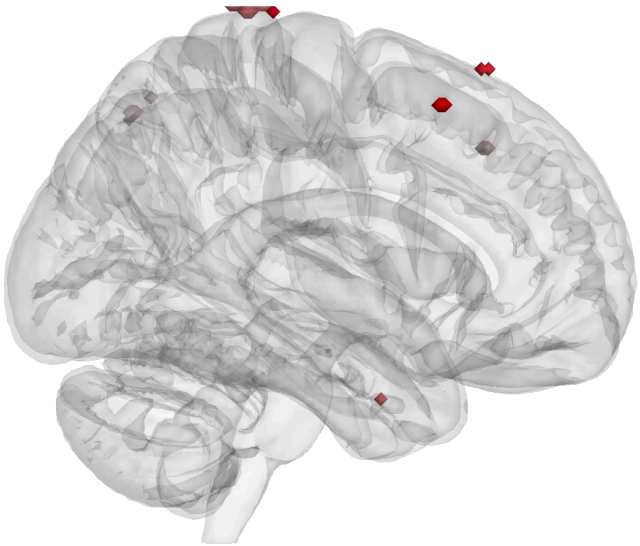
Brightness > 0.35



Brightness < -0.35

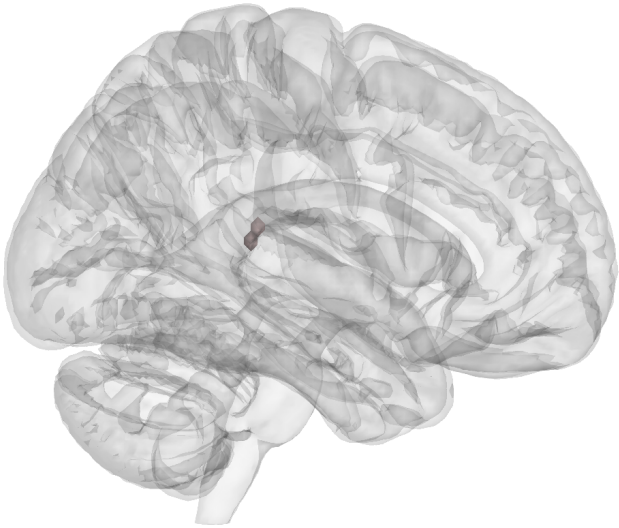


Pulse Clarity > 0.35

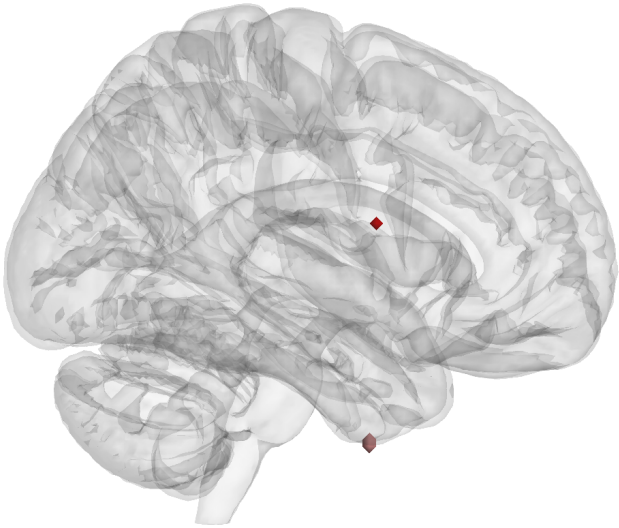


Pulse Clarity < -0.25

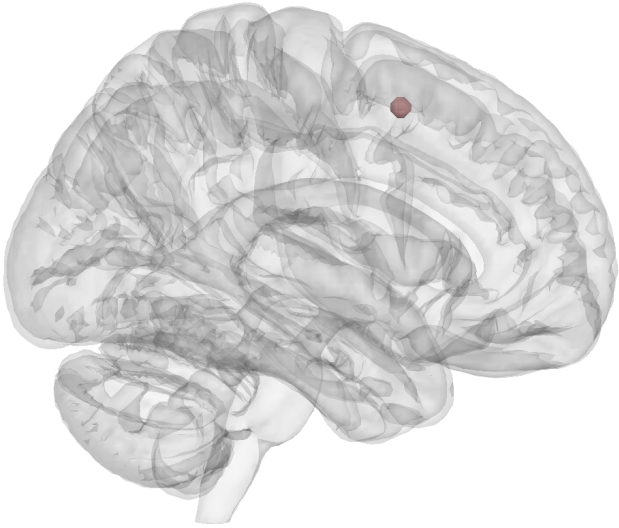
Musician 17



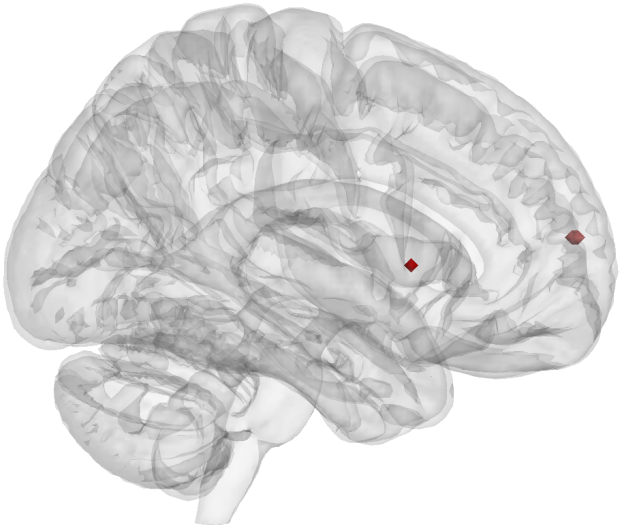
Brightness > 0.39



Brightness < -0.33

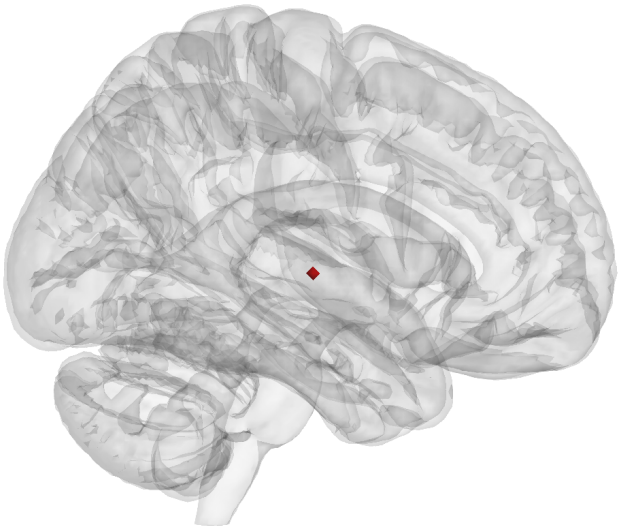


Pulse Clarity > 0.35

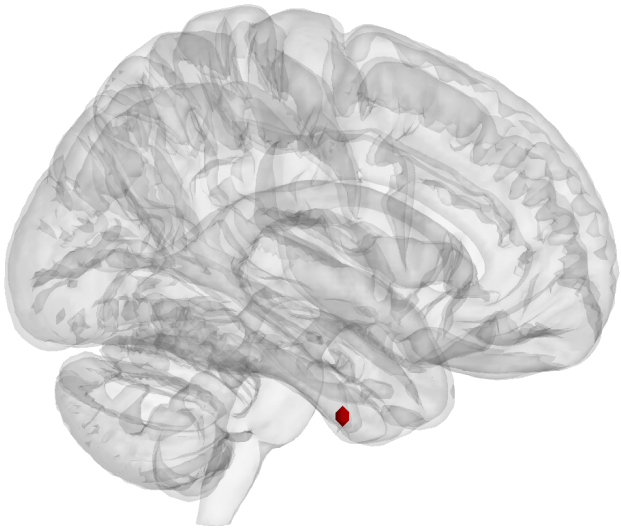


Pulse Clarity < -0.33

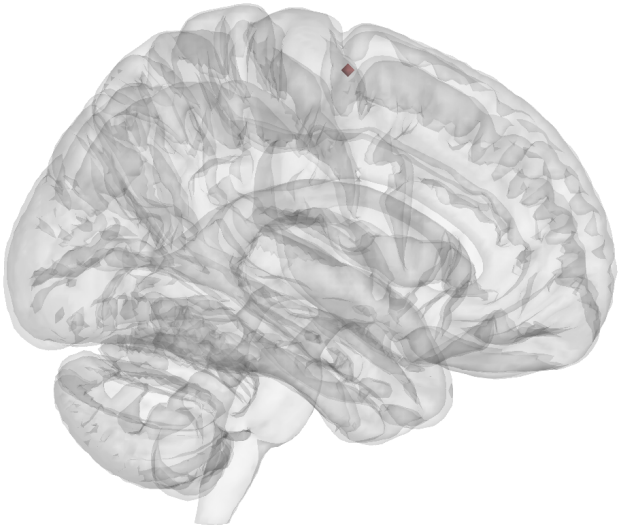
Musician 18



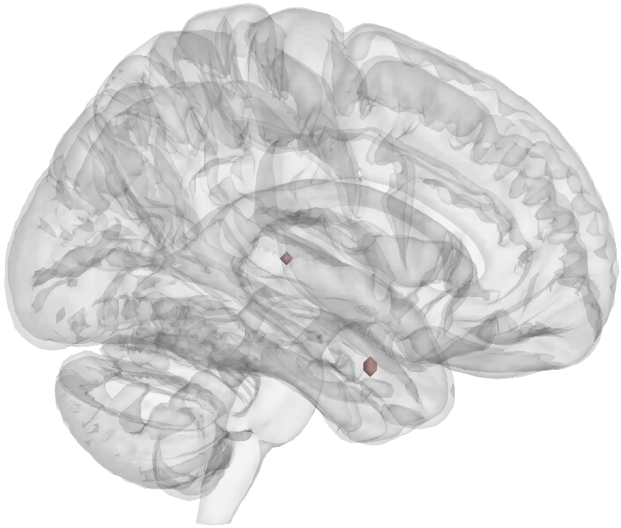
Brightness > 0.45



Brightness < -0.38

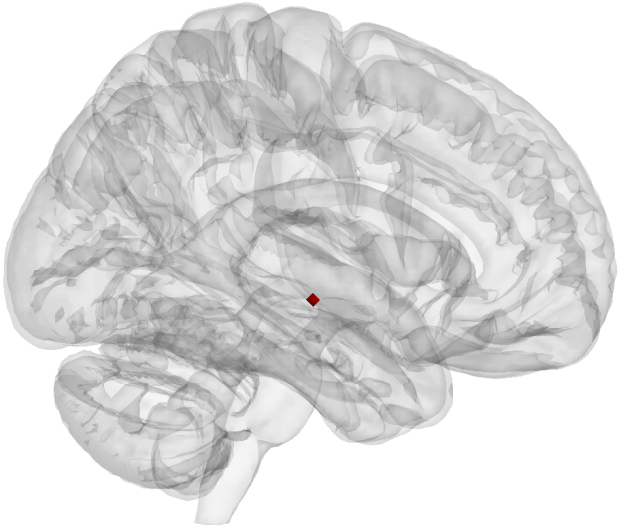


Pulse Clarity > 0.24

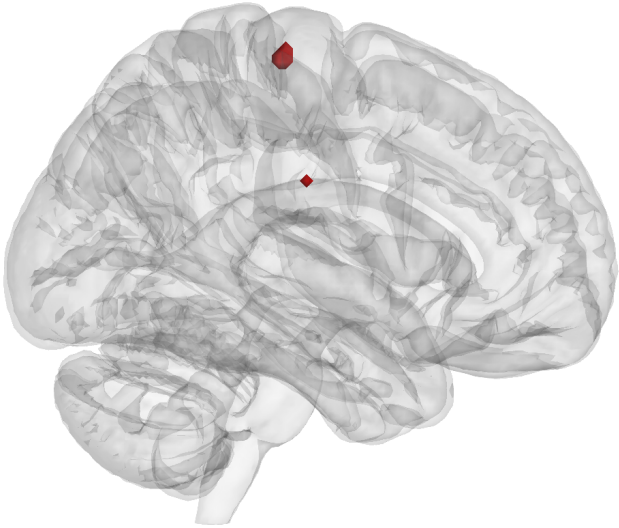


Pulse Clarity < -0.34

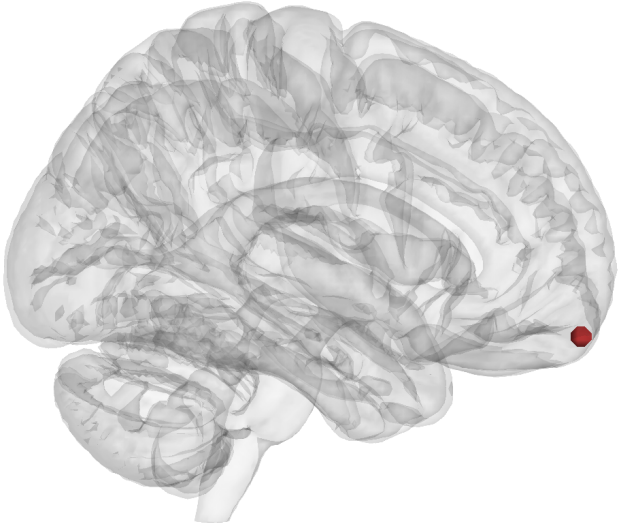
Musician 19



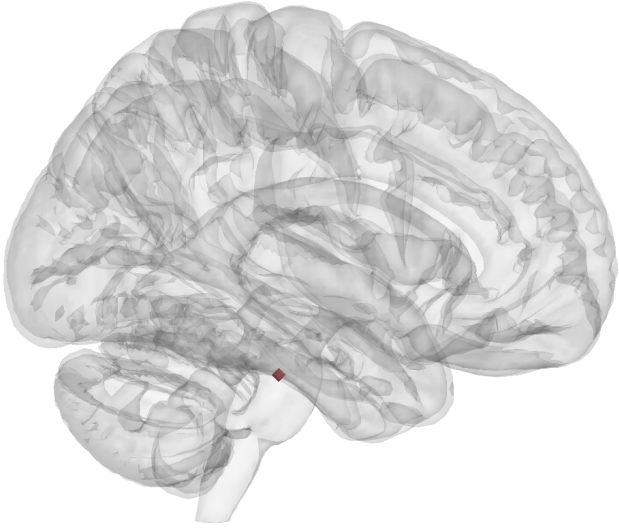
Brightness > 0.42



Brightness < -0.32

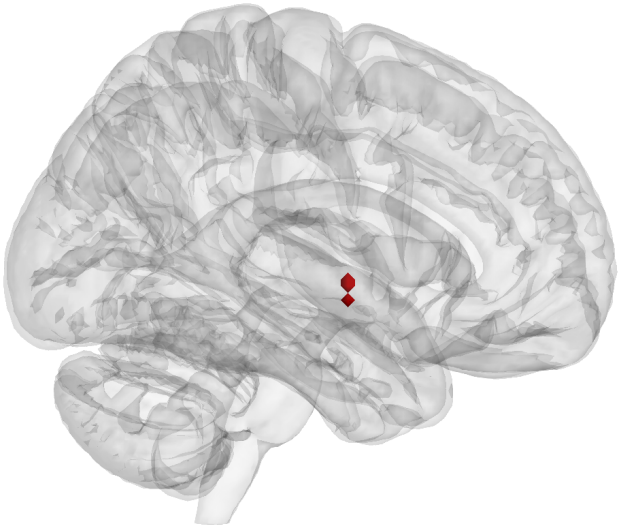


Pulse Clarity > 0.32

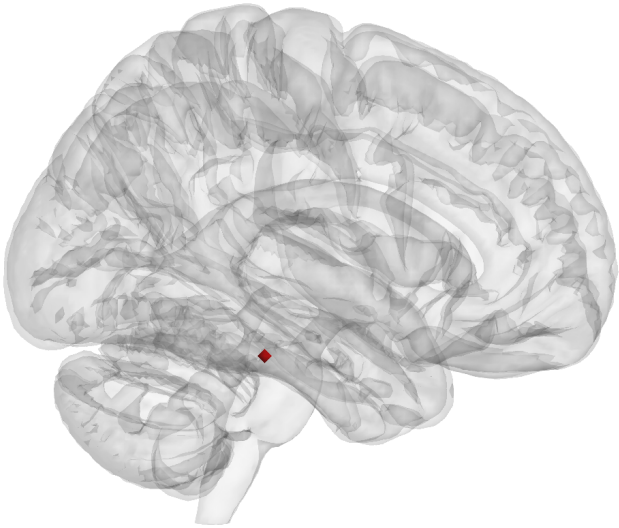


Pulse Clarity < -0.34

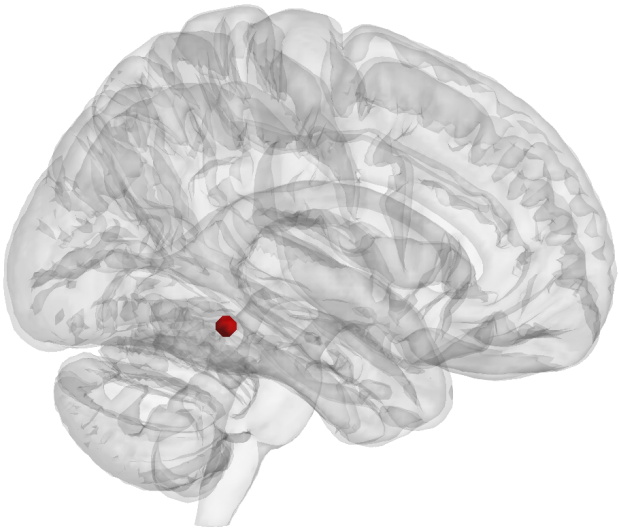
Musician 20



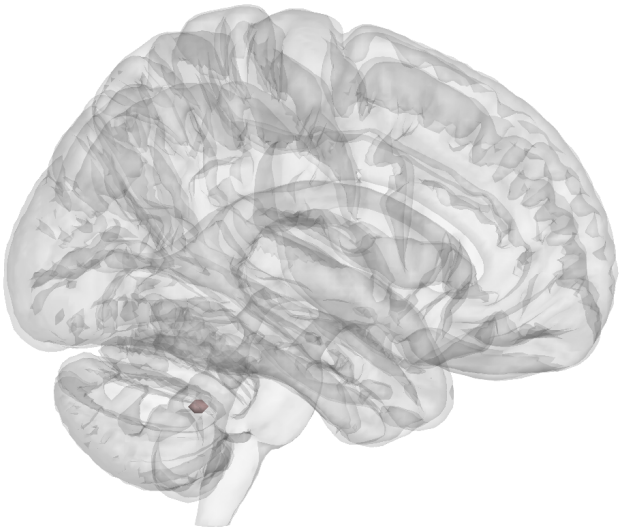
Brightness > 0.35



Brightness < -0.33

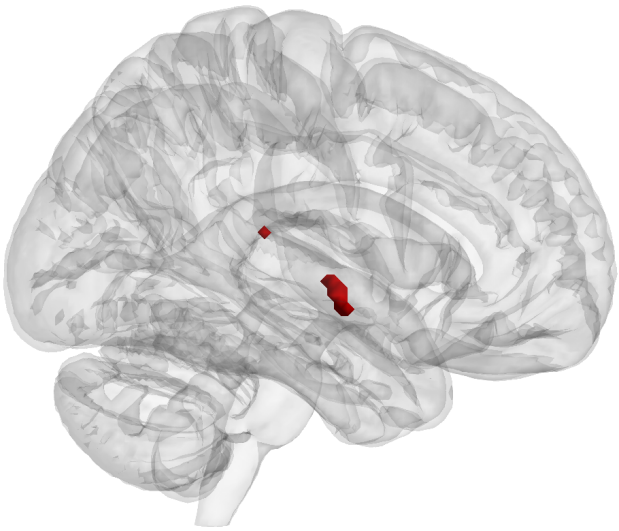


Pulse Clarity > 0.35

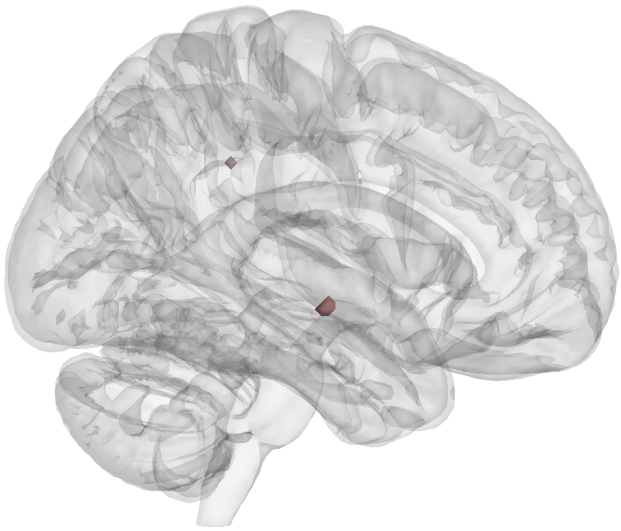


Pulse Clarity < -0.31

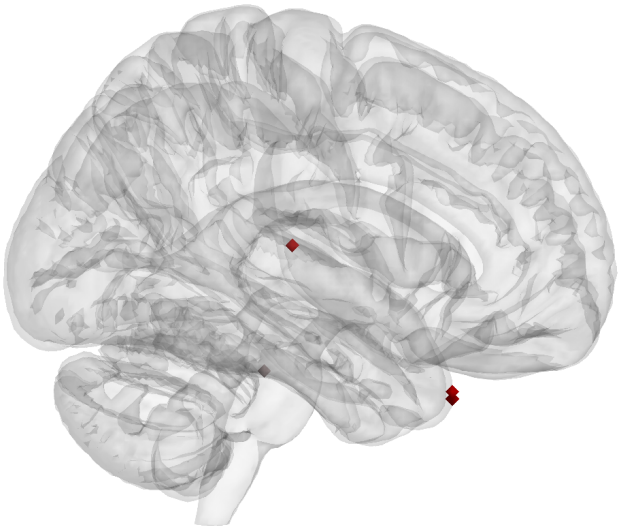
Non-Musician 1



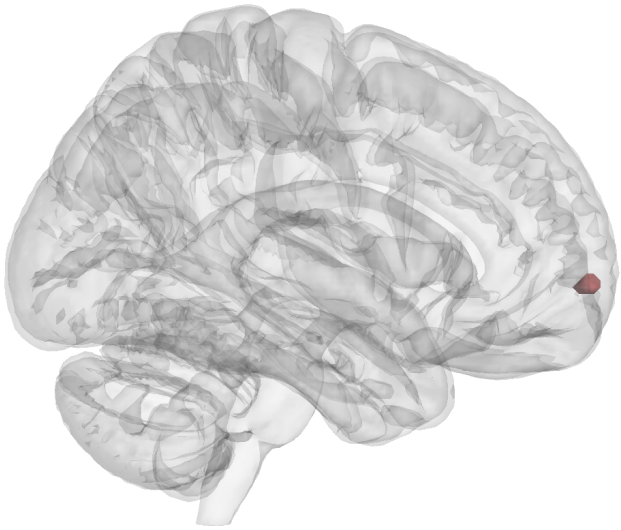
Brightness > 0.36



Brightness < -0.29

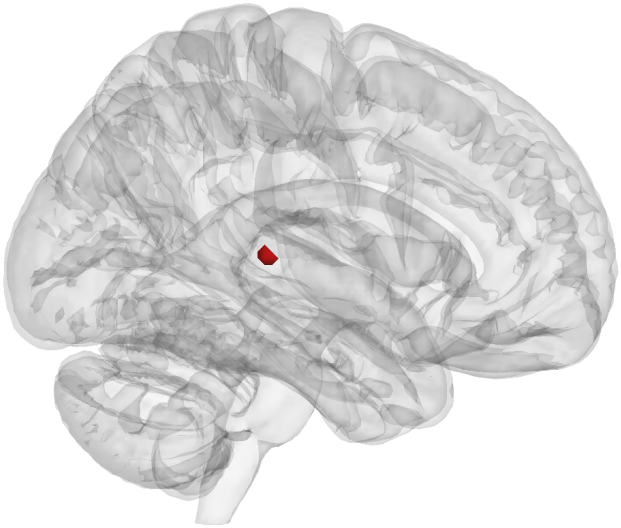


Pulse Clarity > 0.29

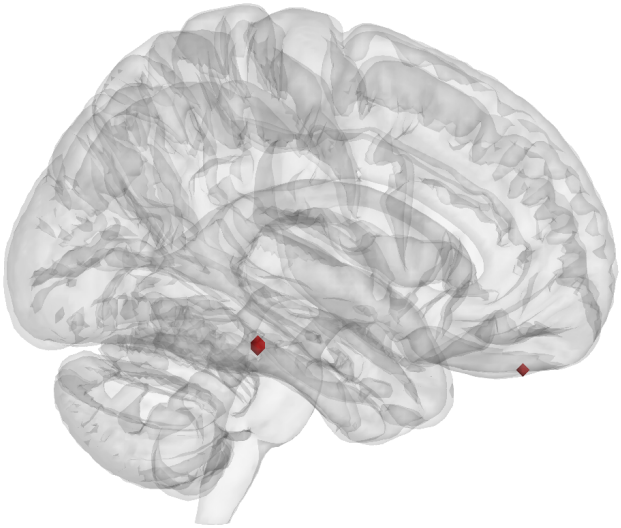


Pulse Clarity < -0.32

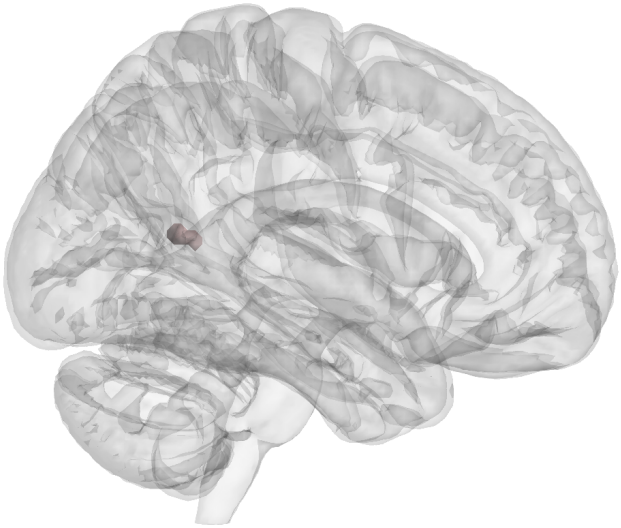
Non-Musician 2



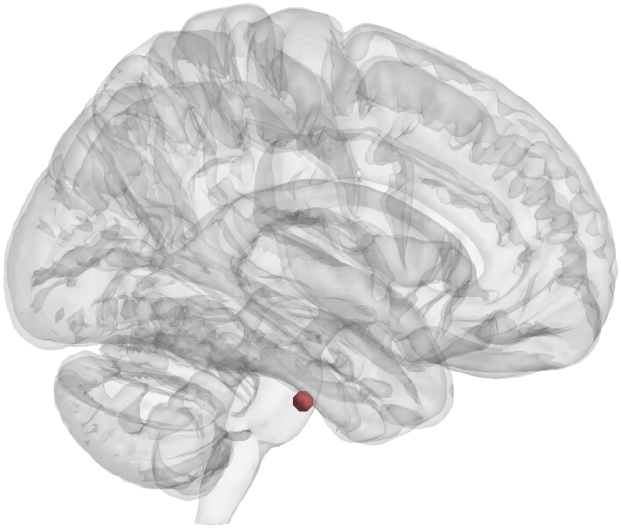
Brightness > 0.35



Brightness < -0.36

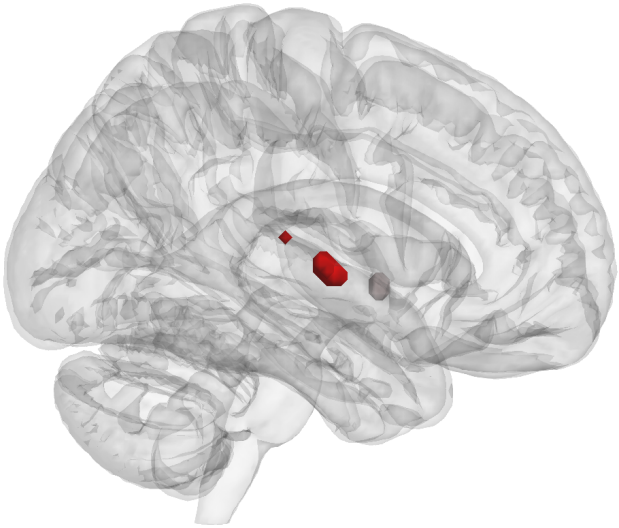


Pulse Clarity > 0.38

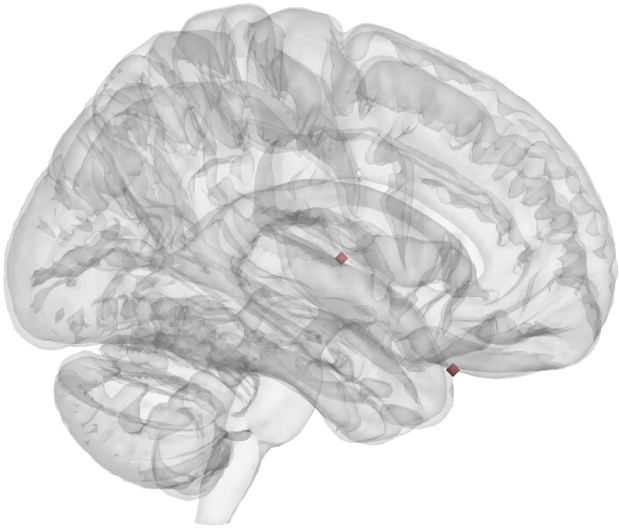


Pulse Clarity < -0.26

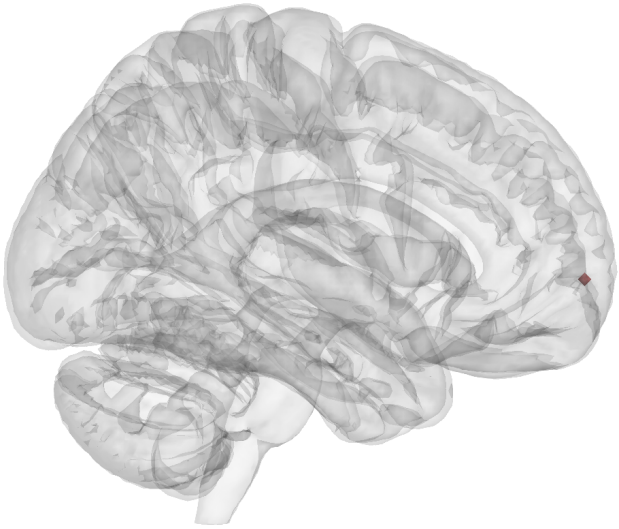
Non-Musician 3



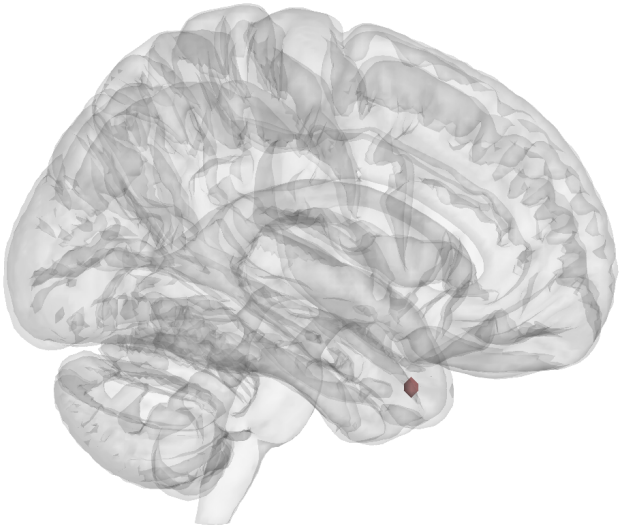
Brightness > 0.35



Brightness < -0.30

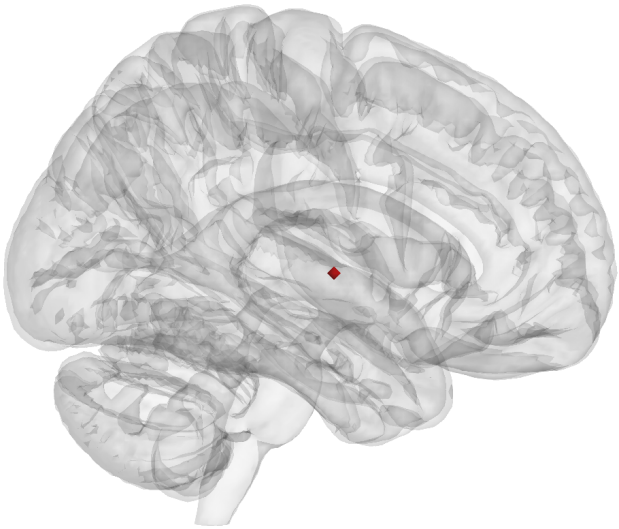


Pulse Clarity > 0.27

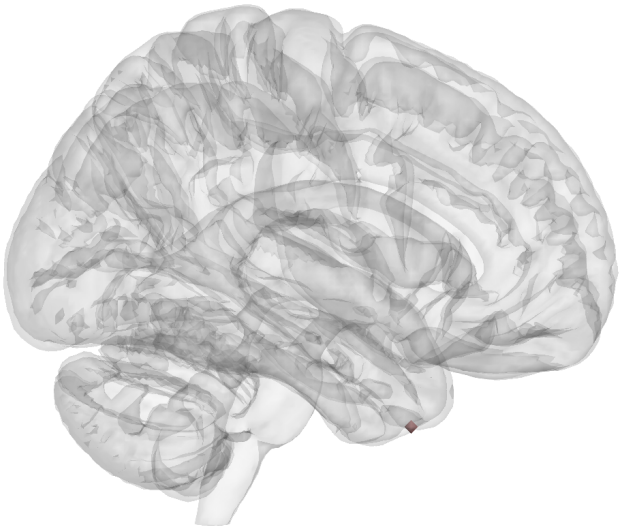


Pulse Clarity < -0.31

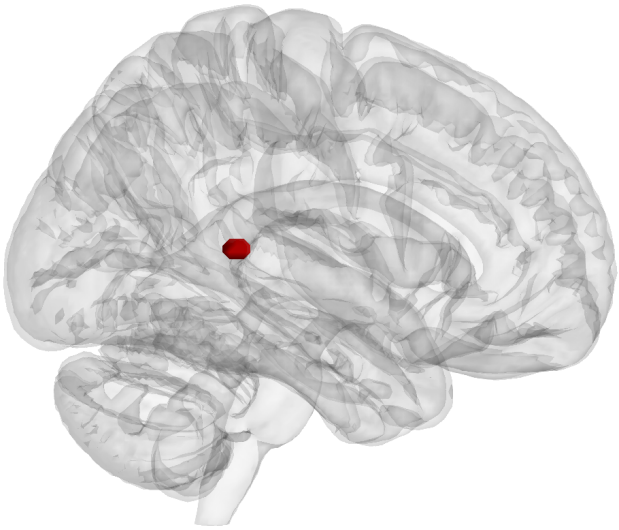
Non-Musician 4



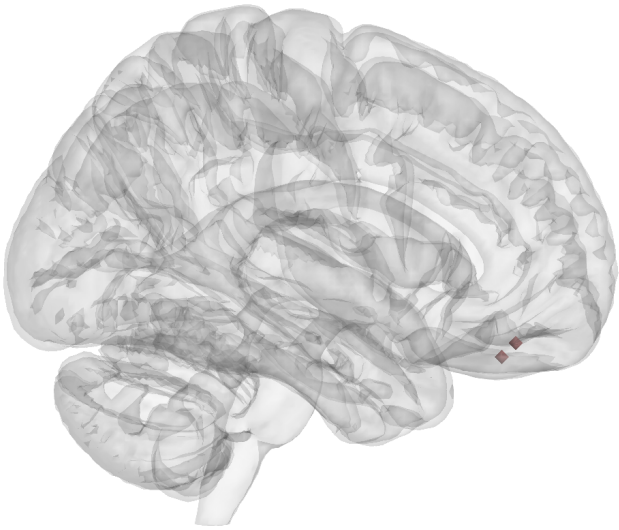
Brightness > 0.40



Brightness < -0.32

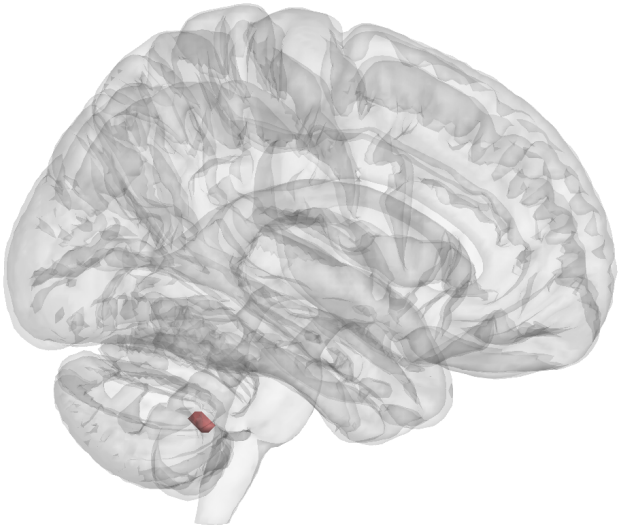


Pulse Clarity > 0.33

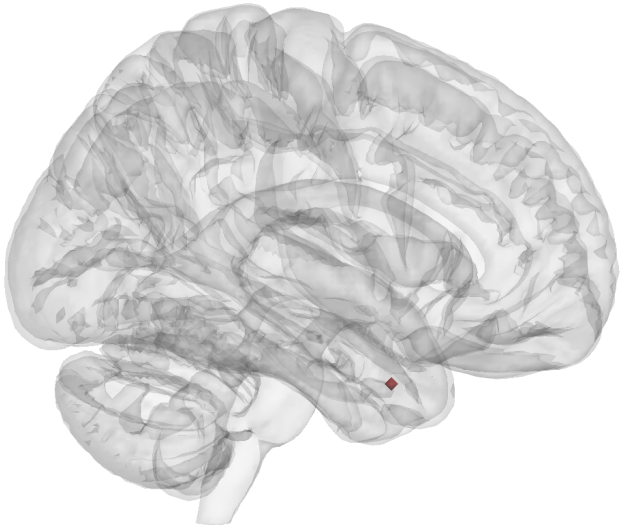


Pulse Clarity < -0.32

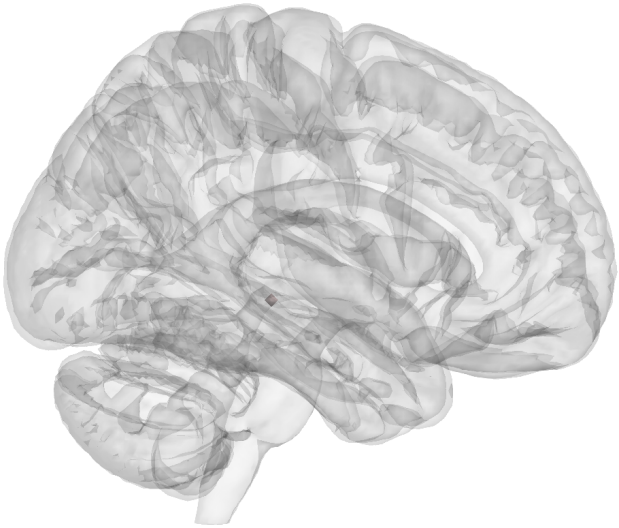
Non-Musician 5



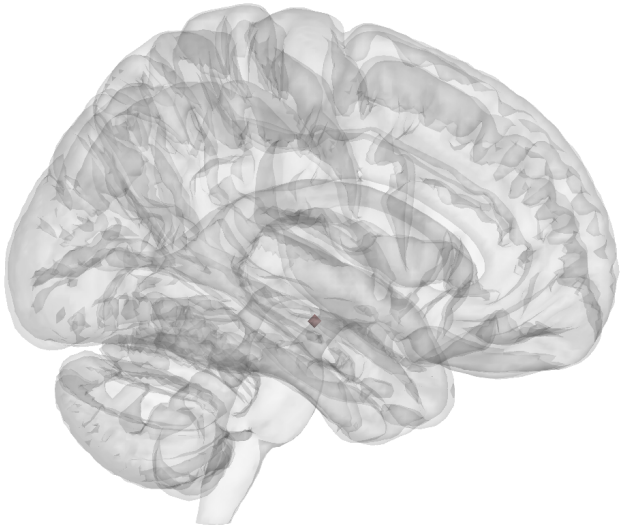
Brightness > 0.32



Brightness < -0.32



Pulse Clarity > 0.28



Pulse Clarity < -0.30

For the values seen for each of the participants across groups, we can see that in musicians there is a higher correlation for brightness than for pulse clarity. We can also see that there is a lower correlation for pulse clarity than brightness.

Now looking at the non-musicians group, we see that there is a higher correlation for brightness than for pulse clarity (around 3 non-musicians out of 5). And similar to musicians groups we see lower correlation for pulse clarity in the non-musicians group.

Hence, we can say that brightness is a feature that demonstrates similarities across participant groups. This is because even for a higher threshold, brightness shows correlation among the groups and across the groups.