Technical Report Analysis

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Theta analysis

Electrode matching

First, prepare a general theta data frame with electrodes that were identified to have strongest activity for theta band and which are overlapping between the two systems.

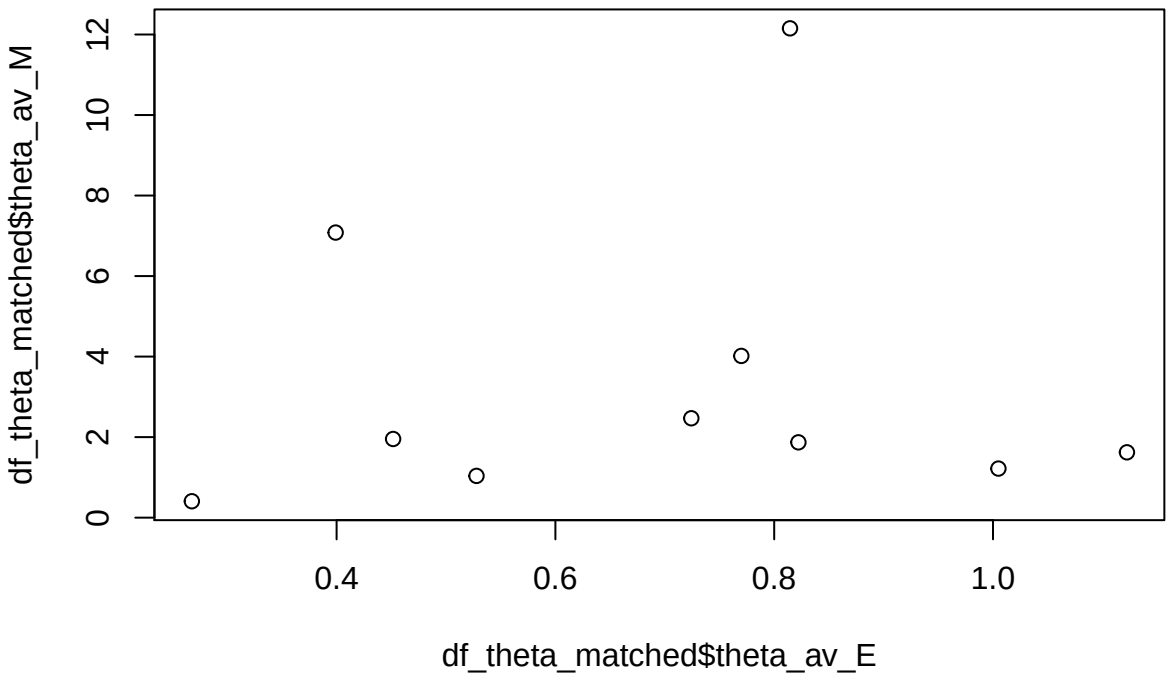
These are: Fp2, P7 and P8

Averaging

Now calculate the average values for each system separately for each participant to prepare these variables for plotting and correlation tests.

Plot and test the data in its original format

```
plot(df_theta_matched$theta_av_E, df_theta_matched$theta_av_M)
```




```
cor.test(df_theta_matched$theta_av_E, df_theta_matched$theta_av_M, method="spearman")
```

```
##
##  Spearman's rank correlation rho
##
## data:  df_theta_matched$theta_av_E and df_theta_matched$theta_av_M
## S = 160, p-value = 0.9457
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##        rho
## 0.03030303
```

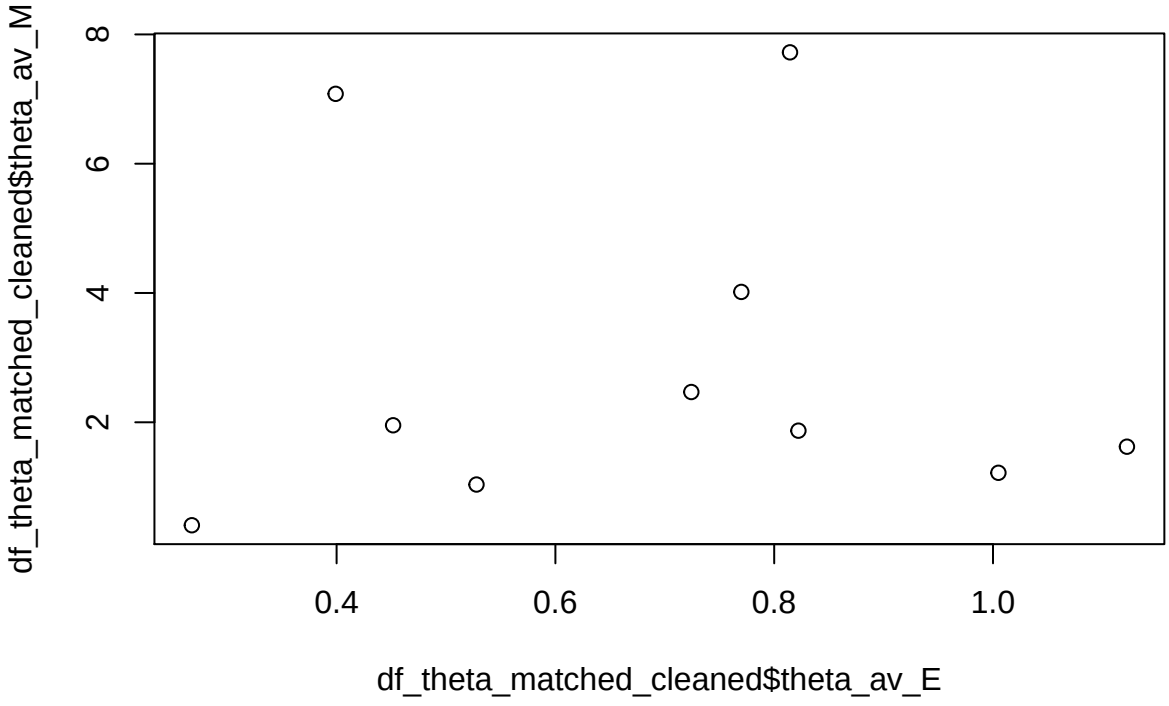
Results It is evident that there is a clear outlier in the data. It doesn't seem like there is any clear relationship in the data and it might be obscured by the outlier. Generally, the data seems very inconsistent. It could be due to the fact that noisy electrodes were picked up.

Plot and test the data without outliers

It is clear that there is an outlier in the data reaching mean power at 12 micorvolts for Mobita. This is due to an extreme value reported for Mobita - pt 2, electrode P8. This value will now be replaced with NA and the correlation will be run again.

Plot and test for the data excluding the extreme value

```
plot(df_theta_matched_cleaned$theta_av_E, df_theta_matched_cleaned$theta_av_M)
```



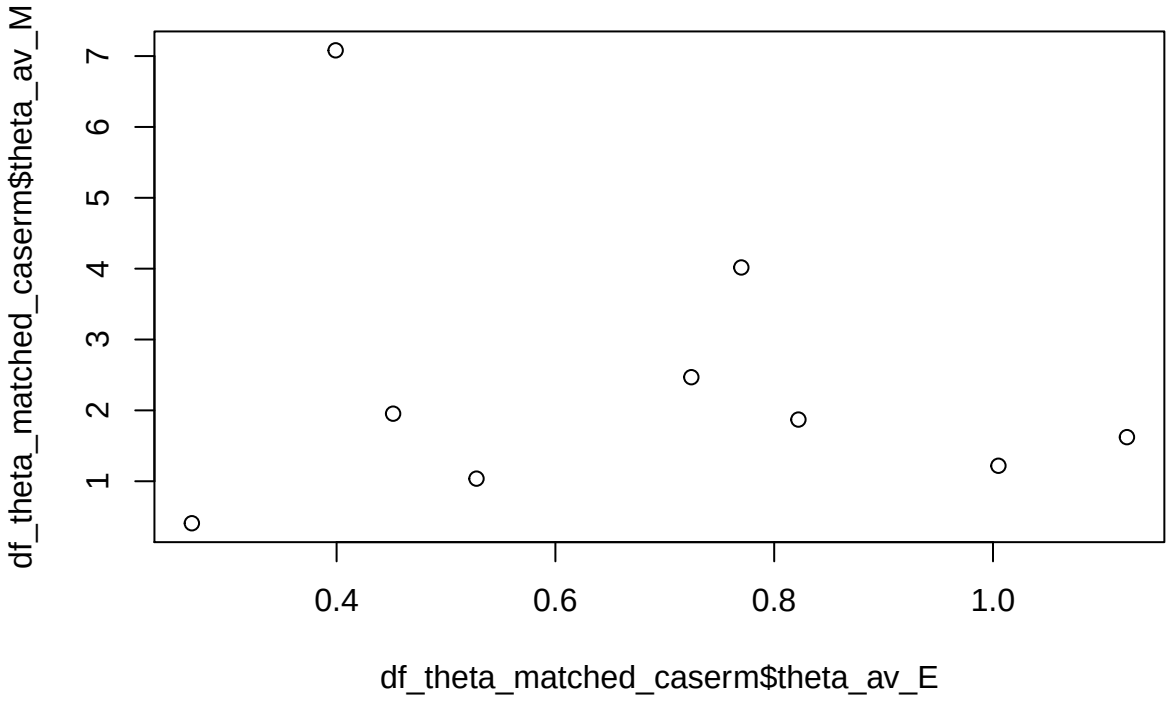

```
cor.test(df_theta_matched_cleaned$theta_av_E, df_theta_matched_cleaned$theta_av_M, method="spearman")
```

```
##
##  Spearman's rank correlation rho
##
## data:  df_theta_matched_cleaned$theta_av_E and df_theta_matched_cleaned$theta_av_M
## S = 160, p-value = 0.9457
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##        rho
## 0.03030303
```

Results Now the plot looks slightly better but the test statistic hasn't changed. The data still looks inconsistent. The next step will be to remove the whole case and see how this affects the data.

Plot and test for the data excluding the extreme case

```
plot(df_theta_matched_caserm$theta_av_E, df_theta_matched_caserm$theta_av_M)
```




```
cor.test(df_theta_matched_caserm$theta_av_E, df_theta_matched_caserm$theta_av_M, method="spearman")
```

```
##
##  Spearman's rank correlation rho
##
## data:  df_theta_matched_caserm$theta_av_E and df_theta_matched_caserm$theta_av_M
## S = 124, p-value = 0.9484
## alternative hypothesis: true rho is not equal to 0
## sample estimates:
##         rho
## -0.03333333
```

Results The data still looks inconsistent with no clear relationship.

Further steps Because noisy electrodes have been identified through the process of selecting the electrodes with the strongest activity, these representations might not accurately represent the reliability of measuring the theta signal with the two systems. I will now repeat the analysis using a subset of central electrodes and assess the reliability for these instead.