THE REPUBLIC OF TURKEY
BAHCESEHIR UNIVERSITY

ANOVA ANALYSIS ON PHASE SYNCHRONIZATION ESTIMATIONS IN CONTRASTING EMOTIONAL STATES BY MEANS OF EEG

Master's Thesis

ÖZLEM TIĞLI

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THE REPUBLIC OF TURKEY

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BIOENGINEERING

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This is to certify that we have read this thesis and we find it fully adequate in scope, quality and content, as a thesis for the degree of Master of Science.

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ABSTRACT

ANOVA ANALYSIS ON PHASE SYNCHRONIZATION ESTIMATIONS IN CONTRASTING EMOTIONAL STATES BY MEANS OF EEG

Özlem Tığlı

Bioengineering

Thesis Supervisor: Assoc. Prof. Dr. Serap Aydın

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This study deals with the comparison of the EEG feature extraction methods based on Cross Wavelet, Wavelet Energy and Wavelet Entropy according to the Analysis of Variance. 16 channel EEG recording with visual stimuli is performed on 30 subjects at delta, theta, alpha, beta and gamma frequency bands by using 18 pleasant, unpleasant and neutral pictures which are selected from the International Affective Picture System. It is aimed to make a detailed evaluation on EEG features with a statistical approach.

Keywords: EEG,Wavelet , Feature Extraction, ANOVA, Emotional

ÖZET

ANOVA ANALYSIS ON PHASE SYNCHRONIZATION ESTIMATIONS IN CONTRASTING EMOTIONAL STATES BY MEANS OF EEG

Özlem Tığlı

Biyomühendislik

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Bu çalışma, Varyans Analizi yapılarak çapraz dalgacık, dalgacık enerjisi ve dalgacık entropisi baz alınarak yapılan EEG karakteri çıkartılması metotlarının karşılaştırılmasını ele alır. Uluslararası Duygusal Resim Sistemi' nden seçilmiş 18' er adet hoşa gitmeyen, nötral ve hoş resimlerin 30 deneğe delta, theta, alpha, beta ve gamma frekans bantlarında 16 kanallı EEG kaydı alınarak görsel uyartım olarak uygulanmıştır. İstatistiksel yaklaşım ile EEG karakterlerinin detaylı değerlendirilmesinin yapılması hedeflenmiştir.

Anahtar Kelimeler: EEG, Dalgacık , Özellik Çıkarımı, ANOVA, Duygusal

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ABBREVIATIONS

ANOVA	:	Analysis of Variance
CWT	:	Continuous Wavelet Transform
DWT	:	Discrete Wavelet Transform
EEG	:	Electroencephalography, Electroencephalogram
Hz	:	Hertz
IAPS	:	International Affective Picture System
RWE	:	Relative Wavelet Entropy
Sig	:	Significance
SSA	:	Sum of Squared Errors of All Sample Means vs Grand Mean
Std	:	Standard
WE	:	Wavelet Entropy

SYMBOLS

W (a,b): CWT of the Signal

Energy	:	E_j
Function	:	S(t)
Hilbert Space	:	L^2 (R)
Integer	:	k
Mother Wavelet	:	$\psi(t)$
Period	:	ω_a
Probability Distribution	:	p_j
Residual Signal	:	$r_j(t)$
Resolution Level	:	j
RWE	:	E_{tot}
Sampling Rate	:	t_s
Scaling Parameter	:	a
Signal	:	x(t)
Sinusoidal Mock Signal	:	fm(t)
Source Signal	:	fa(t)
Transformation Parameter	:	b
Wavelet Coefficents	:	Cj(k)
Wavelet Family	:	ψ (a,b)

1. INTRODUCTION

1.1 STATEMENT OF PROBLEM

Emotions are crucially important since they mostly define how to react and behave. In this study we will evaluate the brain reactivity to the IAPS stimuli.

With EEG it became easier to understand how the brain neurologically work. The development of quantitive approach to EEG analysis begins with fourier transform but in time we have seen the wavelet analysis is more adequate technique for EEG signals since these signals are nonstationary. Evaluating the wavelet entropies, wavelet energies and cross spectrums of the EEGs can give us the desired analysis.

1.2 PURPOSE

The aim of this experiment is assess the brain’s reactivity to emotional pictures by recording event-related potentials and find reliable methods of wavelet analysis for EEG feature extraction and includes shannon entropy of wavelets, wavelet energy of the bands and cross wavelet estimations(cross spectral analysis) of the bands according to the EEG channels. With this research we tried to see which electrode pairs have the significant voltage differences when we show the neutral, unpleasant and pleasant pictures at different frequency bands according to the wavelet entropies, wavelet energy and the cross spectrums.

1.3 HYPOTHESIS AND RESEARCH QUESTIONS

In this study the EEG data of the control group, which have been collected under visual stimuli, have been analyzed using different metodologies. Wavelet Entropies, wavelet energy and the cross spectrums have been evaluated. Emotional pictures have been used as the source of the stimuli. The parameters were not only limited with the pictures the data also examined according to the different frequency bands. Healthy control group’ s brain reactivity to the neutral, pleasant and unpleasant pictures from IAPS have been examined. The comparison of the methods and their results will help us to figure out where and how to look when we analyze the EEG features and gain the researchers expanded perspective.

1.4 SIGNIFICANCE OF THE STUDY

Emotions and their analysis are significantly important in our lives since they lead us how to behave, act and think. All of the participants of this study are healthy with no medical problematic backround, ,non smoker right handed men. When we have the detailed analysis of the brain reactivity to the emotional pictures the researcher may use the analysis to compare the data with the unhealthy subjects o patients, thus it will be possible to see the differences at the micro level and may help the accuracy of the diagnosis.

1.5 OPERATIONAL DEFINITIONS

1.5.1 Electroencephalography (EEG)

Electroencephalography is a recording procedure of the electrical activity of the brain. The measure of the brain waves is defined as Electroencephalogram. With the use of the electrodes we can be able to record the electrical activity of the brain through the scalp. The voltage difference between the electrode pairs, that placed on the scalp, gives us information about the electrical activity of the brain. (Niedermeyer and Lopes da Silva, 2005)

1.5.2 Analysis of Variance (ANOVA)

ANOVA is a statistical analysis method that povides us to determine the significance of the differences between samples. (Armstrong, Eperjesi and Gilmartin, 2002)

1.5.3 Fourier Transform

Fourier Transform is one of the first transform in signal processing. This technique provides us to evaluate signal's spectrums, determine the systems with their properties in frequency domain. Inverse Fourier Transform and Fourier Transform are as the following (Goswami and Chan, 2010)

In Fourier , signal is multipled and summated with complex factor in the time interval. Thus, the transform gives the Fourier Coefficent. This transformation technique was unefficient for processing EEG signals since the EEG signals are nonstationary.

1.5.4 Wavelet Transform

Differs from Fourier Transform, Wavelet Transform has different window sizes that provide us gaining time frequency resolution in all frequency ranges. The window sizes are narrow for high frequencies and wide for low frequencies.

Wavelet Transform is effective for analyzing the time series signals that have non stationary amplitudes in different frequencies. (A. Prochazka and J. Jech, 1994)

The wavelet is smooth, fast vanishing oscillating function having good localization in frequency and time. Wavelet family **ψ (**a,b) is the set of functions that generated from dilations and translations of specific admissible mother wavelet ψ(t).

Wavelet Transform equation is the following;

$$W(a,b) = \frac{1}{\sqrt{a}} \int_{-\infty}^{\infty} x(t)\,.\,\overline{\psi\left(\frac{t-b}{a}\right)}\,dt \qquad \textbf{(1.1)}$$

$$\psi_{a,b}(t) = \frac{1}{\sqrt{a}} \psi\left(\frac{t-b}{a}\right) \qquad \textbf{(1.2)}$$

$$W(a,b) = \int_{-\infty}^{\infty} x(t)\,.\,\overline{\left(\psi_{a,b}(t)\right)dt} \qquad \textbf{(1.3)}$$

a > 0 , b ∈ R , a is scaling parameter, b is transformation parameter , x(t) is the signal, ψ is the wavelet function, and W (a,b) is the continuous wavelet transform of signal.

When ‘a’ increases, wavelet becomes narrower. So, one obtains specific analytic pattern, its replications in different scales with variable time localization.

Differs from Fourier Transform that uses just time frequency domain, WT also uses time scale domain. The principle of WT is to derive sub-components out of the main signal with using low pass and high pass filters (Tawade and Warpe, 2011)

Wavelet Transform is reapplied to signal with low frequency which is generated by first level. With this method, the main signal becomes segmented by the subcomponents and this procedure continuous till getting the desired signal.

1.5.5 The Continuous Wavelet Transform

The continuous wavelet transform of the signal S(t)∈L^2(R) (which indicates the space of real square summable functions) is the interrelation between S(t) with the family wavelet for a and b:

$$\left(W_{\psi} S\right)(a,b) = |a|^{-1/2} \int_{-\infty}^{\infty} S(t)\psi^{*}\left(\frac{t-b}{a}\right) dt = \langle S, \psi_{a,b} \rangle \qquad \textbf{(1.4)}$$

For election of the mother wavelet function and the discrete set of parameters, the family is;

$$\psi_{j,k}(t) = 2^{j/2}\psi\left(2^{j}t - k\right) \;\; j,k \in Z \qquad \textbf{(1.5)}$$

It constitutes an orthonormal basis of L^2 (R) (Hilbert space) containing finite energy signals. Correlated discrete wavelet transform provides necessary indication of the signal. Its values form the coefficients in wavelet series. Wavelet coefficients provide all information simply and also provides direct estimation of local energies at other scales.

1.5.6 Relative Wavelet Energy

The family C_j,k(t) is orthonormal basis for L^2 . Concept of energy is linked to the usual notions derived from Fourier theory. The wavelet coefficients are given with the energy at each level j= −1, …, −N, will become the specific energy of the detail signal;

$$C_j(k) = \langle S, \psi_{j,k} \rangle \quad \textbf{(1.6)}$$

The energy at each sampled time k becomes;

$$E_j = |r_j|^2 = \sum_k |C_j(k)|^2 \quad \textbf{(1.7)}$$

The total energy can be obtained by ;

$$E(k) = \sum_{j-\ \ -N}^{-1} |C_j(k)|^2 \quad \textbf{(1.8)}$$

Then, the relative wavelet energy,

$$E_{tot} = \|S\|^2 = \sum_{j<0} \sum_k |C_j(k)|^2 = \sum_{j<0} E_j \quad \textbf{(1.9)}$$

for the resolution level j= −1, −2, …, −N, define by scales the probability distribution of the energy.

$$p_j = \frac{E_j}{E_{tot}} \quad \textbf{(1.10)}$$

Distribution {pj} can be thought as a time scale density. That gives a effective tool which can be used for detecting and defining specific phenomena in time-frequency planes.

1.5.7 Total Wavelet Entropy

The Shannon entropy is a useful criterion for evaluating and comparing probability distribution, it gives a measure of information of analyzed distribution. Total WE is defined as;

$$S_{WT} \equiv S_{WT}(p) = -\sum_{j<0} p_j . ln[p_j] \qquad \textbf{(1.11)}$$

The WE is measure of scale of order-disorder of the signal, and can provide useful data about the dynamical process related with the signal. A very ordered process could be a periodic mono-frequency signal. Wavelet representation of such signal is going to be resolved in one unique resolution level, all RWEs will be zero except for the wavelet resolution level that has the representative signal frequency. At this level the RWE will be almost one and the total WE will be near zero or a very low value. The signal that generated by random process can be taken as defining a disordered behavior. This signal will have a wavelet indication with significant contributions from every frequency band. It could be expected that, all contributions will be at the same order. The RWE will be almost the same for all resolution levels, the WE will take their maximum rates.

1.5.8 Relative Wavelet Entropy

For example we have two different probability distributions pj and qj with

$$\sum p_j . \sum \mu_j = 1 \qquad \textbf{(1.12)}$$

They can be thought of as indicating by scales probability distribution of WE for segments of the signal or two different signals. RWE is defined, formally a Kullback–Leibler entropy , as:

$$S_{WT}(p|q) = \sum_{j<0} p_j . ln\left[\frac{p_j}{q_j}\right] \qquad \textbf{(1.13)}$$

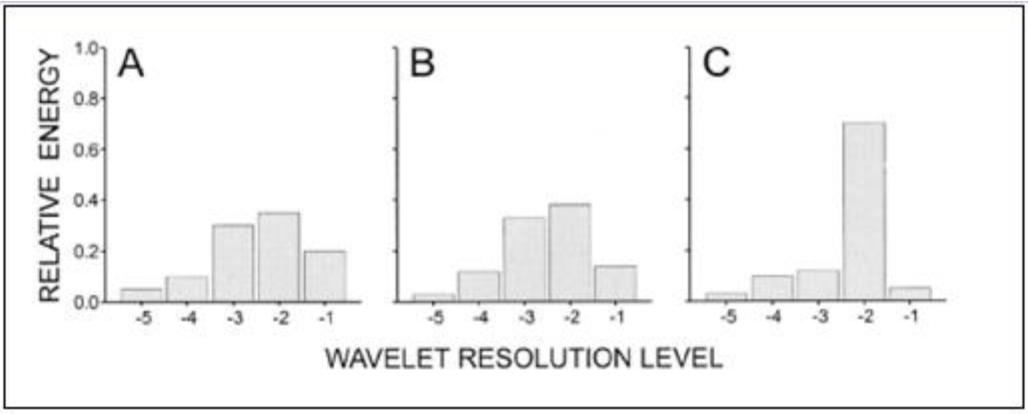
It gives the measure of the degree of parallelity between two probability distributions. Figure 1 indicates three different RWE distributions corresponding to five wavelet levels of resolution (j= −5, …, −1). A and B are similar, and present broad band spectra. But the distribution C shows a dominance of the level j=−2. According to the description given before, for the total WE following relation can be assumed:

$$S_{WT}(A) \approx S_{WT}(B) > S_{WT}(C) \quad \textbf{(1.14)}$$

Taking the distribution A as reference, it can be predicted for the RWE that:
If the corresponding numerical rates for the distributions are used, a well agreement with previous relations are achieved.

$$S_{WT}\big((B|A)\big) \cong 0 \quad , \quad S_{WT}((C|A)) \gg 0 \quad \textbf{(1.15)}$$

Figure 1.1: Wavelet Resolution Level



Source: Rosso Osvaldo A (2001), *Wavelet entropy: a new tool for analysis of short duration brain electrical signals,* 2001.

1.5.9 Cross Wavelet Transform

Kelly, Hughes, H. D. Aller, and Aller, (2003), stated in their study that the Continuous WT is efficient to evaluate how time series change in time and scale but does not include information how time series vary over a range of scales while assigning a period which characterizes it effectively. After characterizing that a periodic pattern exists in noisy and poorly sampled data, one finds the dilation which describes the period from timeaveraged data, from that dilation period is computed. For a quasiperiodic signal there isn't a specific dilation; it requires a method of directly evaluating a characteristic timescales, which includes information on how a source changes in dilation, for this we analyze the cross wavelet transform. With two time series *f*a(t) and *f*m(t), we enable to construct the cross-wavelet transform.

$$\tilde{f}_c(l,t') = \tilde{f}_a(l,t')\tilde{f}_m^*(l,t') \tag{1.16}$$

In the analysis fa(t) is the source signal, fm(t) is a sinusoidal mock signal, although it can be used any two time series which are correlated. Because of quasi-periodic behavior is what we are looking for, it is firstly assumed an ideal signal with the form

$$f_a(t) = A_a e^{i(\omega_a t + \phi_a)}\ , \quad -\infty < t < \infty \tag{1.17}$$

$\omega_a = 2\pi/\tau_a$ for period τ_a. With the assumption that it'll be effective to cross the main signal with a signal with similar form, we sample a mock signal

$$f_m(t) = A_m e^{i(\omega_m t + \phi_m)}\ , \quad -\infty < t < \infty \tag{1.18}$$

Both these signals will have continuous wavelet coefficients

$$\tilde{f}(l,t') = A\sqrt{2l\pi^{1/2}}e^{-(1/2)(l\omega-k)^2}e^{i(\omega t'+\phi)} \tag{1.19}$$

The cross-wavelet for the two signals comes in

$$\tilde{f}_c(l,t') = 2\sqrt{\pi}A_a A_m e^{i(\phi_a-\phi_m)}le^{-k^2} \times e^{-(1/2)[(\omega_a^2+\omega_m^2)l^2-2kl(\omega_a+\omega_m)]}e^{(\omega_a-\omega_m)it'} \tag{1.20}$$

$$
\begin{aligned}
&A \equiv 2\sqrt{\pi}A_a A_m e^{-k^2} \ , \\
&\eta \equiv \omega_a^2 + \omega_m^2 \ , \\
&\gamma \equiv \omega_a + \omega_m \ , \\
&\beta \equiv \omega_a - \omega_m \ , \\
&\phi \equiv \phi_a - \phi_m \ ,
\end{aligned}
\qquad \textbf{(1.21)}
$$

Equation becomes;

$$
\tilde{f}_c(l, t') = Ale^{-(1/2)(\eta l^2 - 2k\gamma l)} e^{i(\beta t' + \phi)} \qquad \textbf{(1.22)}
$$

Which is easily interpreted. With this equation we can indicate important characteristics of this cross-wavelet: which is that it posses a form of Gaussian in dilation coordinate , it is sinusoidal in translation coordinate with frequency from difference in the frequencies of the main signal and the mock signal. When the two frequencies are the same, the translation dependence disappears, the cross wavelet reduces to Gaussian in dilation coordinate. ''(Kelly , Hughes , H. D. Aller , and Aller , 2003)

2. LITERATURE REVIEW

Bradley and Lang, (2007), have stated at their work that electroencephalographic results indicated that enchanced activation to emotional stimuli pictures in visual cortex. They have shown with their study that with the IAPS visual stimuli we can understand more about the mechanism of normal emotion and the pathalogical states. (Bradley and Lang, 2007).

Bradley, Hamby, Löw, and Lang, (2007), reached the consistent data in their study, that the perceptual difference dominate EEGs at temporal stream, with difference based on emotional excitation a related late comer to the electrical activity taken from the scalp (Bradley et al., 2007)

Aydın, Demirtaş, Ateş and Tunga, (2016), studied with IAPS stimuli at their recent work. In the study the highest cortical activity was measured from the pleasant pictures mostly at frontal, parietal and temporal zones of the brain. The results of their study was coherent with the previous works and the basics of the knowledge on the brain lobes that the frontal lobe modifies emotions, the parietal lobe coordinates and runs senses in addition to sensory data for cognition. The temporal lobe consists of the hippocampus, and amygdala is highly important in streamlined processing of emotional visual stimuli. (Aydın et al., 2016)

3. DATA AND METHOD

3.1 RESEARCH DESIGN

In this study we used the EEG information from a recent study (Aydın et al., 2016). With the EEG data that collected under IAPS stimuli, from the participants at Delta(0.5-4Hz), Theta(4-8Hz), Beta(8-16Hz), Alpha(16-32Hz) and Gamma(32-64Hz) frequency bands including wavelet entropies, wavelet energies and cross spectrums, we made a detailed comparison using ANOVA.

3.2 UNIVERSE AND PARTICIPANTS

Thirty healthy, nonsmoker and right handed men, aged with the mean age 28.90 ± 9.8 years volunteered as participants to the recent study.

3.3 PROCEDURE

Total 54 pictures consisting of 18 neutral, 18 pleasant, and 18 unpleasant pictures selected from IAPS have been performed as emotional visual stimuli. Under the effect of the emotional stimuli the EEG data have been collected and ANOVA have been performed to the data to see the interactions.

3.3.1 Source Of Data

Wavelet Energy, Wavelet Entropy and Cross Spectrums of the EEG data which have been collected from 30 subjects are our sources for ANOVA. Interpretation of the data by using ANOVA gave us the interactions between bands, electrodes and the stimuli types

3.3.2 Data Collection Procedures

Visual affective stimuli, colorful emotional pictures have been shown on 17 inch screen which was connected to personal computer. The Distance between the screen and participant was 1.5 m.

EEG recordings have been taken with 16 channel recording system Glonner Neurosys System-2000. Argent-Argent Chloride electrodes were placed with international 10–20 electrode placement system on the scalp surface of the participants; prefrontal electrodes (Fp1, Fp2), frontal electrodes (F3, F4, F7,F8), central electrodes (C3, C4), parietal electrodes (P3, P4), temporal electrodes (T3, T4, T5, T6) and occipital electrodes (O1, O2) were the recording sites. 16 bit analog/digital converter has been used in the recording system. Luminence was controlled, temperature was approximately 22◦C Degrees in the recording chamber. The impedance of the electrodes were less than 5 kΩ. Bandpass (0.318–70Hz) and Notch filter (50Hz) were performed to raw data.

The sampling frequency was 500 Hz. Level of decomposition was 6 to reach the desired requencies which were Delta(0.5-4Hz), Theta(4-8Hz), Beta(8-16Hz), Alpha(16-32Hz) and Gamma(32-64Hz) frequency bands (Aydın et al., 2016).

3.3.3 Data Analysis Procedures.

ANOVA for the repeated-measures variables have been performed to analyze within subjects effects. Main effects of Band, channel, stimulus types and their interactions are analyzed.

Based on Mauchly's sphericity test for each of the three repeated-measures effects and their interactions, for the stimuli type, assumption of sphericity was assumed (Sig. is above .05). On the other hand, for the other effects sphericity assumption was violated.

The mean scores of electrodes were interpreted when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction were computed for the pairwise comparisons and the results are obtained. The Sig. value less than 0.05 can be interpreted as significant from the tables. Unsignificant results are also printed.

3.3.4 Limitation and Deliminations.

The source of the limitation with the analysis is mostly related with the participants since it includes only a certain interval of age and consists of only men. The results could have been different than the present if we include women and children

4. FINDINGS

4.2 SHANNON ENTROPY

ANOVA for the repeated-measures variables have been performed to analyze within subjects effects. Main effects of Band, channel, stimulus types and their interactions are analyzed.

Based on Mauchly's sphericity test for each of the three repeated-measures effects and their interactions, for the stimuli type, assumption of sphericity was assumed (Sig. is above .05). On the other hand, for the other effects sphericity assumption was violated.

As the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.13, 46.853)=7.845$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Table 4.1: Shannon Entropy Estimates

			95% Confidence Interval	
Band	Mean	Std. Error	Lower Bound	Upper Bound
Delta	-7,015E10	1,300E10	-9,712E10	-4,318E10
Theta	-1,955E10	2,990E9	-2,575E10	-1,335E10
Alpha	-3,018E10	5,498E9	-4,158E10	-1,878E10
Beta	-3,891E10	7,057E9	-5,355E10	-2,428E10
Gamma	-3,806E10	9,322E9	-5,740E10	-1,873E10

Post hoc tests using the Bonferroni correction revealed that, for the pairwise comparisons, mean values for Delta band is found to be lower than theta band ($p=0.003$), and mean Delta band value was found to be lower than alpha ($p=0.032$). In addition to these, mean theta band value was found to be smaller than mean alpha ($p=0.031$) and mean beta values ($p=0.045$). The other pairwise comparisons were not significant and the summary of the results are given in Table 4.2

Table 4.2: Bonferroni Post Hoc Test, Pairwise Comparison of the Bands

Measure:shannon_entropy

(I)Band	(J)Band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% CI for Difference[a]	
					Lower Bound	Upper Bound
Delta	Theta	-5,060E10	1,180E10	,003	-8,741E10	-1,380E10
	Alpha	-3,997E10	1,210E10	,032	-7,770E10	-2,247E9
	Beta	-3,124E10	1,234E10	,191	-6,974E10	7,262E9
	Gamma	-3,209E10	1,388E10	,305	-7,536E10	1,119E10
Theta	Delta	5,060E10	1,180E10	,003	1,380E10	8,741E10
	Alpha	1,063E10	3,207E9	,031	6,298E8	2,063E10
	Beta	1,936E10	6,114E9	,045	2,968E8	3,843E10
	Gamma	1,852E10	8,452E9	,394	-7,844E9	4,488E10
Alpha	Delta	3,997E10	1,210E10	,032	2,247E9	7,770E10
	Theta	-1,063E10	3,207E9	,031	-2,063E10	-6,298E8
	Beta	8,734E9	6,305E9	1,000	-1,093E10	2,840E10
	Gamma	7,885E9	8,767E9	1,000	-1,946E10	3,523E10
Beta	Delta	3,124E10	1,234E10	,191	-7,262E9	6,974E10
	Theta	-1,936E10	6,114E9	,045	-3,843E10	-2,968E8
	Alpha	-8,734E9	6,305E9	1,000	-2,840E10	1,093E10
	Beta	-8,491E8	6,568E9	1,000	-2,133E10	1,964E10
Gamma	Delta	3,209E10	1,388E10	,305	-1,119E10	7,536E10
	Theta	-1,852E10	8,452E9	,394	-4,488E10	7,844E9
	Alpha	-7,885E9	8,767E9	1,000	-3,523E10	1,946E10
	Beta	8,491E8	6,568E9	1,000	-1,964E10	2,133E10

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

As the main effect, the mean scores of Electrode were found to be statistically significantly different ($F(4.053, 89.169)=3.422$, $p<0.012$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Significant results deduced by the Post hoc tests using the Bonferroni correction is summarized as;

Table 4.3: Summary of the Significant Results by the Post Hoc Tests

Electrode I	Electrode J	Result	p-value
Fp1	P4	Fp1<P4	0.018
F7	P3	F7<P3	0.016
F7	P4	F7< P4	0.003
F7	O1	F7<O1	0.006
F8	P3	F8<P3	0.033
F8	P4	F8< P4	0.002
F8	O1	F8<O1	0.015
P4	T6	P4>T6	0.003
T6	O1	T6<O1	0.038

The mean scores of Stimulus type were not found to be statistically significantly different ($F(1.812, 39.868)=1.282$, $p=0.287$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

4.2 LOGEN ENTROPY

ANOVA for the repeated-measures variables have been performed to analyze within subjects effects. Main effects of Band, channel, stimulus types and their interactions are analyzed.

Based on Mauchly's sphericity test for each of the three repeated-measures effects and their interactions, for the stimuli type, assumption of sphericity was assumed (Sig. is above .05). On the other hand, for the other effects sphericity assumption was violated.

As the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.13, 46.853)=7.845$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Table 4.4: Logen Entropy, Band Values

Band	Mean	Std. Error	95% Confidence Interval Lower Bound	Upper Bound
Delta	-7,015E10	1,300E10	-9,712E10	-4,318E10
Theta	-1,955E10	2,990E9	-2,575E10	-1,335E10
Alpha	-3,018E10	5,498E9	-4,158E10	-1,878E10
Beta	-3,891E10	7,057E9	-5,355E10	-2,428E10
Gamma	-3,806E10	9,322E9	-5,740E10	-1,873E10

Post hoc tests using the Bonferroni correction revealed that, for the pairwise comparisons, mean values for Delta band is found to be lower than theta band ($p=0.003$), and mean Delta band value was found to be lower than alpha ($p=0.032$). In addition to these, mean theta band value was found to be smaller than mean alpha ($p=0.031$) and mean beta values ($p=0.045$). The other pairwise comparisons were not significant and the summary of the results are given in Table 4.5

Table 4.5: Logen Entropy, Pairwise Comparison of the Band Values

(I) band	(J) band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Delta	Theta	-5,060E10	1,180E10	,003	-8,741E10	-1,380E10
	Alpha	-3,997E10	1,210E10	,032	-7,770E10	-2,247E9
	Beta	-3,124E10	1,234E10	,191	-6,974E10	7,262E9
	Gamma	-3,209E10	1,388E10	,305	-7,536E10	1,119E10
Theta	Delta	5,060E10	1,180E10	,003	1,380E10	8,741E10
	Alpha	1,063E10	3,207E9	,031	6,298E8	2,063E10
	Beta	1,936E10	6,114E9	,045	2,968E8	3,843E10
	Gamma	1,852E10	8,452E9	,394	-7,844E9	4,488E10
Alpha	Delta	3,997E10	1,210E10	,032	2,247E9	7,770E10
	Theta	-1,063E10	3,207E9	,031	-2,063E10	-6,298E8
	Beta	8,734E9	6,305E9	1,000	-1,093E10	2,840E10
	Gamma	7,885E9	8,767E9	1,000	-1,946E10	3,523E10
Beta	Delta	3,124E10	1,234E10	,191	-7,262E9	6,974E10
	Theta	-1,936E10	6,114E9	,045	-3,843E10	-2,968E8
	Alpha	-8,734E9	6,305E9	1,000	-2,840E10	1,093E10
	Gamma	-8,491E8	6,568E9	1,000	-2,133E10	1,964E10
Gamma	Delta	3,209E10	1,388E10	,305	-1,119E10	7,536E10
	Theta	-1,852E10	8,452E9	,394	-4,488E10	7,844E9
	Alpha	-7,885E9	8,767E9	1,000	-3,523E10	1,946E10
	Beta	8,491E8	6,568E9	1,000	-1,964E10	2,133E10

As the main effect, the mean scores of Electrode were found to be statistically significantly different ($F(4.053, 89.169)=3.422$, $p<0.012$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Significant results summarized as;

Table 4.6: Summary of the Significant Results by the Post Hoc Tests, Log En

Electrode I	Electrode J	Result	p-value
Fp1	P4	Fp1<P4	0.018
F7	P3	F7<P3	0.016
F7	P4	F7< P4	0.003
F7	O1	F7<O1	0.006
F8	P3	F8<P3	0.033
F8	P4	F8< P4	0.002
F8	O1	F8<O1	0.015
P4	T6	P4>T6	0.003
T6	O1	T6<O1	0.038

The mean scores of Stimulus type were not found to be statistically significantly different ($F(1.812, 39.868)=1.282$, $p=0.287$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

The interaction of band and electrode was significant ($F(4.008, 88.173)=16.34$, $p<0.001$). Pairwise comparisons has been performed and Bonferonni correction was applied and the results on the Table 1 (see. Appendix-1) were deduced.

The band x emotional state ($F(2.1, 46)=1.588$, $p=0.215$).

The electrode x emotional state ($F(3.2, 72)=0.952$, $p=0.426$).

The band x electrode x emotional state interactions was not significant ($F(3.89, 85)=0.969$, $p=0.427$).

4.3 WAVELET ENERGY

ANOVA for the repeated-measures variables have been performed to analyze within subjects effects. Main effects of Band, channel, stimulus types and their interactions are analyzed.

Based on Mauchly's sphericity test for each of the three repeated-measures effects and their interactions, sphericity assumption was violated.

As the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.243, 49.353)=10.23$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction revealed that, for the pairwise comparisons, mean values for Delta band is found to be higher than the other bands (theta, alpha, beta and gamma) with the significance values, $p<0.008$, $p<0.005$, $p<0.001$, p<0.041) respectively. Mean theta band value was found to be higher than mean beta (p=0.025) as shown in below table.

Table 4.7: Wavelet Energy, Pairwise Comparisons of the Bands

(I) band	(J) band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Delta	Theta	,001*	,000	,008	,000	,002
	Alpha	,001*	,000	,005	,000	,003
	Beta	,002*	,000	,000	,001	,003
	Gamma	,001*	,000	,041	3,806E-5	,003
Theta	Delta	-,001*	,000	,008	-,002	,000
	Alpha	,000	,000	1,000	,000	,001
	Beta	,000*	,000	,025	3,883E-5	,001
	Gamma	,000	,000	1,000	-,001	,001
Alpha	Delta	-,001*	,000	,005	-,003	,000
	Theta	,000	,000	1,000	-,001	,000
	Beta	,000	,000	1,000	,000	,001
	Gamma	-2,159E-5	,000	1,000	-,001	,001
Beta	Delta	-,002*	,000	,000	-,003	-,001
	Theta	,000*	,000	,025	-,001	-3,883E-5
	Alpha	,000	,000	1,000	-,001	,000
	Gamma	,000	,000	1,000	-,001	,001
Gamma	Delta	-,001*	,000	,041	-,003	-3,806E-5
	Theta	,000	,000	1,000	-,001	,001
	Alpha	2,159E-5	,000	1,000	-,001	,001
	Beta	,000	,000	1,000	-,001	,001

As the main effect, the mean scores of electrodes were found to be statistically significantly different ($F(15, 66.506)=14.896$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction were computed for the pairwise comparisons and the below results are obtained. The Sig. value less than 0.05 can be interpreted as significant from Table 2 (see Appendix-2). Unsignificant results are also printed.

As the main effect, the stimulus_type scores were found to be statistically significantly different (F(1.233, 27.137)=5.569, p<0.02) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction were computed for the pairwise comparisons and the below results are obtained. Neutral wavelet energy is found to be greater than Unpleasant (p<0.008) and pleasant wavelet energy is higher than unpleasant (p<0.04).

Table 4.8: Wavelet Energy Comparisons of the Stimuli Types

(I) Stimulus Type	(J) Stimulus Type	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Neutral	Pleasant	,000	,000	,418	-,001	,000
	Unpleasant	,000*	,000	,008	6,166E-5	,000
Pleasant	Neutral	,000	,000	,418	,000	,001
	Unpleasant	,001*	,000	,040	1,866E-5	,001
Unplesant	Neutral	,000*	,000	,008	,000	-6,166E-5
	Pleasant	-,001*	,000	,040	-,001	-1,866E-5

a. Adjustment for multiple comparisons: Bonferroni.

*. The mean difference is significant at the .05 level.

Furthermore, The interaction of band and electrode was significant (F(3.88, 85.4)=12.82, p<0.001). Pairwise comparisons has been performed and Bonferonni correction was applied and the results on Table 3 (see. Appendix-3) were deduced.

The interactions of band x emotional state (F(2, 44.763)=1.419, p=0.253), electrode x emotional state (F(2.5, 55.8)=1.468, p=0.237) and band x electrode x emotional state (F(2.9, 64.9)=2.04, p=0.118) were not significant (Greenhouse-Geisser correction was applied).

4.4 CROSS SPECTRUM

Based on Mauchly's sphericity test for each of the three repeated-measures effects and their interactions, assumption of sphericity was violated.

From the test of within-subjects effects, as the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.120, 61.485)=16.06$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction revealed that, for the pairwise comparisons, the differences that is provided by cross spectrum estimations for Delta band is found to be higher than theta band, alpha band and gamma band ($p<0.001$). Moreover theta band is found to be higher than alpha band ($p<0.001$), alpha band is found to be lower than beta ($p<0.023$) and gamma is found to be lower than beta. The other pairwise comparisons were not significant and the summary of the results are given in the Table 4. (see. Appendix-4)

From the test of within-subjects effects, as the main effect, the mean scores of Electrodes was found to be statistically significantly different ($F(3.21, 93.185)=11.145$, $p<0.001$) when an ANOVA with repeated measures with a Greenhouse-Geisser correction was applied.

Post hoc tests using the Bonferroni correction is computed and the pairwise comparisons, The other pairwise comparison results are listed in the Table 5. (see. Appendix-5).

From the test of within-subjects effects, as the main effect, the change in the mean scores of stimulus type was not statistically significant ($F(1.965,56.988)=0.62$, $p<0.539$) (ANOVA with repeated measures with a Greenhouse-Geisser correction was applied).

For the interaction of band x electrode, a significant change has been observed ($F(2.91,84.396)=20.525$, $p<0.001$). Post hoc tests using the Bonferroni correction is computed for the pairwise comparisons, The other pairwise comparison results are listed in the Table 6. (see. Appendix-6)

The band x emotional state, ($F(2.746,79.62)=1.419$, $p=0.245$), electrode x emotional state ($F(4.219,122.357)=1.121$, $p=0.351$) and band x electrode x emotional state ($F(4.713,136.685)=0.874$, $p=0.495$) interactions were unsignificant.

5. DISCUSSION AND CONCLUSIONS

5.1 WAVELET ENTROPY

When we evaluate the Wavelet Entropies , the mean scores of Band were found to be statistically significantly different ($F(2.13, 46.853)=7.845$, $p<0.001$)

For the pairwise comparisons, mean values for Delta band is found to be lower than theta band ($p=0.003$), and mean Delta band value was found to be lower than alpha ($p=0.032$). In addition to these, mean theta band value was found to be smaller than mean alpha ($p=0.031$) and mean beta values ($p=0.045$).

As the main effect, the mean scores of Electrodes were found to be statistically significantly different ($F(4.053, 89.169)=3.422$, $p<0.012$)

The mean scores of Stimulus type were not found to be statistically significantly different ($F(1.812, 39.868)=1.282$, $p=0.287$)

The interactions of;

The Band x Emotional State ($F(2.1, 46)=1.588$, $p=0.215$).

The Electrode x Emotional State ($F(3.2, 72)=0.952$, $p=0.426$).

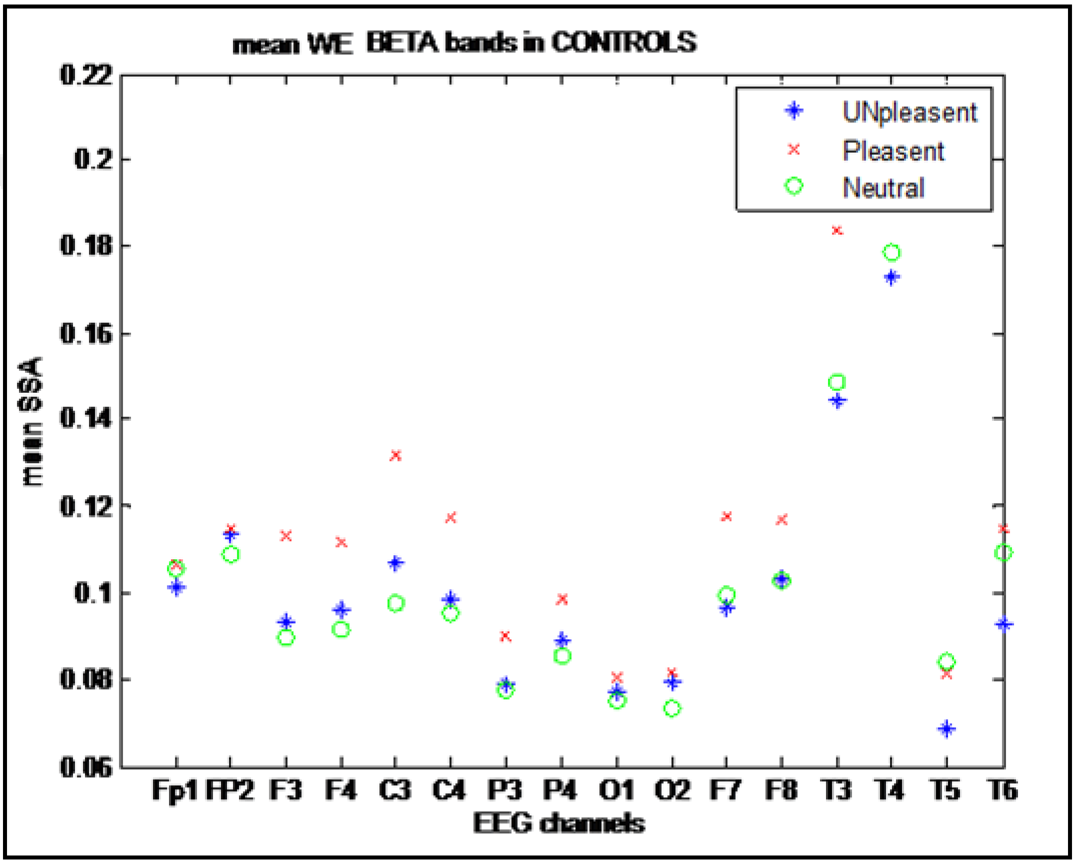
The Band x Electrode x Emotional state ($F(3.89, 85)=0.969$, $p=0.427$) was not found to be significant, since the p value is higher than 0.05.

We should mention that while looking fort he significant results for WE comparison fort he band values and the interactions for the band values and electrodes ANOVA takes the data including all stimuli types. So separating the data for neutral, pleasent and unpleasent stimulus types and making cross comparison between them may be more helpful to reach more reliable data.

To assist the existing data the mean values of the stimulus types have been analyzed. According to the mean values of the data, the following figures have been obtained;

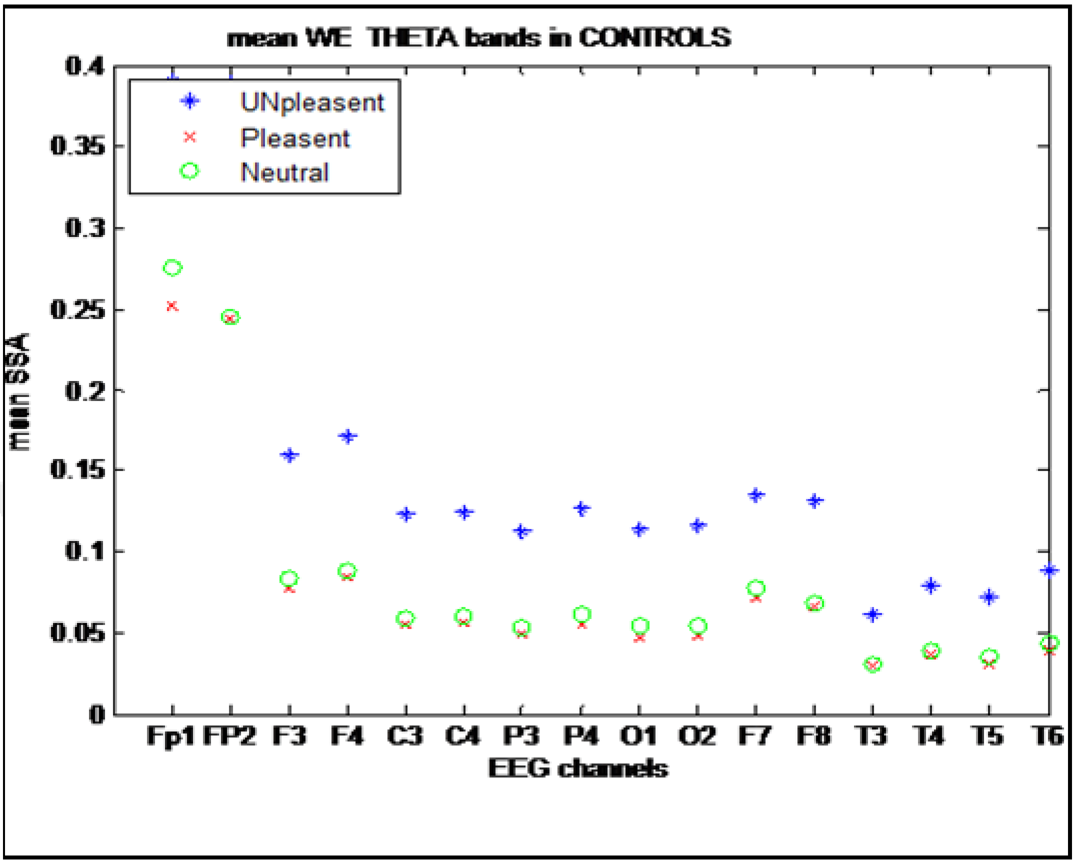
The Wavelet Entropy mean values in Beta frequency band shows that Pleasent type emotional stimuli has more WE, which means also complexity and this result is consistent with the early studies. Also it is clear that we can obtain significant results from the frontocentral (F3, F4, C3, C4) and temporal region (T3, T4, T5, T6) of the brain because the differences on the figure between the stimuli types increases. The data that overlaps on the Figure 2 means we may not reach any significant result at that region in beta band. Neutral and Unpleasant visual emotional stimuli types appereantly has lower WE than the Pleasent stimuli. For a basic idea the figure may lead us to an answer, but we always need empirical results and that is why ANOVA f test have been used in this analysis and from the p values we could accurately claim that if the result is significant or not.

Figure 5.1: Mean WE BETA Bands In Controls



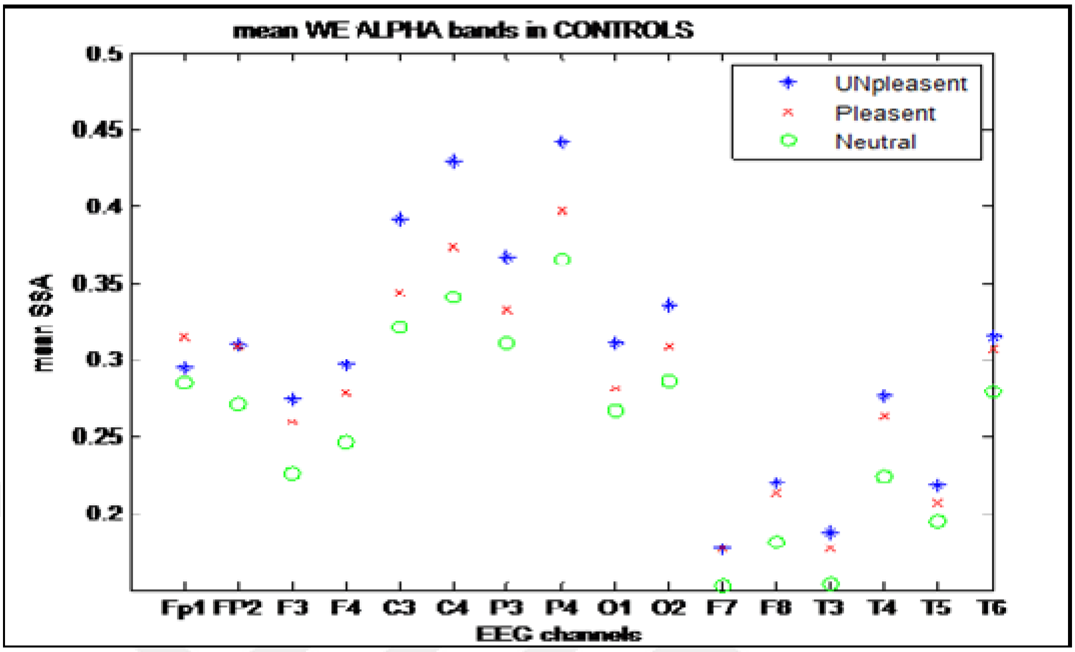
From Figure 5.1, it can be said that the Unpleasent visual emotional stimuli has the highest WE in Theta band and the significant results in this frequency band can be obtained from prefrontal region (Fp1) of the brain. The other data overlaps. This result is also consistent with the previous studies.

Figure 5.2: Mean WE Theta Bands In Controls



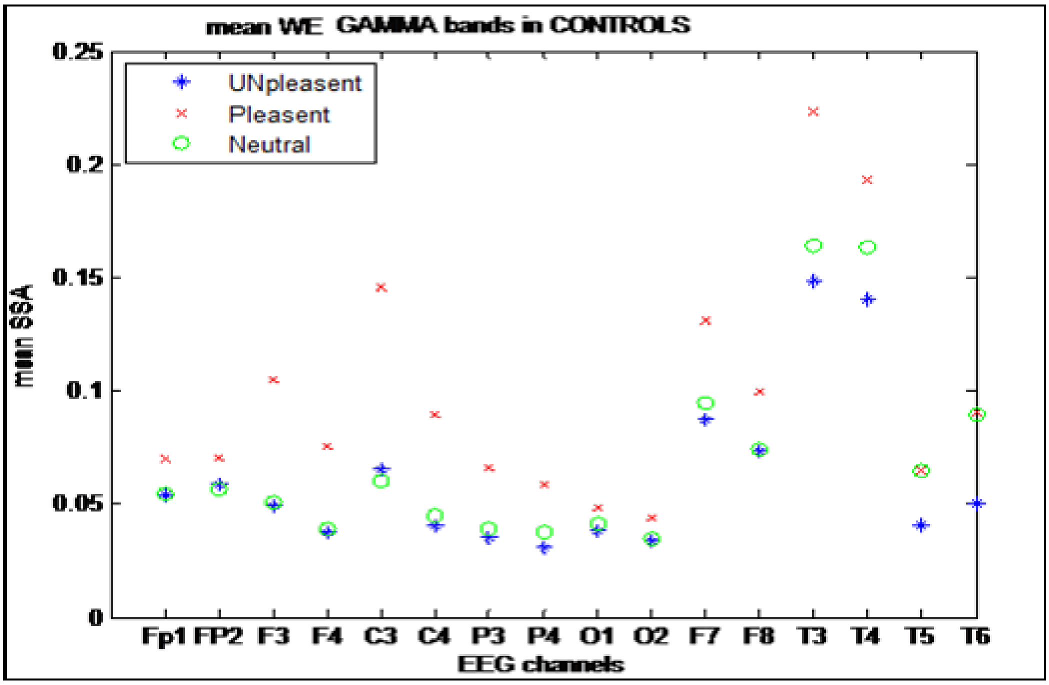
According to Figure 5.2, the WE in Alpha band is higher for Unpleasent visual emotional stimuli and lower for neutral stimuli. The significant results can be obtained from prefrontal (Fp1) frontal (F3, F4), central (C3, C4), parietal (P3, P4), occipital (O1, O2) and temporal regions (T3, T4, T5, T6) of the brain. So from the figure we should also indicate that the alpha band is the most efficient frequency band that we can gain the significant results.

Figure 5.3: Mean WE ALPHA Band In Controls



Pleasent emotional visual stimuli has the highest and the Unpleasent stimuli has the lowest WE in Gamma band. Thesignificant results in Gamma band can be deduced from temporal region (T3, T4) and frontal region (F7) of the brain.

Figure 5.4: Mean WE GAMMA Bands In Controls



When we analyze Figure 5.4 it can be mentioned that the Pleasent emotional visual stimuli has the highest WE. The significant results in Gamma band can be measured from frontal (F7) and temporal (T3, T4) region of the brain.

5.2 WAVELET ENERGY

As the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.243, 49.353)=10.23$, $p<0.001$) For the pairwise comparisons, mean values for Delta band is found to be higher than the other bands (theta, alpha, beta and gamma) with the significance values, $p<0.008$, $p<0.005$, $p<0.001$, $p<0.041$) respectively. Mean theta band value was found to be higher than mean beta ($p=0.025$).

As the main effect, the mean scores of electrodes were found to be statistically significantly different ($F(15, 66.506)=14.896$, $p<0.001$) As the main effect, the stimulus type scores were found to be statistically significantly different ($F(1.233, 27.137)=5.569$, $p<0.02$). Neutral wavelet energy is found to be greater than Unpleasent ($p<0.008$) and pleasent wavelet energy is higher than unpleasent ($p<0.04$). It should be mentioned that ANOVA evaluated the different stimulus types' Wavelet Energy by gathering at all frequency bands and electrodes and their mean values. Evaluating them seperately gives us more accurate results. So Wavelet Energy analysis according to the stimulus types with ANOVA can be misleading.

The interaction of band and electrode was significant ($F(3.88, 85.4)=12.82$, $p<0.001$)

The interactions of Band x Emotional State ($F(2, 44.763)=1.419$, $p=0.253$)

Electrode x Emotional State ($F(2.5, 55.8)=1.468$, $p=0.237$)

Band x Electrode x Emotional state ($F(2.9, 64.9)=2.04$, $p=0.118$) were not significant since the p value is higher than 0.05.

5.3 CROSS SPECTRUM

From the test of within-subjects effects, as the main effect, the mean scores of Band were found to be statistically significantly different ($F(2.120, 61.485)=16.06$, $p<0.001$) . For the pairwise comparisons, mean values for Delta band is found to be higher than theta band, alpha band and gamma band ($p<0.001$). Theta band is found to be higher than alpha band ($p<0.001$), alpha band is found to be lower than beta band ($p<0.023$) and gamma band is found to be lower than beta band.

The mean scores of Electrodes was found to be statistically significantly different ($F(3.21, 93.185)=11.145$, $p<0.001$) .

Sig values lower than 0.05 show the signifcant values of electrode pairs.

From the test of within-subjects effects, as the main effect, the change in the mean scores of stimulus type was not statistically significant ($F(1.965,56.988)=0.62$, $p<0.539$).

For the interaction of band x electrode, a significant change has been observed ($F(2.91,84.396)=20.525$, $p<0.001$).

The interactions of Band x Emotional State, ($F(2.746,79.62)=1.419$, $p=0.245$)

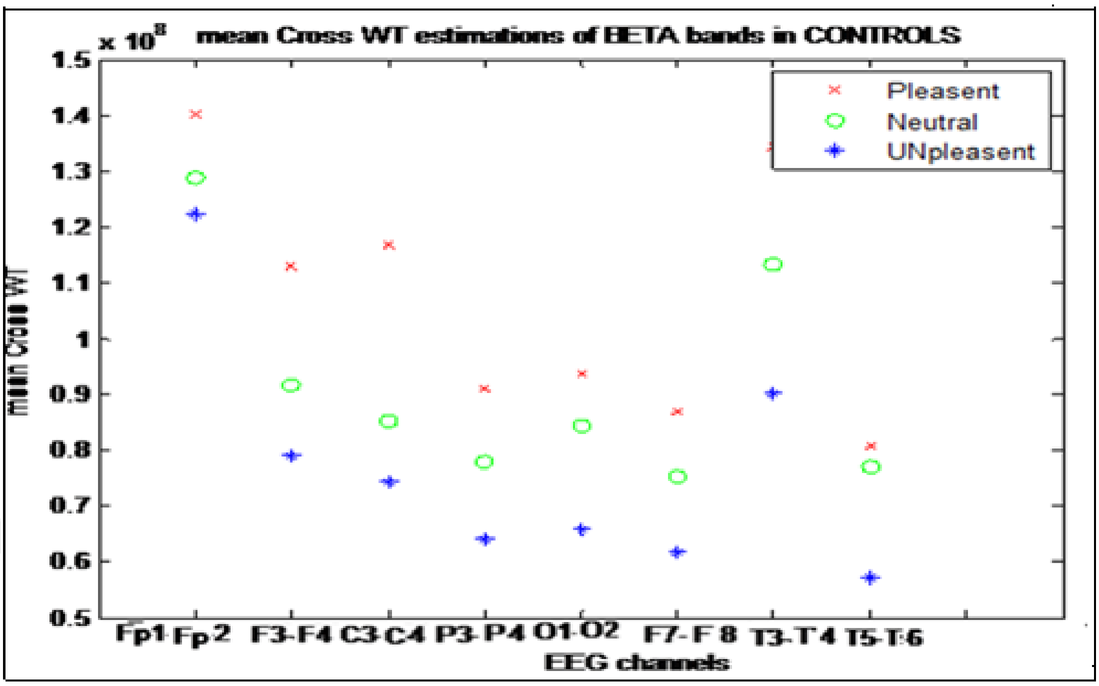
Electrode x Emotional State ($F(4.219,122.357)=1.121$, $p=0.351$)

Band x Electrode x Emotional State ($F(4.713,136.685)=0.874$, $p=0.495$) were not found o be significant according to the p values.(>0.05)

Since ANOVA take all the stimulus types together tomake cross comparison it is obvious that it could not give us a significant result according to the emotional state.

To help the data that we obtain from ANOVA. The mean values of the stimulus types have been analyzed and hemispheric cross comparison has been applied according to the mean cross spectrums and The following figures have been obtained;

Figure 5.5: Mean Cross WT Estimations Of BETA Bands In Controls



According to Figure 5.5, which shows us the cross spectrum estimations in beta band, Pleasent visual emotional stimuli has the cross highest spectrum and Unpleasent stimuli hasthe lowest. The differences in temporal region increases and dicreases in prefrontal region and it is obviously related with the distance between the electrodes. Since there isn't any overlapping with the data, it can be mentioned that we can obtain significant results in prefrontal (Fp1-Fp2), frontal (F3-F4, F7-F8), central (C3-C4), parietal (P3-P4), occipital (O1-O2) and temporal (T3-T4, T5-T6) regions of the brain. The beta band is the most valid frequency band to anlyze the cross spectrums.

Figure 5.6: Mean Cross WT Estimations Of GAMMA Bands In Controls

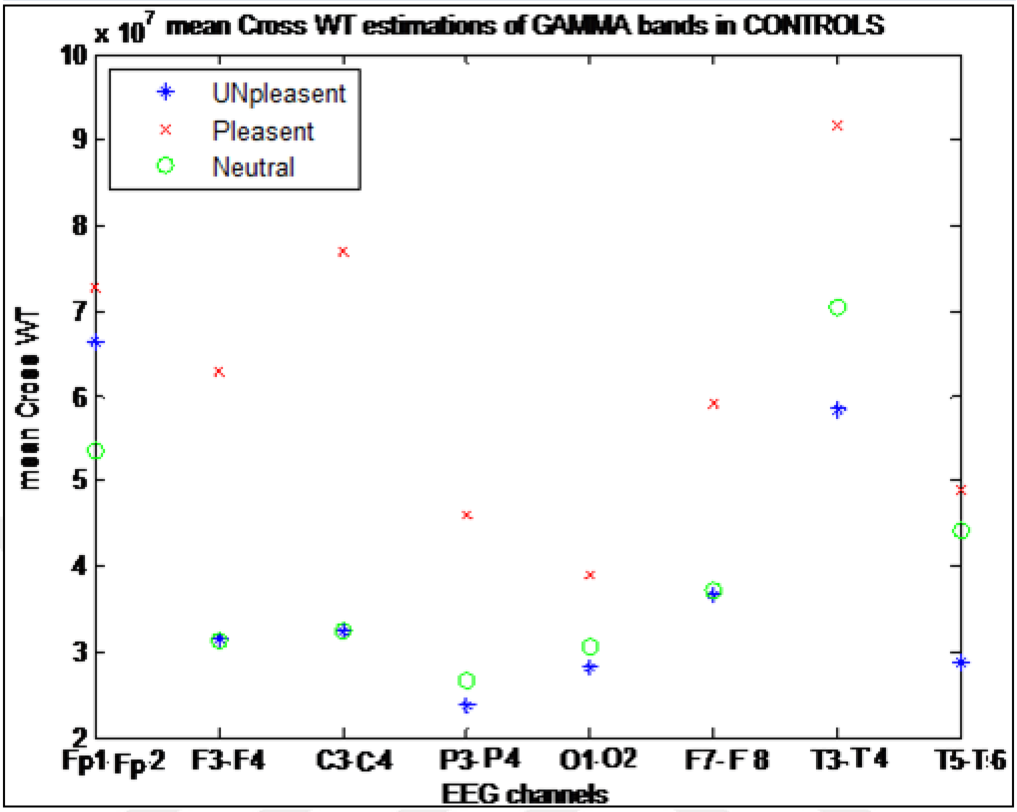


Figure 5.6 indicates mean cross wavelet estimations according to the stimulus types from electrode pairs that placed in different hemispheres in gamma frequency band. In gamma band Pleasent stimulus type using emotional visual stimuli, has the highest mean cross spectrum. Since the data intersects at most of the regions gamma band is not a valid freaquency band to analyze the cross spectrum. Significant results by means of cross wavelets can only be obtained from prefrontal (Fp1-Fp2), parietal (P3-P4), and temporal (T3-T4, T5-T6) regions of the brain.

Figure 5.7: Mean Cross WT Estimations Of ALPHA Bands In Controls

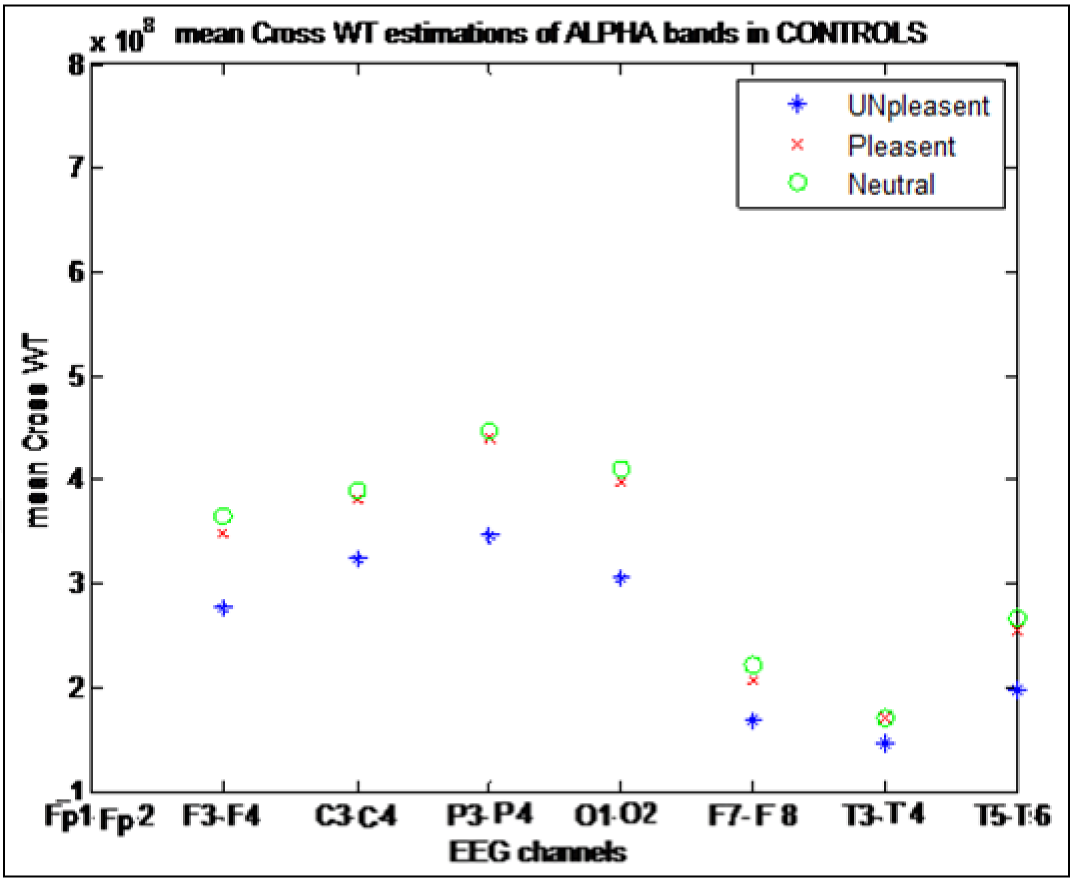
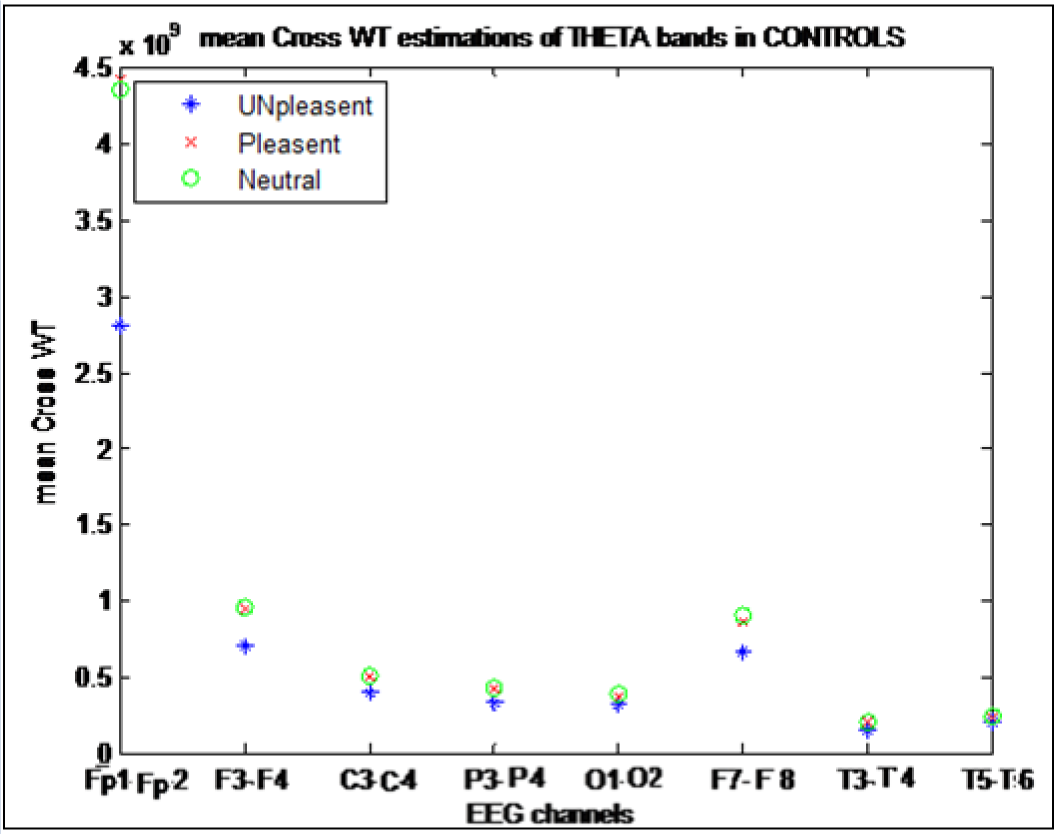


Figure 5.7 shows cross wavelet estimations of alpha band according to the stimulus types and neutral stimulus types has the highest spectrum and the intersections does not exist only in frontal (F3-F4, F7-F8) regions of the brain. Since there are lots of intersections in this frequency band and the results is not consistent with the previous studies, alpha band is not a valid frequency band for cross wavelet estimations.

Figure 5.8: Mean Cross WT Estimations Of THETA Bands In Controls



According to Figure 5.8, there is not a significant result in the cross wavelet analysis by means of emotional stimuli. Hemispheric comparison of the electrodes intersects at all regions of the brain. It can be said that theta band is also not validfor cross wavelet estimations.

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

ANOVA by means of EEG of the healthy control group, even if the research is limitted with subjects consist of only healthy men, may help the researchers have an idea about normal brain reactivity to emotional stimuli. With this information researchers, neorologists may diagnose patalogical conditions by relying on the studies focused on control groups.

For the future, researchers can determine specific regions and frequency bands to analyze the emotional state, frequency, electrode and band dependency with the use of the significant results of this study and make a validation by using neural networks. And for a better analysis Multivariate analysis of variance (MANOVA) can be used by giving the parameters different dimentions and remove the problem that ANOVA caused by taking the data together in terms of emotional state when applying the pairwie comparisons according to the band values and electrodes.

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APPENDICES

Appendix-1: Table 1, Wavelet Entropy, Band and Electrode Pairwise Comparisons

Measure:logen_entropy							
						95% Confidence Interval for Difference[a]	
Band	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.[a]	Lower Bound	Upper Bound
Delta	Fp1	Fp2	-3,912E11	7,878E10	,007	-7,183E11	-6,417E10
		F3	-3,958E11	7,901E10	,006	-7,238E11	-6,773E10
		F4	-3,968E11	7,903E10	,006	-7,249E11	-6,869E10
		F7	-3,970E11	7,903E10	,006	-7,252E11	-6,892E10
		C3	-3,915E11	7,873E10	,007	-7,183E11	-6,461E10
		C4	-3,957E11	7,900E10	,006	-7,237E11	-6,775E10
		P3	-3,966E11	7,900E10	,006	-7,245E11	-6,860E10
		P4	-3,968E11	7,899E10	,006	-7,248E11	-6,890E10
		T4	-3,957E11	7,901E10	,006	-7,237E11	-6,766E10
		T5	-3,961E11	7,906E10	,006	-7,243E11	-6,786E10
		T6	-3,968E11	7,906E10	,006	-7,250E11	-6,860E10
		O1	-3,970E11	7,906E10	,006	-7,252E11	-6,873E10
	Fp2	Fp1	3,912E11	7,878E10	,007	6,417E10	7,183E11
		F3	-4,545E9	1,033E9	,027	-8,834E9	-2,562E8
		F4	-5,582E9	1,216E9	,017	-1,063E10	-5,322E8
		F7	-5,814E9	1,231E9	,012	-1,092E10	-7,044E8
		F8	2,625E11	4,402E10	,001	7,971E10	4,452E11
		C4	-4,524E9	1,070E9	,042	-8,967E9	-8,105E7
		P3	-5,342E9	1,258E9	,040	-1,056E10	-1,196E8
		P4	-5,612E9	1,265E9	,025	-1,086E10	-3,589E8
		T5	-4,866E9	1,169E9	,049	-9,719E9	-1,362E7
		T6	-5,600E9	1,208E9	,015	-1,062E10	-5,842E8
		O1	-5,745E9	1,213E9	,012	-1,078E10	-7,098E8
	F3	Fp1	3,958E11	7,901E10	,006	6,773E10	7,238E11
		Fp2	4,545E9	1,033E9	,027	2,562E8	8,834E9
		F4	-1,037E9	2,205E8	,013	-1,952E9	-1,218E8

	F7	-1,269E9	2,393E8	,003	-2,262E9	-2,753E8
	F8	2,670E11	4,425E10	,001	8,332E10	4,507E11
	C3	4,309E9	1,027E9	,045	4,770E7	8,571E9
	T6	-1,055E9	2,046E8	,004	-1,904E9	-2,051E8
	O1	-1,200E9	2,480E8	,009	-2,230E9	-1,706E8
F4	Fp1	3,968E11	7,903E10	,006	6,869E10	7,249E11
	Fp2	5,582E9	1,216E9	,017	5,322E8	1,063E10
	F3	1,037E9	2,205E8	,013	1,218E8	1,952E9
	F7	-2,318E8	3,747E7	,000	-3,874E8	-7,627E7
	F8	2,681E11	4,426E10	,001	8,431E10	4,518E11
	C3	5,347E9	1,169E9	,018	4,934E8	1,020E10
	C4	1,058E9	1,880E8	,001	2,776E8	1,838E9
	T4	1,117E9	2,178E8	,005	2,125E8	2,021E9
	T5	7,157E8	1,512E8	,012	8,813E7	1,343E9
F5	Fp1	3,970E11	7,903E10	,006	6,892E10	7,252E11
	Fp2	5,814E9	1,231E9	,012	7,044E8	1,092E10
	F3	1,269E9	2,393E8	,003	2,753E8	2,262E9
	F4	2,318E8	3,747E7	,000	7,627E7	3,874E8
	F8	2,683E11	4,426E10	,001	8,453E10	4,520E11
	C3	5,578E9	1,177E9	,012	6,904E8	1,047E10
	C4	1,290E9	1,995E8	,000	4,618E8	2,118E9
	T4	1,349E9	2,293E8	,001	3,967E8	2,301E9
	T5	9,476E8	1,630E8	,001	2,709E8	1,624E9
F8						
	Fp2	-2,625E11	4,402E10	,001	-4,452E11	-7,971E10
	F3	-2,670E11	4,425E10	,001	-4,507E11	-8,332E10
	F4	-2,681E11	4,426E10	,001	-4,518E11	-8,431E10
	F7	-2,683E11	4,426E10	,001	-4,520E11	-8,453E10
	C3	-2,627E11	4,400E10	,001	-4,454E11	-8,005E10
	C4	-2,670E11	4,424E10	,001	-4,507E11	-8,334E10
	P3	-2,678E11	4,423E10	,001	-4,514E11	-8,421E10
	P4	-2,681E11	4,422E10	,001	-4,517E11	-8,450E10
	T4	-2,669E11	4,425E10	,001	-4,507E11	-8,322E10
	T5	-2,673E11	4,429E10	,001	-4,512E11	-8,349E10

	T6	-2,681E11	4,429E10	,001	-4,520E11	-8,418E10
	O1	-2,682E11	4,430E10	,001	-4,522E11	-8,429E10
C3	Fp1	3,915E11	7,873E10	,007	6,461E10	7,183E11
	F4	-5,347E9	1,169E9	,018	-1,020E10	-4,934E8
	F7	-5,578E9	1,177E9	,012	-1,047E10	-6,904E8
	F8	2,627E11	4,400E10	,001	8,005E10	4,454E11
	C4	-4,289E9	1,019E9	,044	-8,521E9	-5,624E7
	P3	-5,106E9	1,179E9	,032	-1,000E10	-2,097E8
	P4	-5,376E9	1,184E9	,019	-1,029E10	-4,603E8
	T6	-5,364E9	1,157E9	,015	-1,017E10	-5,590E8
	O1	-5,510E9	1,151E9	,011	-1,029E10	-7,295E8
C4	Fp1	3,957E11	7,900E10	,006	6,775E10	7,237E11
	Fp2	4,524E9	1,070E9	,042	8,105E7	8,967E9
	F4	-1,058E9	1,880E8	,001	-1,838E9	-2,776E8
	F7	-1,290E9	1,995E8	,000	-2,118E9	-4,618E8
	F8	2,670E11	4,424E10	,001	8,334E10	4,507E11
	C3	4,289E9	1,019E9	,044	5,624E7	8,521E9
	T6	-1,076E9	1,633E8	,000	-1,754E9	-3,974E8
	O1	-1,221E9	1,925E8	,000	-2,020E9	-4,218E8
P3	Fp1	3,966E11	7,900E10	,006	6,860E10	7,245E11
	Fp2	5,342E9	1,258E9	,040	1,196E8	1,056E10
	F8	2,678E11	4,423E10	,001	8,421E10	4,514E11
	C3	5,106E9	1,179E9	,032	2,097E8	1,000E10
	P4	-2,695E8	4,010E7	,000	-4,360E8	-1,030E8
P4	Fp1	3,968E11	7,899E10	,006	6,890E10	7,248E11
	Fp2	5,612E9	1,265E9	,025	3,589E8	1,086E10
	F8	2,681E11	4,422E10	,001	8,450E10	4,517E11
	C3	5,376E9	1,184E9	,019	4,603E8	1,029E10
	P3	2,695E8	4,010E7	,000	1,030E8	4,360E8
T4	Fp1	3,957E11	7,901E10	,006	6,766E10	7,237E11
	F4	-1,117E9	2,178E8	,005	-2,021E9	-2,125E8
	F7	-1,349E9	2,293E8	,001	-2,301E9	-3,967E8
	F8	2,669E11	4,425E10	,001	8,322E10	4,507E11
	T6	-1,134E9	2,058E8	,002	-1,989E9	-2,801E8

		O1	-1,280E9	2,622E8	,008	-2,368E9	-1,915E8
	T5	Fp1	3,961E11	7,906E10	,006	6,786E10	7,243E11
		Fp2	4,866E9	1,169E9	,049	1,362E7	9,719E9
		F4	-7,157E8	1,512E8	,012	-1,343E9	-8,813E7
		F7	-9,476E8	1,630E8	,001	-1,624E9	-2,709E8
		F8	2,673E11	4,429E10	,001	8,349E10	4,512E11
		T6	-7,333E8	1,206E8	,000	-1,234E9	-2,326E8
		O1	-8,788E8	1,749E8	,006	-1,605E9	-1,525E8
	T6	Fp1	3,968E11	7,906E10	,006	6,860E10	7,250E11
		Fp2	5,600E9	1,208E9	,015	5,842E8	1,062E10
		F3	1,055E9	2,046E8	,004	2,051E8	1,904E9
		F8	2,681E11	4,429E10	,001	8,418E10	4,520E11
		C3	5,364E9	1,157E9	,015	5,590E8	1,017E10
		C4	1,076E9	1,633E8	,000	3,974E8	1,754E9
		T4	1,134E9	2,058E8	,002	2,801E8	1,989E9
		T5	7,333E8	1,206E8	,000	2,326E8	1,234E9
	O1	Fp1	3,970E11	7,906E10	,006	6,873E10	7,252E11
		Fp2	5,745E9	1,213E9	,012	7,098E8	1,078E10
		F3	1,200E9	2,480E8	,009	1,706E8	2,230E9
		F8	2,682E11	4,430E10	,001	8,429E10	4,522E11
		C3	5,510E9	1,151E9	,011	7,295E8	1,029E10
		C4	1,221E9	1,925E8	,000	4,218E8	2,020E9
		T4	1,280E9	2,622E8	,008	1,915E8	2,368E9
		T5	8,788E8	1,749E8	,006	1,525E8	1,605E9
Theta	Fp1						
		F3	-1,142E9	1,953E8	,001	-1,953E9	-3,311E8
		F4	-1,490E9	1,930E8	,000	-2,291E9	-6,886E8
		F7	1,382E11	2,043E10	,000	5,341E10	2,230E11
		C4	-1,088E9	1,782E8	,000	-1,827E9	-3,481E8
		T5	-1,107E9	2,056E8	,003	-1,960E9	-2,531E8
		T6	-1,367E9	2,360E8	,001	-2,346E9	-3,869E8
		O1	8,939E10	1,536E10	,001	2,561E10	1,532E11
		O2	-8,533E8	1,856E8	,017	-1,624E9	-8,263E7

Fp2						
	F3	-8,060E8	1,294E8	,000	-1,343E9	-2,687E8
	F4	-1,154E9	1,633E8	,000	-1,832E9	-4,761E8
	F7	1,386E11	2,043E10	,000	5,373E10	2,234E11
	C4	-7,520E8	1,346E8	,002	-1,311E9	-1,933E8
	T5	-7,708E8	1,664E8	,015	-1,462E9	-7,998E7
	T6	-1,031E9	2,253E8	,018	-1,966E9	-9,566E7
	O1	8,972E10	1,534E10	,001	2,602E10	1,534E11
F3	Fp1	1,142E9	1,953E8	,001	3,311E8	1,953E9
	Fp2	8,060E8	1,294E8	,000	2,687E8	1,343E9
	F4	-3,481E8	5,963E7	,001	-5,956E8	-1,005E8
	F7	1,394E11	2,046E10	,000	5,442E10	2,243E11
	C3	1,279E9	2,530E8	,006	2,289E8	2,330E9
	T3	4,650E8	1,045E8	,024	3,101E7	8,990E8
	T4	1,504E9	2,576E8	,001	4,344E8	2,573E9
	O1	9,053E10	1,538E10	,001	2,669E10	1,544E11
F4	Fp1	1,490E9	1,930E8	,000	6,886E8	2,291E9
	Fp2	1,154E9	1,633E8	,000	4,761E8	1,832E9
	F3	3,481E8	5,963E7	,001	1,005E8	5,956E8
	F7	1,397E11	2,047E10	,000	5,472E10	2,247E11
	F8	7,846E8	1,631E8	,010	1,074E8	1,462E9
	C3	1,627E9	2,786E8	,001	4,705E8	2,784E9
	C4	4,021E8	8,419E7	,011	5,255E7	7,516E8
	T3	8,131E8	1,147E8	,000	3,369E8	1,289E9
	T4	1,852E9	2,872E8	,000	6,595E8	3,044E9
	T5	3,833E8	6,579E7	,001	1,102E8	6,564E8
	O1	9,088E10	1,539E10	,001	2,698E10	1,548E11
F7	Fp1	-1,382E11	2,043E10	,000	-2,230E11	-5,341E10
	Fp2	-1,386E11	2,043E10	,000	-2,234E11	-5,373E10
	F3	-1,394E11	2,046E10	,000	-2,243E11	-5,442E10
	F4	-1,397E11	2,047E10	,000	-2,247E11	-5,472E10
	F8	-1,389E11	2,040E10	,000	-2,236E11	-5,425E10
	C3	-1,381E11	2,045E10	,000	-2,230E11	-5,321E10
	C4	-1,393E11	2,049E10	,000	-2,244E11	-5,427E10

	P3	-1,393E11	2,053E10	,000	-2,245E11	-5,406E10
	P4	-7,863E10	1,492E10	,003	-1,406E11	-1,668E10
	T3	-1,389E11	2,040E10	,000	-2,236E11	-5,420E10
	T4	-1,379E11	2,046E10	,000	-2,228E11	-5,292E10
	T5	-1,393E11	2,048E10	,000	-2,243E11	-5,432E10
	T6	-1,396E11	2,050E10	,000	-2,247E11	-5,448E10
	O1	-4,884E10	9,932E9	,008	-9,007E10	-7,607E9
	O2	-1,391E11	2,040E10	,000	-2,238E11	-5,441E10
F8						
	F4	-7,846E8	1,631E8	,010	-1,462E9	-1,074E8
	F7	1,389E11	2,040E10	,000	5,425E10	2,236E11
	O1	9,009E10	1,535E10	,001	2,637E10	1,538E11
C3						
	F3	-1,279E9	2,530E8	,006	-2,330E9	-2,289E8
	F4	-1,627E9	2,786E8	,001	-2,784E9	-4,705E8
	F7	1,381E11	2,045E10	,000	5,321E10	2,230E11
	C4	-1,225E9	2,249E8	,002	-2,159E9	-2,917E8
	T5	-1,244E9	2,629E8	,012	-2,335E9	-1,526E8
	T6	-1,504E9	3,290E8	,018	-2,870E9	-1,380E8
	O1	8,925E10	1,539E10	,001	2,538E10	1,531E11
C4	Fp1	1,088E9	1,782E8	,000	3,481E8	1,827E9
	Fp2	7,520E8	1,346E8	,002	1,933E8	1,311E9
	F4	-4,021E8	8,419E7	,011	-7,516E8	-5,255E7
	F7	1,393E11	2,049E10	,000	5,427E10	2,244E11
	C3	1,225E9	2,249E8	,002	2,917E8	2,159E9
	T4	1,450E9	2,349E8	,000	4,746E8	2,425E9
	O1	9,047E10	1,540E10	,001	2,654E10	1,544E11
P3						
	F7	1,393E11	2,053E10	,000	5,406E10	2,245E11
	T4	1,425E9	3,107E8	,017	1,346E8	2,715E9
	O1	9,045E10	1,541E10	,001	2,649E10	1,544E11
P4						
	F7	7,863E10	1,492E10	,003	1,668E10	1,406E11
	O1	2,979E10	7,166E9	,049	3,714E7	5,953E10

T3						
	F3	-4,650E8	1,045E8	,024	-8,990E8	-3,101E7
	F4	-8,131E8	1,147E8	,000	-1,289E9	-3,369E8
	F7	1,389E11	2,040E10	,000	5,420E10	2,236E11
	O1	9,006E10	1,534E10	,001	2,637E10	1,538E11
T4						
	F3	-1,504E9	2,576E8	,001	-2,573E9	-4,344E8
	F4	-1,852E9	2,872E8	,000	-3,044E9	-6,595E8
	F7	1,379E11	2,046E10	,000	5,292E10	2,228E11
	C4	-1,450E9	2,349E8	,000	-2,425E9	-4,746E8
	P3	-1,425E9	3,107E8	,017	-2,715E9	-1,346E8
	T5	-1,469E9	2,592E8	,001	-2,544E9	-3,926E8
	T6	-1,729E9	3,241E8	,003	-3,074E9	-3,829E8
	O1	8,903E10	1,536E10	,001	2,526E10	1,528E11
T5	Fp1	1,107E9	2,056E8	,003	2,531E8	1,960E9
	Fp2	7,708E8	1,664E8	,015	7,998E7	1,462E9
	F4	-3,833E8	6,579E7	,001	-6,564E8	-1,102E8
	F7	1,393E11	2,048E10	,000	5,432E10	2,243E11
	C3	1,244E9	2,629E8	,012	1,526E8	2,335E9
	T4	1,469E9	2,592E8	,001	3,926E8	2,544E9
	O1	9,049E10	1,539E10	,001	2,662E10	1,544E11
T6	Fp1	1,367E9	2,360E8	,001	3,869E8	2,346E9
	Fp2	1,031E9	2,253E8	,018	9,566E7	1,966E9
	F7	1,396E11	2,050E10	,000	5,448E10	2,247E11
	C3	1,504E9	3,290E8	,018	1,380E8	2,870E9
	T4	1,729E9	3,241E8	,003	3,829E8	3,074E9
	O1	9,075E10	1,540E10	,001	2,680E10	1,547E11
O1	Fp1	-8,939E10	1,536E10	,001	-1,532E11	-2,561E10
	Fp2	-8,972E10	1,534E10	,001	-1,534E11	-2,602E10
	F3	-9,053E10	1,538E10	,001	-1,544E11	-2,669E10
	F4	-9,088E10	1,539E10	,001	-1,548E11	-2,698E10
	F7	4,884E10	9,932E9	,008	7,607E9	9,007E10
	F8	-9,009E10	1,535E10	,001	-1,538E11	-2,637E10
	C3	-8,925E10	1,539E10	,001	-1,531E11	-2,538E10

		C4	-9,047E10	1,540E10	,001	-1,544E11	-2,654E10
		P3	-9,045E10	1,541E10	,001	-1,544E11	-2,649E10
		P4	-2,979E10	7,166E9	,049	-5,953E10	-3,714E7
		T3	-9,006E10	1,534E10	,001	-1,538E11	-2,637E10
		T4	-8,903E10	1,536E10	,001	-1,528E11	-2,526E10
		T5	-9,049E10	1,539E10	,001	-1,544E11	-2,662E10
		T6	-9,075E10	1,540E10	,001	-1,547E11	-2,680E10
		O2	-9,024E10	1,535E10	,001	-1,540E11	-2,651E10
	O2	Fp1	8,533E8	1,856E8	,017	8,263E7	1,624E9
		F7	1,391E11	2,040E10	,000	5,441E10	2,238E11
		O1	9,024E10	1,535E10	,001	2,651E10	1,540E11
alpha	Fp1	Fp2	-1,602E9	2,796E8	,001	-2,763E9	-4,409E8
		F3	-1,846E9	3,131E8	,001	-3,145E9	-5,460E8
		F4	2,350E11	4,958E10	,012	2,922E10	4,409E11
		F7	-1,067E9	2,522E8	,041	-2,114E9	-2,032E7
		C3	-1,556E9	2,986E8	,004	-2,796E9	-3,168E8
		C4	-1,893E9	3,293E8	,001	-3,260E9	-5,259E8
		P3	9,338E10	2,014E10	,015	9,766E9	1,770E11
		P4	-1,242E9	2,562E8	,009	-2,306E9	-1,788E8
		T4	-1,573E9	3,330E8	,012	-2,956E9	-1,908E8
		T5	-1,839E9	3,570E8	,004	-3,322E9	-3,571E8
		T6	1,300E11	2,306E10	,001	3,426E10	2,257E11
		O1	-1,248E9	2,665E8	,014	-2,355E9	-1,418E8
	Fp2	Fp1	1,602E9	2,796E8	,001	4,409E8	2,763E9
		F4	2,366E11	4,960E10	,011	3,072E10	4,426E11
		F7	5,345E8	9,433E7	,001	1,429E8	9,261E8
		F8	1,771E9	3,248E8	,002	4,230E8	3,119E9
		P3	9,499E10	2,017E10	,013	1,125E10	1,787E11
		P4	3,593E8	7,120E7	,006	6,373E7	6,550E8
		T3	1,199E9	2,310E8	,004	2,402E8	2,158E9
		T6	1,316E11	2,306E10	,001	3,585E10	2,273E11
		O1	3,535E8	6,601E7	,003	7,942E7	6,275E8
		O2	1,256E9	2,844E8	,026	7,491E7	2,437E9
	F3	Fp1	1,846E9	3,131E8	,001	5,460E8	3,145E9

	F4	2,369E11	4,963E10	,011	3,082E10	4,429E11
	F7	7,784E8	1,250E8	,000	2,596E8	1,297E9
	F8	2,015E9	3,388E8	,001	6,086E8	3,422E9
	P3	9,523E10	2,020E10	,013	1,136E10	1,791E11
	P4	6,032E8	1,027E8	,001	1,770E8	1,029E9
	T3	1,443E9	2,642E8	,002	3,461E8	2,540E9
	T6	1,318E11	2,309E10	,001	3,600E10	2,277E11
	O1	5,974E8	1,033E8	,001	1,685E8	1,026E9
	O2	1,500E9	3,074E8	,008	2,236E8	2,776E9
F4	Fp1	-2,350E11	4,958E10	,012	-4,409E11	-2,922E10
	Fp2	-2,366E11	4,960E10	,011	-4,426E11	-3,072E10
	F3	-2,369E11	4,963E10	,011	-4,429E11	-3,082E10
	F7	-2,361E11	4,957E10	,011	-4,419E11	-3,031E10
	F8	-2,349E11	4,960E10	,012	-4,408E11	-2,893E10
	C3	-2,366E11	4,961E10	,011	-4,425E11	-3,064E10
	C4	-2,369E11	4,963E10	,011	-4,430E11	-3,088E10
	P4	-2,363E11	4,957E10	,011	-4,421E11	-3,049E10
	T3	-2,354E11	4,958E10	,012	-4,413E11	-2,959E10
	T4	-2,366E11	4,962E10	,011	-4,426E11	-3,060E10
	T5	-2,369E11	4,965E10	,011	-4,430E11	-3,074E10
	O1	-2,363E11	4,959E10	,011	-4,421E11	-3,043E10
	O2	-2,354E11	4,962E10	,012	-4,414E11	-2,939E10
F7	Fp1	1,067E9	2,522E8	,041	2,032E7	2,114E9
	Fp2	-5,345E8	9,433E7	,001	-9,261E8	-1,429E8
	F3	-7,784E8	1,250E8	,000	-1,297E9	-2,596E8
	F4	2,361E11	4,957E10	,011	3,031E10	4,419E11
	F8	1,237E9	2,975E8	,049	1619844,47	2,472E9
	C3	-4,891E8	1,055E8	,015	-9,269E8	-5,130E7
	C4	-8,258E8	1,218E8	,000	-1,331E9	-3,202E8
	P3	9,445E10	2,014E10	,013	1,083E10	1,781E11
	T5	-7,721E8	1,710E8	,021	-1,482E9	-6,211E7
	T6	1,311E11	2,303E10	,001	3,546E10	2,267E11
F8						
	Fp2	-1,771E9	3,248E8	,002	-3,119E9	-4,230E8

	F3	-2,015E9	3,388E8	,001	-3,422E9	-6,086E8
	F4	2,349E11	4,960E10	,012	2,893E10	4,408E11
	F7	-1,237E9	2,975E8	,049	-2,472E9	-1619844
	C3	-1,726E9	3,212E8	,003	-3,059E9	-3,923E8
	C4	-2,063E9	3,577E8	,001	-3,547E9	-5,776E8
	P3	9,322E10	2,017E10	,016	9,484E9	1,769E11
	P4	-1,412E9	2,993E8	,013	-2,655E9	-1,692E8
	T4	-1,743E9	3,759E8	,015	-3,303E9	-1,822E8
	T5	-2,009E9	4,001E8	,006	-3,670E9	-3,478E8
	T6	1,298E11	2,306E10	,001	3,410E10	2,256E11
	O1	-1,418E9	3,059E8	,015	-2,688E9	-1,476E8
C3	Fp1	1,556E9	2,986E8	,004	3,168E8	2,796E9
	F4	2,366E11	4,961E10	,011	3,064E10	4,425E11
	F7	4,891E8	1,055E8	,015	5,130E7	9,269E8
	F8	1,726E9	3,212E8	,003	3,923E8	3,059E9
	C4	-3,367E8	5,763E7	,001	-5,760E8	-9,746E7
	P3	9,494E10	2,017E10	,013	1,118E10	1,787E11
	T3	1,154E9	2,362E8	,008	1,731E8	2,134E9
	T6	1,316E11	2,306E10	,001	3,582E10	2,273E11
	O2	1,210E9	2,780E8	,031	5,612E7	2,365E9
C4	Fp1	1,893E9	3,293E8	,001	5,259E8	3,260E9
	F4	2,369E11	4,963E10	,011	3,088E10	4,430E11
	F7	8,258E8	1,218E8	,000	3,202E8	1,331E9
	F8	2,063E9	3,577E8	,001	5,776E8	3,547E9
	C3	3,367E8	5,763E7	,001	9,746E7	5,760E8
	P3	9,528E10	2,020E10	,013	1,143E10	1,791E11
	P4	6,507E8	1,199E8	,002	1,529E8	1,148E9
	T3	1,490E9	2,740E8	,002	3,530E8	2,628E9
	T6	1,319E11	2,308E10	,001	3,608E10	2,277E11
	O1	6,448E8	1,064E8	,001	2,033E8	1,086E9
	O2	1,547E9	3,145E8	,008	2,415E8	2,853E9
P3	Fp1	-9,338E10	2,014E10	,015	-1,770E11	-9,766E9
	Fp2	-9,499E10	2,017E10	,013	-1,787E11	-1,125E10
	F3	-9,523E10	2,020E10	,013	-1,791E11	-1,136E10

	F7	-9,445E10	2,014E10	,013	-1,781E11	-1,083E10
	F8	-9,322E10	2,017E10	,016	-1,769E11	-9,484E9
	C3	-9,494E10	2,017E10	,013	-1,787E11	-1,118E10
	C4	-9,528E10	2,020E10	,013	-1,791E11	-1,143E10
	P4	-9,463E10	2,014E10	,013	-1,782E11	-1,103E10
	T3	-9,379E10	2,015E10	,015	-1,774E11	-1,013E10
	T4	-9,496E10	2,019E10	,013	-1,788E11	-1,113E10
	T5	-9,522E10	2,022E10	,013	-1,792E11	-1,129E10
	O1	-9,463E10	2,015E10	,013	-1,783E11	-1,099E10
	O2	-9,373E10	2,018E10	,015	-1,775E11	-9,958E9
P4	Fp1	1,242E9	2,562E8	,009	1,788E8	2,306E9
	Fp2	-3,593E8	7,120E7	,006	-6,550E8	-6,373E7
	F3	-6,032E8	1,027E8	,001	-1,029E9	-1,770E8
	F4	2,363E11	4,957E10	,011	3,049E10	4,421E11
	F8	1,412E9	2,993E8	,013	1,692E8	2,655E9
	C4	-6,507E8	1,199E8	,002	-1,148E9	-1,529E8
	P3	9,463E10	2,014E10	,013	1,103E10	1,782E11
	T6	1,312E11	2,304E10	,001	3,560E10	2,269E11
T3						
	Fp2	-1,199E9	2,310E8	,004	-2,158E9	-2,402E8
	F3	-1,443E9	2,642E8	,002	-2,540E9	-3,461E8
	F4	2,354E11	4,958E10	,012	2,959E10	4,413E11
	C3	-1,154E9	2,362E8	,008	-2,134E9	-1,731E8
	C4	-1,490E9	2,740E8	,002	-2,628E9	-3,530E8
	P3	9,379E10	2,015E10	,015	1,013E10	1,774E11
	T4	-1,171E9	2,633E8	,024	-2,264E9	-7,754E7
	T5	-1,437E9	2,946E8	,009	-2,660E9	-2,137E8
	T6	1,304E11	2,306E10	,001	3,467E10	2,261E11
T4	Fp1	1,573E9	3,330E8	,012	1,908E8	2,956E9
	F4	2,366E11	4,962E10	,011	3,060E10	4,426E11
	F8	1,743E9	3,759E8	,015	1,822E8	3,303E9
	P3	9,496E10	2,019E10	,013	1,113E10	1,788E11
	T3	1,171E9	2,633E8	,024	7,754E7	2,264E9

	T5	-2,660E8	6,019E7	,026	-5,159E8	-1,614E7
	T6	1,316E11	2,309E10	,001	3,572E10	2,274E11
T5	Fp1	1,839E9	3,570E8	,004	3,571E8	3,322E9
	F4	2,369E11	4,965E10	,011	3,074E10	4,430E11
	F7	7,721E8	1,710E8	,021	6,211E7	1,482E9
	F8	2,009E9	4,001E8	,006	3,478E8	3,670E9
	P3	9,522E10	2,022E10	,013	1,129E10	1,792E11
	T3	1,437E9	2,946E8	,009	2,137E8	2,660E9
	T4	2,660E8	6,019E7	,026	1,614E7	5,159E8
	T6	1,318E11	2,311E10	,001	3,589E10	2,278E11
	O1	5,911E8	1,422E8	,049	665229,718	1,182E9
	O2	1,493E9	3,380E8	,026	9,037E7	2,896E9
T6	Fp1	-1,300E11	2,306E10	,001	-2,257E11	-3,426E10
	Fp2	-1,316E11	2,306E10	,001	-2,273E11	-3,585E10
	F3	-1,318E11	2,309E10	,001	-2,277E11	-3,600E10
	F7	-1,311E11	2,303E10	,001	-2,267E11	-3,546E10
	F8	-1,298E11	2,306E10	,001	-2,256E11	-3,410E10
	C3	-1,316E11	2,306E10	,001	-2,273E11	-3,582E10
	C4	-1,319E11	2,308E10	,001	-2,277E11	-3,608E10
	P4	-1,312E11	2,304E10	,001	-2,269E11	-3,560E10
	T3	-1,304E11	2,306E10	,001	-2,261E11	-3,467E10
	T4	-1,316E11	2,309E10	,001	-2,274E11	-3,572E10
	T5	-1,318E11	2,311E10	,001	-2,278E11	-3,589E10
	O1	-1,312E11	2,304E10	,001	-2,269E11	-3,558E10
	O2	-1,303E11	2,307E10	,001	-2,261E11	-3,455E10
O1	Fp1	1,248E9	2,665E8	,014	1,418E8	2,355E9
	Fp2	-3,535E8	6,601E7	,003	-6,275E8	-7,942E7
	F3	-5,974E8	1,033E8	,001	-1,026E9	-1,685E8
	F4	2,363E11	4,959E10	,011	3,043E10	4,421E11
	F8	1,418E9	3,059E8	,015	1,476E8	2,688E9
	C4	-6,448E8	1,064E8	,001	-1,086E9	-2,033E8
	P3	9,463E10	2,015E10	,013	1,099E10	1,783E11
	T5	-5,911E8	1,422E8	,049	-1,182E9	-665229
	T6	1,312E11	2,304E10	,001	3,558E10	2,269E11

	O2						
		Fp2	-1,256E9	2,844E8	,026	-2,437E9	-7,491E7
		F3	-1,500E9	3,074E8	,008	-2,776E9	-2,236E8
		F4	2,354E11	4,962E10	,012	2,939E10	4,414E11
		C3	-1,210E9	2,780E8	,031	-2,365E9	-5,612E7
		C4	-1,547E9	3,145E8	,008	-2,853E9	-2,415E8
		P3	9,373E10	2,018E10	,015	9,958E9	1,775E11
		T5	-1,493E9	3,380E8	,026	-2,896E9	-9,037E7
		T6	1,303E11	2,307E10	,001	3,455E10	2,261E11
Beta	Fp1						
		F3	2,128E11	5,001E10	,039	5,198E9	4,205E11
		C4	2,158E11	4,952E10	,030	1,024E10	4,214E11
	Fp2						
		F3	2,131E11	5,002E10	,038	5,399E9	4,207E11
		C4	2,161E11	4,953E10	,030	1,044E10	4,217E11
	F3	Fp1	-2,128E11	5,001E10	,039	-4,205E11	-5,198E9
		Fp2	-2,131E11	5,002E10	,038	-4,207E11	-5,399E9
		F4	-2,119E11	4,999E10	,041	-4,194E11	-4,305E9
		F7	-2,127E11	4,998E10	,039	-4,201E11	-5,163E9
		F8	-2,127E11	5,000E10	,039	-4,203E11	-5,090E9
		C3	-2,124E11	5,004E10	,040	-4,201E11	-4,636E9
		P3	-2,121E11	5,002E10	,040	-4,198E11	-4,448E9
		P4	-2,125E11	5,000E10	,039	-4,200E11	-4,903E9
		T3	-2,127E11	5,002E10	,039	-4,203E11	-5,023E9
		T4	-2,127E11	5,003E10	,039	-4,204E11	-4,988E9
		T6	-2,131E11	4,998E10	,038	-4,205E11	-5,574E9
		O1	-2,126E11	4,999E10	,039	-4,201E11	-5,086E9
		O2	-2,119E11	5,010E10	,041	-4,199E11	-3,932E9
	F4						
		F3	2,119E11	4,999E10	,041	4,305E9	4,194E11
		F7	-7,903E8	1,724E8	,017	-1,506E9	-7,473E7
		C4	2,149E11	4,951E10	,032	9,321E9	4,204E11
		T6	-1,190E9	1,781E8	,000	-1,930E9	-4,510E8
	F7						

	F3	2,127E11	4,998E10	,039	5,163E9	4,201E11
	F4	7,903E8	1,724E8	,017	7,473E7	1,506E9
	C4	2,157E11	4,949E10	,030	1,021E10	4,211E11
	T6	-4,001E8	8,509E7	,013	-7,533E8	-4,683E7
F8						
	F3	2,127E11	5,000E10	,039	5,090E9	4,203E11
	C4	2,157E11	4,952E10	,030	1,012E10	4,213E11
C3						
	F3	2,124E11	5,004E10	,040	4,636E9	4,201E11
	C4	2,154E11	4,955E10	,031	9,669E9	4,211E11
C4	Fp1	-2,158E11	4,952E10	,030	-4,214E11	-1,024E10
	Fp2	-2,161E11	4,953E10	,030	-4,217E11	-1,044E10
	F4	-2,149E11	4,951E10	,032	-4,204E11	-9,321E9
	F7	-2,157E11	4,949E10	,030	-4,211E11	-1,021E10
	F8	-2,157E11	4,952E10	,030	-4,213E11	-1,012E10
	C3	-2,154E11	4,955E10	,031	-4,211E11	-9,669E9
	P3	-2,151E11	4,951E10	,031	-4,207E11	-9,549E9
	P4	-2,155E11	4,950E10	,031	-4,210E11	-9,973E9
	T3	-2,157E11	4,952E10	,030	-4,213E11	-1,010E10
	T4	-2,157E11	4,952E10	,030	-4,213E11	-1,009E10
	T6	-2,161E11	4,946E10	,029	-4,214E11	-1,070E10
	O1	-2,156E11	4,948E10	,030	-4,211E11	-1,018E10
	O2	-2,149E11	4,958E10	,032	-4,208E11	-9,115E9
P3						
	F3	2,121E11	5,002E10	,040	4,448E9	4,198E11
	C4	2,151E11	4,951E10	,031	9,549E9	4,207E11
	T6	-9,469E8	2,105E8	,021	-1,821E9	-7,283E7
P4						
	F3	2,125E11	5,000E10	,039	4,903E9	4,200E11
	C4	2,155E11	4,950E10	,031	9,973E9	4,210E11
T3						
	F3	2,127E11	5,002E10	,039	5,023E9	4,203E11
	C4	2,157E11	4,952E10	,030	1,010E10	4,213E11
T4						

		F3	2,127E11	5,003E10	,039	4,988E9	4,204E11
		C4	2,157E11	4,952E10	,030	1,009E10	4,213E11
	T6						
		F3	2,131E11	4,998E10	,038	5,574E9	4,205E11
		F4	1,190E9	1,781E8	,000	4,510E8	1,930E9
		F7	4,001E8	8,509E7	,013	4,683E7	7,533E8
		C4	2,161E11	4,946E10	,029	1,070E10	4,214E11
		P3	9,469E8	2,105E8	,021	7,283E7	1,821E9
	O1						
		F3	2,126E11	4,999E10	,039	5,086E9	4,201E11
		C4	2,156E11	4,948E10	,030	1,018E10	4,211E11
	O2						
		F3	2,119E11	5,010E10	,041	3,932E9	4,199E11
Gamma	Fp1	Fp2	1,398E11	3,074E10	,019	1,215E10	2,674E11
	Fp2	Fp1	-1,398E11	3,074E10	,019	-2,674E11	-1,215E10
		F3	-1,414E11	3,048E10	,015	-2,680E11	-1,484E10
		F4	-1,406E11	3,053E10	,016	-2,673E11	-1,386E10
		F7	-1,399E11	3,064E10	,018	-2,671E11	-1,271E10
		F8	-1,397E11	3,070E10	,019	-2,672E11	-1,225E10
		C4	-1,414E11	3,047E10	,015	-2,679E11	-1,493E10
		P3	-1,408E11	3,048E10	,016	-2,673E11	-1,425E10
		P4	-1,414E11	3,054E10	,016	-2,682E11	-1,462E10
		T3	-1,415E11	3,056E10	,016	-2,683E11	-1,462E10
		T5	-1,413E11	3,048E10	,015	-2,678E11	-1,476E10
		T6	-1,403E11	3,054E10	,017	-2,671E11	-1,351E10
		O1	-1,411E11	3,056E10	,016	-2,680E11	-1,428E10
		O2	-1,412E11	3,059E10	,016	-2,682E11	-1,423E10
	F3						
		Fp2	1,414E11	3,048E10	,015	1,484E10	2,680E11
	F4						
		Fp2	1,406E11	3,053E10	,016	1,386E10	2,673E11
	F7						
		Fp2	1,399E11	3,064E10	,018	1,271E10	2,671E11

F8						
	Fp2	1,397E11	3,070E10	,019	1,225E10	2,672E11
C4						
	Fp2	1,414E11	3,047E10	,015	1,493E10	2,679E11
	P3	6,186E8	1,300E8	,011	7,902E7	1,158E9
P3						
	Fp2	1,408E11	3,048E10	,016	1,425E10	2,673E11
	C4	-6,186E8	1,300E8	,011	-1,158E9	-7,902E7
P4						
	Fp2	1,414E11	3,054E10	,016	1,462E10	2,682E11
T3						
	Fp2	1,415E11	3,056E10	,016	1,462E10	2,683E11
T5						
	Fp2	1,413E11	3,048E10	,015	1,476E10	2,678E11
O2						
	Fp2	1,403E11	3,054E10	,017	1,351E10	2,671E11
O1						
	Fp2	1,411E11	3,056E10	,016	1,428E10	2,680E11
O2						
	Fp2	1,412E11	3,059E10	,016	1,423E10	2,682E11

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Appendix-2: Table 2, Wavelet Energy, Pairwise Comparisons of the Electrodes

(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Fp1	Fp2	-,001	,000	1,000	-,003	,001
	F3	,001*	,000	,018	,000	,003
	F4	,001	,000	,079	-5,081E-5	,002
	F7	,001	,000	,282	,000	,002
	F8	5,274E-5	,000	1,000	-,001	,001
	C3	-,001	,000	,937	-,003	,000
	C4	,001*	,000	,013	,000	,003
	P3	,001	,000	,334	,000	,002
	P4	,001*	,000	,011	,000	,003
	T3	,001	,000	,099	-7,692E-5	,002
	T4	,001	,000	1,000	-,001	,002
	T5	,001*	,000	,018	,000	,003
	T6	,001*	,000	,013	,000	,003
	O1	,002*	,000	,006	,000	,003
	O2	,001	,000	1,000	,000	,002
Fp2	Fp1	,001	,000	1,000	-,001	,003
	F3	,002*	,000	,003	,000	,004
	F4	,002*	,000	,011	,000	,003
	F7	,002	,000	,278	,000	,004
	F8	,001	,000	1,000	-,001	,003
	C3	,000	,000	1,000	-,002	,001
	C4	,002*	,000	,004	,000	,004
	P3	,002	,000	,056	-1,836E-5	,003
	P4	,002*	,001	,028	,000	,004
	T3	,002	,000	,107	,000	,004
	T4	,001	,000	,642	,000	,003
	T5	,002*	,000	,010	,000	,004
	T6	,002*	,000	,010	,000	,004
	O1	,002*	,001	,018	,000	,004

	O2	,001	,001	1,000	-,001	,004
F3	Fp1	-,001*	,000	,018	-,003	,000
	Fp2	-,002*	,000	,003	-,004	,000
	F4	,000*	,000	,026	-,001	-1,939E-5
	F7	-,001	,000	1,000	-,002	,001
	F8	-,001	,000	,080	-,003	6,517E-5
	C3	-,003*	,000	,001	-,004	-,001
	C4	8,331E-6	,000	1,000	,000	,000
	P3	,000	,000	,266	-,001	8,867E-5
	P4	6,959E-5	,000	1,000	-,001	,001
	T3	,000	,000	1,000	-,001	,000
	T4	-,001*	,000	,000	-,001	,000
	T5	8,864E-5	,000	1,000	,000	,000
	T6	7,498E-5	,000	1,000	,000	,001
	O1	,000	,000	1,000	-,001	,001
	O2	-,001	,000	1,000	-,002	,001
F4	Fp1	-,001	,000	,079	-,002	5,081E-5
	Fp2	-,002*	,000	,011	-,003	,000
	F3	,000*	,000	,026	1,939E-5	,001
	F7	,000	,000	1,000	-,001	,001
	F8	-,001	,000	,250	-,002	,000
	C3	-,002*	,000	,002	-,004	-,001
	C4	,000	,000	,158	-4,332E-5	,001
	P3	,000	,000	1,000	-,001	,000
	P4	,000	,000	1,000	,000	,001
	T3	-9,746E-6	,000	1,000	-,001	,001
	T4	-,001*	,000	,012	-,001	-6,632E-5
	T5	,000	,000	,409	,000	,001
	T6	,000	,000	,641	,000	,001
	O1	,000	,000	1,000	,000	,001
	O2	,000	,000	1,000	-,002	,001
F7	Fp1	-,001	,000	,282	-,002	,000
	Fp2	-,002	,000	,278	-,004	,000
	F3	,001	,000	1,000	-,001	,002

	F4	,000	,000	1,000	-,001	,001
	F8	-,001*	,000	,004	-,002	,000
	C3	-,002	,001	,070	-,004	7,057E-5
	C4	,001	,000	1,000	,000	,002
	P3	6,173E-5	,000	1,000	-,001	,001
	P4	,001	,000	1,000	,000	,002
	T3	,000	,000	1,000	-,001	,001
	T4	,000	,000	1,000	-,001	,001
	T5	,001	,000	1,000	,000	,002
	T6	,001	,000	1,000	,000	,002
	O1	,001	,000	1,000	,000	,002
	O2	,000	,000	1,000	-,001	,001
F8	Fp1	-5,274E-5	,000	1,000	-,001	,001
	Fp2	-,001	,000	1,000	-,003	,001
	F3	,001	,000	,080	-6,517E-5	,003
	F4	,001	,000	,250	,000	,002
	F7	,001*	,000	,004	,000	,002
	C3	-,001	,000	1,000	-,003	,001
	C4	,001	,000	,063	-3,215E-5	,003
	P3	,001	,000	1,000	,000	,002
	P4	,001	,000	,052	-4,706E-6	,003
	T3	,001	,000	,306	,000	,002
	T4	,000	,000	1,000	-,001	,002
	T5	,001	,000	,051	-1,473E-6	,003
	T6	,001*	,000	,035	4,823E-5	,003
	O1	,001*	,000	,044	1,707E-5	,003
	O2	,001	,000	1,000	-,001	,002
C3	Fp1	,001	,000	,937	,000	,003
	Fp2	,000	,000	1,000	-,001	,002
	F3	,003*	,000	,001	,001	,004
	F4	,002*	,000	,002	,001	,004
	F7	,002	,001	,070	-7,057E-5	,004
	F8	,001	,000	1,000	-,001	,003
	C4	,003*	,000	,001	,001	,004

	P3	,002*	,000	,004	,000	,004
	P4	,003*	,001	,004	,001	,005
	T3	,002*	,000	,022	,000	,004
	T4	,002	,000	,086	-9,650E-5	,003
	T5	,003*	,000	,002	,001	,005
	T6	,003*	,000	,002	,001	,005
	O1	,003*	,001	,003	,001	,005
	O2	,002	,001	,507	-,001	,004
C4	Fp1	-,001*	,000	,013	-,003	,000
	Fp2	-,002*	,000	,004	-,004	,000
	F3	-8,331E-6	,000	1,000	,000	,000
	F4	,000	,000	,158	-,001	4,332E-5
	F7	-,001	,000	1,000	-,002	,000
	F8	-,001	,000	,063	-,003	3,215E-5
	C3	-,003*	,000	,001	-,004	-,001
	P3	,000	,000	,324	-,001	,000
	P4	6,126E-5	,000	1,000	-,001	,001
	T3	,000	,000	1,000	-,001	,000
	T4	-,001*	,000	,000	-,001	,000
	T5	8,031E-5	,000	1,000	,000	,000
	T6	6,665E-5	,000	1,000	,000	,001
	O1	,000	,000	1,000	,000	,001
	O2	-,001	,000	1,000	-,002	,001
P3	Fp1	-,001	,000	,334	-,002	,000
	Fp2	-,002	,000	,056	-,003	1,836E-5
	F3	,000	,000	,266	-8,867E-5	,001
	F4	,000	,000	1,000	,000	,001
	F7	-6,173E-5	,000	1,000	-,001	,001
	F8	-,001	,000	1,000	-,002	,000
	C3	-,002*	,000	,004	-,004	,000
	C4	,000	,000	,324	,000	,001
	P4	,001	,000	,248	-9,717E-5	,001
	T3	,000	,000	1,000	-,001	,001
	T4	,000	,000	1,000	-,001	,000

	T5	,001	,000	,554	,000	,001
	T6	,001	,000	,484	,000	,001
	O1	,001	,000	1,000	,000	,001
	O2	,000	,000	1,000	-,002	,001
P4	Fp1	-,001*	,000	,011	-,003	,000
	Fp2	-,002*	,001	,028	-,004	,000
	F3	-6,959E-5	,000	1,000	-,001	,001
	F4	,000	,000	1,000	-,001	,000
	F7	-,001	,000	1,000	-,002	,000
	F8	-,001	,000	,052	-,003	4,706E-6
	C3	-,003*	,001	,004	-,005	-,001
	C4	-6,126E-5	,000	1,000	-,001	,001
	P3	-,001	,000	,248	-,001	9,717E-5
	T3	,000	,000	,546	-,001	,000
	T4	-,001*	,000	,005	-,002	,000
	T5	1,905E-5	,000	1,000	-,001	,001
	T6	5,386E-6	,000	1,000	-,001	,001
	O1	4,481E-5	,000	1,000	-,001	,001
	O2	-,001	,000	1,000	-,002	,000
T3	Fp1	-,001	,000	,099	-,002	7,692E-5
	Fp2	-,002	,000	,107	-,004	,000
	F3	,000	,000	1,000	,000	,001
	F4	9,746E-6	,000	1,000	-,001	,001
	F7	,000	,000	1,000	-,001	,001
	F8	-,001	,000	,306	-,002	,000
	C3	-,002*	,000	,022	-,004	,000
	C4	,000	,000	1,000	,000	,001
	P3	,000	,000	1,000	-,001	,001
	P4	,000	,000	,546	,000	,001
	T4	-,001	,000	,245	-,001	9,863E-5
	T5	,000	,000	,162	-5,614E-5	,001
	T6	,000	,000	,370	,000	,001
	O1	,000*	,000	,004	9,048E-5	,001
	O2	,000	,000	1,000	-,001	,001

T4	Fp1	-,001	,000	1,000	-,002	,001
	Fp2	-,001	,000	,642	-,003	,000
	F3	,001*	,000	,000	,000	,001
	F4	,001*	,000	,012	6,632E-5	,001
	F7	,000	,000	1,000	-,001	,001
	F8	,000	,000	1,000	-,002	,001
	C3	-,002	,000	,086	-,003	9,650E-5
	C4	,001*	,000	,000	,000	,001
	P3	,000	,000	1,000	,000	,001
	T3	,001*	,000	,005	,000	,002
	T4	,001	,000	,245	-9,863E-5	,001
	T5	,001*	,000	,000	,000	,002
	T6	,001*	,000	,000	,000	,002
	O1	,001*	,000	,002	,000	,002
	O2	,000	,000	1,000	-,001	,002
T5	Fp1	-,001*	,000	,018	-,003	,000
	Fp2	-,002*	,000	,010	-,004	,000
	F3	-8,864E-5	,000	1,000	,000	,000
	F4	,000	,000	,409	-,001	,000
	F7	-,001	,000	1,000	-,002	,000
	F8	-,001	,000	,051	-,003	1,473E-6
	C3	-,003*	,000	,002	-,005	-,001
	C4	-8,031E-5	,000	1,000	,000	,000
	P3	-,001	,000	,554	-,001	,000
	P4	-1,905E-5	,000	1,000	-,001	,001
	T3	,000	,000	,162	-,001	5,614E-5
	T4	-,001*	,000	,000	-,002	,000
	T6	-1,366E-5	,000	1,000	,000	,000
	O1	2,576E-5	,000	1,000	,000	,001
	O2	-,001	,000	1,000	-,002	,001
T6	Fp1	-,001*	,000	,013	-,003	,000
	Fp2	-,002*	,000	,010	-,004	,000
	F3	-7,498E-5	,000	1,000	-,001	,000
	F4	,000	,000	,641	-,001	,000

	F7	-,001	,000	1,000	-,002	,000
	F8	-,001*	,000	,035	-,003	-4,823E-5
	C3	-,003*	,000	,002	-,005	-,001
	C4	-6,665E-5	,000	1,000	-,001	,000
	P3	-,001	,000	,484	-,001	,000
	P4	-5,386E-6	,000	1,000	-,001	,001
	T3	,000	,000	,370	-,001	,000
	T4	-,001*	,000	,000	-,002	,000
	T5	1,366E-5	,000	1,000	,000	,000
	O1	3,943E-5	,000	1,000	-,001	,001
	O2	-,001	,000	1,000	-,002	,001
O1	Fp1	-,002*	,000	,006	-,003	,000
	Fp2	-,002*	,001	,018	-,004	,000
	F3	,000	,000	1,000	-,001	,001
	F4	,000	,000	1,000	-,001	,000
	F7	-,001	,000	1,000	-,002	,000
	F8	-,001*	,000	,044	-,003	-1,707E-5
	C3	-,003*	,001	,003	-,005	-,001
	C4	,000	,000	1,000	-,001	,000
	P3	-,001	,000	1,000	-,001	,000
	P4	-4,481E-5	,000	1,000	-,001	,001
	T3	,000*	,000	,004	-,001	-9,048E-5
	T4	-,001*	,000	,002	-,002	,000
	T5	-2,576E-5	,000	1,000	-,001	,000
	T6	-3,943E-5	,000	1,000	-,001	,001
	O2	-,001	,000	,572	-,002	,000
O2	Fp1	-,001	,000	1,000	-,002	,000
	Fp2	-,001	,001	1,000	-,004	,001
	F3	,001	,000	1,000	-,001	,002
	F4	,000	,000	1,000	-,001	,002
	F7	,000	,000	1,000	-,001	,001
	F8	-,001	,000	1,000	-,002	,001
	C3	-,002	,001	,507	-,004	,001
	C4	,001	,000	1,000	-,001	,002

P3	,000	,000	1,000	-,001	,002
P4	,001	,000	1,000	,000	,002
T3	,000	,000	1,000	-,001	,001
T4	,000	,000	1,000	-,002	,001
T5	,001	,000	1,000	-,001	,002
T6	,001	,000	1,000	-,001	,002
O1	,001	,000	,572	,000	,002

Appendix-3: Table 3, Wavelet Energy, Pairwise Comparisons of the Electrodes According to the Band Values

Electrode	(I) Band	(J) Band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Fp1	Delta	Theta	-,002*	,000	,010	-,003	,000
		Alpha	-,002	,001	,080	-,004	,000
		Beta	,001*	,000	,013	,000	,002
		Gamma	-,001	,001	1,000	-,006	,003
	Theta	Delta	,002*	,000	,010	,000	,003
		Alpha	,000	,001	1,000	-,002	,002
		Beta	,003*	,001	,000	,001	,005
		Gamma	,000	,001	1,000	-,004	,005
	Alpha	Delta	,002	,001	,080	,000	,004
		Theta	,000	,001	1,000	-,002	,002
		Beta	,003*	,001	,002	,001	,005
		Gamma	,000	,001	1,000	-,004	,005
	Beta	Delta	-,001*	,000	,013	-,002	,000
		Theta	-,003*	,001	,000	-,005	-,001
		Alpha	-,003*	,001	,002	-,005	-,001
		Gamma	-,003	,001	,844	-,007	,002
	Gamma	Delta	,001	,001	1,000	-,003	,006
		Theta	,000	,001	1,000	-,005	,004
		Alpha	,000	,001	1,000	-,005	,004
		Beta	,003	,001	,844	-,002	,007
Fp2	Delta	Theta	,010*	,002	,003	,003	,017
		Alpha	,012*	,002	,000	,005	,019
		Beta	,012*	,002	,000	,005	,020
		Gamma	,010*	,002	,002	,003	,018
	Theta	Delta	-,010*	,002	,003	-,017	-,003
		Alpha	,002*	,000	,000	,001	,003
		Beta	,003*	,001	,004	,001	,005

		Gamma	,001	,000	1,000	-,001	,002
	Alpha	Delta	-,012*	,002	,000	-,019	-,005
		Theta	-,002*	,000	,000	-,003	-,001
		Beta	,000	,000	1,000	-,001	,002
		Gamma	-,001*	,000	,000	-,002	-,001
	Beta	Delta	-,012*	,002	,000	-,020	-,005
		Theta	-,003*	,001	,004	-,005	-,001
		Alpha	,000	,000	1,000	-,002	,001
		Gamma	-,002*	,000	,001	-,003	-,001
	Gamma	Delta	-,010*	,002	,002	-,018	-,003
		Theta	-,001	,000	1,000	-,002	,001
		Alpha	,001*	,000	,000	,001	,002
		Beta	,002*	,000	,001	,001	,003
F3	Delta	Theta	,002*	,000	,000	,001	,004
		Alpha	,003*	,000	,000	,002	,005
		Beta	,001	,001	,286	,000	,003
		Gamma	,002*	,000	,000	,001	,004
	Theta	Delta	-,002*	,000	,000	-,004	-,001
		Alpha	,001*	,000	,000	,000	,002
		Beta	-,001	,000	,099	-,002	9,950E-5
		Gamma	,000	,000	1,000	,000	,001
	Alpha	Delta	-,003*	,000	,000	-,005	-,002
		Theta	-,001*	,000	,000	-,002	,000
		Beta	-,002*	,000	,000	-,003	-,001
		Gamma	-,001*	,000	,000	-,001	,000
	Beta	Delta	-,001	,001	,286	-,003	,000
		Theta	,001	,000	,099	-9,950E-5	,002
		Alpha	,002*	,000	,000	,001	,003
		Gamma	,001*	,000	,000	,000	,002
	Gamma	Delta	-,002*	,000	,000	-,004	-,001
		Theta	,000	,000	1,000	-,001	,000
		Alpha	,001*	,000	,000	,000	,001
		Beta	-,001*	,000	,000	-,002	,000
F4	Delta	Theta	,001*	,000	,002	,000	,002

		Alpha	-,001	,000	,792	-,002	,000
		Beta	-,002	,001	,070	-,003	7,909E-5
		Gamma	-,001	,000	,914	-,002	,001
	Theta	Delta	-,001*	,000	,002	-,002	,000
		Alpha	-,002*	,000	,000	-,003	-,001
		Beta	-,003*	,000	,000	-,004	-,001
		Gamma	-,002*	,000	,002	-,004	-,001
	Alpha	Delta	,001	,000	,792	,000	,002
		Theta	,002*	,000	,000	,001	,003
		Beta	-,001	,000	,536	-,002	,001
		Gamma	,000	,001	1,000	-,002	,002
	Beta	Delta	,002	,001	,070	-7,909E-5	,003
		Theta	,003*	,000	,000	,001	,004
		Alpha	,001	,000	,536	-,001	,002
		Gamma	,001	,001	1,000	-,001	,003
	Gamma	Delta	,001	,000	,914	-,001	,002
		Theta	,002*	,000	,002	,001	,004
		Alpha	,000	,001	1,000	-,002	,002
		Beta	-,001	,001	1,000	-,003	,001
F7	Delta	Theta	-,001*	,000	,002	-,003	,000
		Alpha	-,002*	,000	,000	-,003	-,001
		Beta	-,001	,000	,909	-,002	,000
		Gamma	-,003	,001	,125	-,006	,000
	Theta	Delta	,001*	,000	,002	,000	,003
		Alpha	,000	,000	1,000	-,001	,001
		Beta	,001*	,000	,039	2,774E-5	,002
		Gamma	-,001	,001	1,000	-,005	,002
	Alpha	Delta	,002*	,000	,000	,001	,003
		Theta	,000	,000	1,000	-,001	,001
		Beta	,001*	,000	,000	,001	,002
		Gamma	-,001	,001	1,000	-,005	,002
	Beta	Delta	,001	,000	,909	,000	,002
		Theta	-,001*	,000	,039	-,002	-2,774E-5
		Alpha	-,001*	,000	,000	-,002	-,001

		Gamma	-,002	,001	,523	-,006	,001
	Gamma	Delta	,003	,001	,125	,000	,006
		Theta	,001	,001	1,000	-,002	,005
		Alpha	,001	,001	1,000	-,002	,005
		Beta	,002	,001	,523	-,001	,006
F8	Delta	Theta	,000	,000	1,000	-,002	,001
		Alpha	-,003*	,001	,041	-,005	-6,628E-5
		Beta	,001	,000	,446	,000	,002
		Gamma	-,002	,001	1,000	-,006	,003
	Theta	Delta	,000	,000	1,000	-,001	,002
		Alpha	-,002*	,001	,045	-,004	-2,807E-5
		Beta	,001*	,000	,033	6,550E-5	,002
		Gamma	-,001	,001	1,000	-,006	,003
	Alpha	Delta	,003*	,001	,041	6,628E-5	,005
		Theta	,002*	,001	,045	2,807E-5	,004
		Beta	,003*	,001	,001	,001	,006
		Gamma	,001	,001	1,000	-,003	,005
	Beta	Delta	-,001	,000	,446	-,002	,000
		Theta	-,001*	,000	,033	-,002	-6,550E-5
		Alpha	-,003*	,001	,001	-,006	-,001
		Gamma	-,002	,001	1,000	-,007	,002
	Gamma	Delta	,002	,001	1,000	-,003	,006
		Theta	,001	,001	1,000	-,003	,006
		Alpha	-,001	,001	1,000	-,005	,003
		Beta	,002	,001	1,000	-,002	,007
C3	Delta	Theta	,008*	,002	,014	,001	,014
		Alpha	,011*	,002	,001	,004	,018
		Beta	,010*	,002	,001	,003	,017
		Gamma	,010*	,002	,002	,003	,016
	Theta	Delta	-,008*	,002	,014	-,014	-,001
		Alpha	,003*	,001	,000	,001	,005
		Beta	,002	,001	,053	-1,872E-5	,005
		Gamma	,002	,001	,079	,000	,004
	Alpha	Delta	-,011*	,002	,001	-,018	-,004

		Theta	-,003*	,001	,000	-,005	-,001
		Beta	-,001	,001	1,000	-,003	,002
		Gamma	-,001*	,000	,002	-,002	,000
	Beta	Delta	-,010*	,002	,001	-,017	-,003
		Theta	-,002	,001	,053	-,005	1,872E-5
		Alpha	,001	,001	1,000	-,002	,003
		Gamma	,000	,001	1,000	-,003	,002
	Gamma	Delta	-,010*	,002	,002	-,016	-,003
		Theta	-,002	,001	,079	-,004	,000
		Alpha	,001*	,000	,002	,000	,002
		Beta	,000	,001	1,000	-,002	,003
C4	Delta	Theta	,002*	,000	,000	,001	,003
		Alpha	,003*	,000	,000	,002	,005
		Beta	,001	,000	,261	,000	,003
		Gamma	,002*	,000	,000	,001	,004
	Theta	Delta	-,002*	,000	,000	-,003	-,001
		Alpha	,001*	,000	,000	,001	,002
		Beta	-,001	,000	,188	-,002	,000
		Gamma	,000	,000	1,000	-,001	,001
	Alpha	Delta	-,003*	,000	,000	-,005	-,002
		Theta	-,001*	,000	,000	-,002	-,001
		Beta	-,002*	,000	,000	-,003	-,002
		Gamma	-,001*	,000	,037	-,002	-3,419E-5
	Beta	Delta	-,001	,000	,261	-,003	,000
		Theta	,001	,000	,188	,000	,002
		Alpha	,002*	,000	,000	,002	,003
		Gamma	,001*	,000	,000	,001	,002
	Gamma	Delta	-,002*	,000	,000	-,004	-,001
		Theta	,000	,000	1,000	-,001	,001
		Alpha	,001*	,000	,037	3,419E-5	,002
		Beta	-,001*	,000	,000	-,002	-,001
P3	Delta	Theta	,001	,001	1,000	-,001	,003
		Alpha	,000	,001	1,000	-,002	,002
		Beta	-,001	,001	1,000	-,003	,002

		Gamma	-1,656E-5	,001	1,000	-,002	,002
	Theta	Delta	-,001	,001	1,000	-,003	,001
		Alpha	-,001	,001	,715	-,003	,001
		Beta	-,002*	,000	,008	-,003	,000
		Gamma	-,001	,001	1,000	-,003	,001
	Alpha	Delta	,000	,001	1,000	-,002	,002
		Theta	,001	,001	,715	-,001	,003
		Beta	-,001	,000	1,000	-,002	,001
		Gamma	,000	,000	1,000	-,001	,001
	Beta	Delta	,001	,001	1,000	-,002	,003
		Theta	,002*	,000	,008	,000	,003
		Alpha	,001	,000	1,000	-,001	,002
		Gamma	,001	,000	1,000	-,001	,002
	Gamma	Delta	1,656E-5	,001	1,000	-,002	,002
		Theta	,001	,001	1,000	-,001	,003
		Alpha	,000	,000	1,000	-,001	,001
		Beta	-,001	,000	1,000	-,002	,001
P4	Delta	Theta	-,001	,001	1,000	-,003	,001
		Alpha	-,001	,001	1,000	-,003	,002
		Beta	-,001	,001	1,000	-,003	,002
		Gamma	,000	,001	1,000	-,002	,003
	Theta	Delta	,001	,001	1,000	-,001	,003
		Alpha	,000	,000	1,000	-,001	,001
		Beta	,000	,000	1,000	-,001	,002
		Gamma	,002*	,000	,001	,000	,003
	Alpha	Delta	,001	,001	1,000	-,002	,003
		Theta	,000	,000	1,000	-,001	,001
		Beta	3,463E-5	,000	1,000	-,001	,001
		Gamma	,001	,000	,116	,000	,002
	Beta	Delta	,001	,001	1,000	-,002	,003
		Theta	,000	,000	1,000	-,002	,001
		Alpha	-3,463E-5	,000	1,000	-,001	,001
		Gamma	,001	,001	,666	-,001	,003
	Gamma	Delta	,000	,001	1,000	-,003	,002

		Theta	-,002*	,000	,001	-,003	,000
		Alpha	-,001	,000	,116	-,002	,000
		Beta	-,001	,001	,666	-,003	,001
T3	Delta	Theta	,000	,000	1,000	-,001	,001
		Alpha	-,001	,001	,845	-,003	,001
		Beta	,001	,001	1,000	-,001	,002
		Gamma	,002*	,000	,005	,000	,003
	Theta	Delta	,000	,000	1,000	-,001	,001
		Alpha	-,001	,000	1,000	-,002	,001
		Beta	,001	,000	,130	,000	,002
		Gamma	,002*	,001	,010	,000	,004
	Alpha	Delta	,001	,001	,845	-,001	,003
		Theta	,001	,000	1,000	-,001	,002
		Beta	,002*	,001	,047	1,392E-5	,004
		Gamma	,003*	,001	,008	,001	,005
	Beta	Delta	-,001	,001	1,000	-,002	,001
		Theta	-,001	,000	,130	-,002	,000
		Alpha	-,002*	,001	,047	-,004	-1,392E-5
		gamma	,001	,001	1,000	-,001	,003
	Gamma	Delta	-,002*	,000	,005	-,003	,000
		Theta	-,002*	,001	,010	-,004	,000
		Alpha	-,003*	,001	,008	-,005	-,001
		Beta	-,001	,001	1,000	-,003	,001
T4	Delta	Theta	,000	,001	1,000	-,002	,002
		Alpha	,003*	,001	,000	,001	,005
		Beta	,003*	,001	,003	,001	,005
		Gamma	,002*	,000	,014	,000	,003
	Theta	Delta	,000	,001	1,000	-,002	,002
		Alpha	,003*	,001	,000	,001	,005
		Beta	,003*	,001	,001	,001	,005
		Gamma	,002	,001	,081	,000	,004
	Alpha	Delta	-,003*	,001	,000	-,005	-,001
		Theta	-,003*	,001	,000	-,005	-,001
		Beta	,000	,001	1,000	-,002	,001

		Gamma	-,001*	,000	,000	-,002	-,001
	Beta	Delta	-,003*	,001	,003	-,005	-,001
		Theta	-,003*	,001	,001	-,005	-,001
		Alpha	,000	,001	1,000	-,001	,002
		Gamma	-,001	,001	,991	-,003	,001
	gamma	Delta	-,002*	,000	,014	-,003	,000
		Theta	-,002	,001	,081	-,004	,000
		Alpha	,001*	,000	,000	,001	,002
		Beta	,001	,001	,991	-,001	,003
T5	Delta	Theta	,002*	,000	,003	,000	,003
		Alpha	,003*	,001	,000	,001	,004
		Beta	,001	,000	1,000	-,001	,002
		Gamma	,002*	,000	,000	,001	,002
	Theta	Delta	-,002*	,000	,003	-,003	,000
		Alpha	,001*	,000	,019	,000	,002
		Beta	-,001	,000	,071	-,002	5,107E-5
		Gamma	-1,768E-5	,000	1,000	-,001	,001
	Alpha	Delta	-,003*	,001	,000	-,004	-,001
		Theta	-,001*	,000	,019	-,002	,000
		Beta	-,002*	,000	,000	-,003	-,001
		Gamma	-,001*	,000	,021	-,002	,000
	Beta	Delta	-,001	,000	1,000	-,002	,001
		Theta	,001	,000	,071	-5,107E-5	,002
		Alpha	,002*	,000	,000	,001	,003
		Gamma	,001*	,000	,004	,000	,002
	Gamma	Delta	-,002*	,000	,000	-,002	-,001
		Theta	1,768E-5	,000	1,000	-,001	,001
		Alpha	,001*	,000	,021	,000	,002
		Beta	-,001*	,000	,004	-,002	,000
T6	Delta	Theta	,001	,000	,139	,000	,002
		Alpha	-,001*	,000	,047	-,002	-8,104E-6
		Beta	,000	,000	1,000	,000	,001
		Gamma	-,002*	,001	,034	-,004	-8,992E-5
	Theta	Delta	-,001	,000	,139	-,002	,000

		Alpha	-,002*	,000	,001	-,003	-,001
		Beta	,000	,000	1,000	-,002	,001
		Gamma	-,003*	,001	,013	-,005	,000
	Alpha	Delta	,001*	,000	,047	8,104E-6	,002
		Theta	,002*	,000	,001	,001	,003
		Beta	,001*	,000	,000	,001	,002
		Gamma	-,001	,001	1,000	-,003	,001
	Beta	Delta	,000	,000	1,000	-,001	,000
		Theta	,000	,000	1,000	-,001	,002
		Alpha	-,001*	,000	,000	-,002	-,001
		Gamma	-,002*	,001	,030	-,004	,000
	Gamma	Delta	,002*	,001	,034	8,992E-5	,004
		Theta	,003*	,001	,013	,000	,005
		Alpha	,001	,001	1,000	-,001	,003
		Beta	,002*	,001	,030	,000	,004
O1	Delta	Theta	-,002*	,000	,020	-,003	,000
		Alpha	-,001*	,000	,019	-,002	,000
		Beta	-,001	,000	,720	-,002	,001
		Gamma	-,001	,001	1,000	-,002	,001
	Theta	Delta	,002*	,000	,020	,000	,003
		Alpha	,000	,000	1,000	-,001	,001
		Beta	,001	,000	,222	,000	,002
		Gamma	,001	,001	,893	-,001	,003
	Alpha	Delta	,001*	,000	,019	,000	,002
		Theta	,000	,000	1,000	-,001	,001
		Beta	,000	,000	,838	,000	,001
		Gamma	,001	,001	1,000	-,001	,002
	Beta	Delta	,001	,000	,720	-,001	,002
		Theta	-,001	,000	,222	-,002	,000
		Alpha	,000	,000	,838	-,001	,000
		Gamma	,000	,001	1,000	-,002	,002
	Gamma	Delta	,001	,001	1,000	-,001	,002
		Theta	-,001	,001	,893	-,003	,001
		Alpha	-,001	,001	1,000	-,002	,001

		Beta	,000	,001	1,000	-,002	,002
O2	Delta	Theta	1,407E-5	,000	1,000	-,001	,001
		Alpha	-,001	,001	,782	-,003	,001
		Beta	-,001	,001	1,000	-,004	,003
		Gamma	,001	,001	1,000	-,001	,004
	Theta	Delta	-1,407E-5	,000	1,000	-,001	,001
		Alpha	-,001	,001	,413	-,003	,001
		Beta	-,001	,001	1,000	-,004	,002
		Gamma	,001	,001	1,000	-,001	,004
	Alpha	Delta	,001	,001	,782	-,001	,003
		Theta	,001	,001	,413	-,001	,003
		Beta	,001	,001	1,000	-,002	,004
		Gamma	,003	,001	,239	-,001	,006
	Beta	Delta	,001	,001	1,000	-,003	,004
		Theta	,001	,001	1,000	-,002	,004
		Alpha	-,001	,001	1,000	-,004	,002
		Gamma	,002	,001	,337	-,001	,005
	Gamma	Delta	-,001	,001	1,000	-,004	,001
		Theta	-,001	,001	1,000	-,004	,001
		Alpha	-,003	,001	,239	-,006	,001
		Beta	-,002	,001	,337	-,005	,001

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Appendix-4: Table 4, Cross Spectrum, Pairwise Comparisons of the Bands

(I) band	(J) band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Delta	Theta	1,007E10	1,825E9	,000	4,524E9	1,561E10
	Alpha	1,080E10	1,857E9	,000	5,160E9	1,644E10
	Beta	4,415E9	2,369E9	,725	-2,783E9	1,161E10
	Gamma	9,482E9	1,870E9	,000	3,803E9	1,516E10
Theta	Delta	-1,007E10	1,825E9	,000	-1,561E10	-4,524E9
	Alpha	7,342E8	1,838E8	,004	1,757E8	1,293E9
	Beta	-5,653E9	1,955E9	,072	-1,159E10	2,855E8
	Gamma	-5,855E8	7,772E8	1,000	-2,947E9	1,776E9
Alpha	Delta	-1,080E10	1,857E9	,000	-1,644E10	-5,160E9
	Theta	-7,342E8	1,838E8	,004	-1,293E9	-1,757E8
	Beta	-6,387E9	1,907E9	,023	-1,218E10	-5,927E8
	Gamma	-1,320E9	7,120E8	,740	-3,483E9	8,435E8
Beta	Delta	-4,415E9	2,369E9	,725	-1,161E10	2,783E9
	Theta	5,653E9	1,955E9	,072	-2,855E8	1,159E10
	Alpha	6,387E9	1,907E9	,023	5,927E8	1,218E10
	Gamma	5,068E9	1,476E9	,018	5,831E8	9,552E9
Gamma	Delta	-9,482E9	1,870E9	,000	-1,516E10	-3,803E9
	Theta	5,855E8	7,772E8	1,000	-1,776E9	2,947E9
	Alpha	1,320E9	7,120E8	,740	-8,435E8	3,483E9
	Beta	-5,068E9	1,476E9	,018	-9,552E9	-5,831E8

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.

Appendix-5: Table 5, Cross Spectrum, Pairwise Comparisons of the Electrodes

(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
Fp1	Fp2	4,929E9	2,449E9	1,000	-3,496E9	1,335E10
	F3	1,125E10	2,122E9	,000	3,952E9	1,855E10
	F4	9,214E9	2,351E9	,014	1,126E9	1,730E10
	F7	1,152E10	2,232E9	,000	3,844E9	1,920E10
	F8	8,073E9	2,114E9	,018	8,009E8	1,535E10
	C3	8,368E9	2,704E9	,121	-9,335E8	1,767E10
	C4	1,178E10	2,229E9	,000	4,115E9	1,945E10
Fp2	Fp1	-4,929E9	2,449E9	1,000	-1,335E10	3,496E9
	F3	6,324E9	1,833E9	,049	1,887E7	1,263E10
	F4	4,286E9	1,662E9	,427	-1,431E9	1,000E10
	F7	6,592E9	1,833E9	,033	2,876E8	1,290E10
	F8	3,144E9	1,986E9	1,000	-3,687E9	9,976E9
	C3	3,440E9	1,683E9	1,000	-2,350E9	9,230E9
	C4	6,852E9	1,935E9	,038	1,977E8	1,351E10
F3	Fp1	-1,125E10	2,122E9	,000	-1,855E10	-3,952E9
	Fp2	-6,324E9	1,833E9	,049	-1,263E10	-1,887E7
	F4	-2,039E9	1,227E9	1,000	-6,258E9	2,181E9
	F7	2,680E8	2,856E8	1,000	-7,145E8	1,250E9
	F8	-3,180E9	1,132E9	,246	-7,073E9	7,132E8
	C3	-2,885E9	1,683E9	1,000	-8,674E9	2,905E9
	C4	5,281E8	2,046E8	,425	-1,757E8	1,232E9
F4	Fp1	-9,214E9	2,351E9	,014	-1,730E10	-1,126E9
	Fp2	-4,286E9	1,662E9	,427	-1,000E10	1,431E9
	F3	2,039E9	1,227E9	1,000	-2,181E9	6,258E9
	F7	2,307E9	1,137E9	1,000	-1,603E9	6,216E9
	F8	-1,141E9	1,547E9	1,000	-6,464E9	4,181E9
	C3	-8,460E8	8,320E8	1,000	-3,708E9	2,016E9

	C4	2,567E9	1,221E9	1,000	-1,634E9	6,768E9
F7	Fp1	-1,152E10	2,232E9	,000	-1,920E10	-3,844E9
	Fp2	-6,592E9	1,833E9	,033	-1,290E10	-2,876E8
	F3	-2,680E8	2,856E8	1,000	-1,250E9	7,145E8
	F4	-2,307E9	1,137E9	1,000	-6,216E9	1,603E9
	F8	-3,448E9	1,149E9	,154	-7,400E9	5,038E8
	C3	-3,153E9	1,565E9	1,000	-8,536E9	2,231E9
	C4	2,601E8	1,882E8	1,000	-3,873E8	9,075E8
F8	Fp1	-8,073E9	2,114E9	,018	-1,535E10	-8,009E8
	Fp2	-3,144E9	1,986E9	1,000	-9,976E9	3,687E9
	F3	3,180E9	1,132E9	,246	-7,132E8	7,073E9
	F4	1,141E9	1,547E9	1,000	-4,181E9	6,464E9
	F7	3,448E9	1,149E9	,154	-5,038E8	7,400E9
	C3	2,953E8	1,798E9	1,000	-5,888E9	6,479E9
	C4	3,708E9	1,148E9	,086	-2,400E8	7,656E9
C3	Fp1	-8,368E9	2,704E9	,121	-1,767E10	9,335E8
	Fp2	-3,440E9	1,683E9	1,000	-9,230E9	2,350E9
	F3	2,885E9	1,683E9	1,000	-2,905E9	8,674E9
	F4	8,460E8	8,320E8	1,000	-2,016E9	3,708E9
	F7	3,153E9	1,565E9	1,000	-2,231E9	8,536E9
	F8	-2,953E8	1,798E9	1,000	-6,479E9	5,888E9
	C4	3,413E9	1,667E9	1,000	-2,322E9	9,147E9
C4	Fp1	-1,178E10	2,229E9	,000	-1,945E10	-4,115E9
	Fp2	-6,852E9	1,935E9	,038	-1,351E10	-1,977E8
	F3	-5,281E8	2,046E8	,425	-1,232E9	1,757E8
	F4	-2,567E9	1,221E9	1,000	-6,768E9	1,634E9
	F7	-2,601E8	1,882E8	1,000	-9,075E8	3,873E8
	Table 12 (cont'd)					
	F8	-3,708E9	1,148E9	,086	-7,656E9	2,400E8
	C3	-3,413E9	1,667E9	1,000	-9,147E9	2,322E9

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

*. The mean difference is significant at the .05 level.

Appendix-6: Table 6, Cross Spectrum, Pairwise Comparisons of the Electrodes According to the Band Values

Electrode	(I) band	(J) band	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Fp1	Delta	Theta	6,483E10	1,108E10	,000	3,116E10	9,849E10
		Alpha	6,451E10	1,108E10	,000	3,084E10	9,817E10
		Beta	6,489E10	1,108E10	,000	3,122E10	9,857E10
		Gamma	6,475E10	1,108E10	,000	3,108E10	9,842E10
	Theta	Delta	-6,483E10	1,108E10	,000	-9,849E10	-3,116E10
		Alpha	-3,219E8	3,002E7	,000	-4,131E8	-2,307E8
		Beta	6,609E7	1,174E7	,000	3,044E7	1,017E8
		Gamma	-7,358E7	1,634E7	,001	-1,232E8	-2,393E7
	Alpha	Delta	-6,451E10	1,108E10	,000	-9,817E10	-3,084E10
		Theta	3,219E8	3,002E7	,000	2,307E8	4,131E8
		Beta	3,880E8	3,363E7	,000	2,858E8	4,902E8
		Gamma	2,483E8	2,433E7	,000	1,744E8	3,223E8
	Beta	Delta	-6,489E10	1,108E10	,000	-9,857E10	-3,122E10
		Theta	-6,609E7	1,174E7	,000	-1,017E8	-3,044E7
		Alpha	-3,880E8	3,363E7	,000	-4,902E8	-2,858E8
		Gamma	-1,397E8	2,060E7	,000	-2,023E8	-7,708E7
	Gamma	Delta	-6,475E10	1,108E10	,000	-9,842E10	-3,108E10
		Theta	7,358E7	1,634E7	,001	2,393E7	1,232E8
		Alpha	-2,483E8	2,433E7	,000	-3,223E8	-1,744E8
		Beta	1,397E8	2,060E7	,000	7,708E7	2,023E8
Fp2	Delta	Theta	3,947E9	7,314E8	,000	1,724E9	6,169E9
		Alpha	3,553E9	7,207E8	,000	1,364E9	5,743E9
		Beta	-3,244E10	9,426E9	,018	-6,107E10	-3,802E9
		Gamma	3,872E9	7,294E8	,000	1,656E9	6,088E9

	Theta	Delta	-3,947E9	7,314E8	,000	-6,169E9	-1,724E9
		Alpha	-3,933E8	6,196E7	,000	-5,815E8	-2,050E8
		Beta	-3,638E10	9,522E9	,006	-6,531E10	-7,456E9
		Gamma	-7,419E7	1,769E7	,002	-1,279E8	-2,044E7
	Alpha	Delta	-3,553E9	7,207E8	,000	-5,743E9	-1,364E9
		Theta	3,933E8	6,196E7	,000	2,050E8	5,815E8
		Beta	-3,599E10	9,522E9	,007	-6,492E10	-7,063E9
		Gamma	3,191E8	6,022E7	,000	1,361E8	5,020E8
	Beta	Delta	3,244E10	9,426E9	,018	3,802E9	6,107E10
		Theta	3,638E10	9,522E9	,006	7,456E9	6,531E10
		Alpha	3,599E10	9,522E9	,007	7,063E9	6,492E10
		Gamma	3,631E10	9,522E9	,007	7,383E9	6,524E10
	Gamma	Delta	-3,872E9	7,294E8	,000	-6,088E9	-1,656E9
		Theta	7,419E7	1,769E7	,002	2,044E7	1,279E8
		Alpha	-3,191E8	6,022E7	,000	-5,020E8	-1,361E8
		Beta	-3,631E10	9,522E9	,007	-6,524E10	-7,383E9
F3	Delta	Theta	-7,093E9	1,043E9	,000	-1,026E10	-3,924E9
		Alpha	5,671E8	8,552E7	,000	3,073E8	8,270E8
		Beta	-1,915E8	6,126E7	,040	-3,776E8	-5372472
		Gamma	5,752E8	8,418E7	,000	3,195E8	8,310E8
	Theta	Delta	7,093E9	1,043E9	,000	3,924E9	1,026E10
		Alpha	7,660E9	1,067E9	,000	4,419E9	1,090E10
		Beta	6,902E9	1,021E9	,000	3,799E9	1,000E10
		Gamma	7,668E9	1,067E9	,000	4,428E9	1,091E10
	Alpha	Delta	-5,671E8	8,552E7	,000	-8,270E8	-3,073E8
		Theta	-7,660E9	1,067E9	,000	-1,090E10	-4,419E9
		Beta	-7,586E8	1,291E8	,000	-1,151E9	-3,664E8
		Gamma	8107420,0	1,552E7	1,000	-3,905E7	5,526E7
	Beta	Delta	1,915E8	6,126E7	,040	5372471,9	3,776E8
		Theta	-6,902E9	1,021E9	,000	-1,000E10	-3,799E9
		Alpha	7,586E8	1,291E8	,000	3,664E8	1,151E9
		Gamma	7,667E8	1,269E8	,000	3,813E8	1,152E9

	Gamma	Delta	-5,752E8	8,418E7	,000	-8,310E8	-3,195E8
		Theta	-7,668E9	1,067E9	,000	-1,091E10	-4,428E9
		Alpha	-8107420,0	1,552E7	1,00	-5,526E7	3,905E7
		Beta	-7,667E8	1,269E8	,000	-1,152E9	-3,813E8
F4	Delta	Theta	-3,685E8	4,782E7	,000	-5,138E8	-2,233E8
		Alpha	1,024E8	2,809E7	,010	1,703E7	1,877E8
		Beta	-7,432E7	2,980E7	,186	-1,648E8	1,621E7
		Gamma	-1,857E10	6,058E9	,047	-3,697E10	-1,610E8
	Theta	Delta	3,685E8	4,782E7	,000	2,233E8	5,138E8
		Alpha	4,709E8	4,103E7	,000	3,463E8	5,955E8
		Beta	2,942E8	3,155E7	,000	1,984E8	3,901E8
		Gamma	-1,820E10	6,061E9	,055	-3,661E10	2,166E8
	Alpha	Delta	-1,024E8	2,809E7	,010	-1,877E8	-1,703E7
		Theta	-4,709E8	4,103E7	,000	-5,955E8	-3,463E8
		Beta	-1,767E8	2,128E7	,000	-2,413E8	-1,120E8
		Gamma	-1,867E10	6,057E9	,045	-3,707E10	-2,671E8
	Beta	Delta	7,432E7	2,980E7	,186	-1,621E7	1,648E8
		Theta	-2,942E8	3,155E7	,000	-3,901E8	-1,984E8
		Alpha	1,767E8	2,128E7	,000	1,120E8	2,413E8
		Gamma	-1,849E10	6,057E9	,048	-3,689E10	-8,857E7
	Gamma	Delta	1,857E10	6,058E9	,047	1,610E8	3,697E10
		Theta	1,820E10	6,061E9	,055	-2,166E8	3,661E10
		Alpha	1,867E10	6,057E9	,045	2,671E8	3,707E10
		Beta	1,849E10	6,057E9	,048	8,857E7	3,689E10
F7	Delta	Theta	-3,218E8	5,173E7	,000	-4,790E8	-1,646E8
		Alpha	-7,213E9	1,019E9	,000	-1,031E10	-4,117E9
		Beta	-1,298E7	1,325E7	1,00	-5,323E7	2,727E7
		Gamma	-1,772E8	3,144E7	,000	-2,727E8	-8,169E7
	Theta	Delta	3,218E8	5,173E7	,000	1,646E8	4,790E8
		Alpha	-6,891E9	1,016E9	,000	-9,977E9	-3,806E9
		Beta	3,088E8	4,346E7	,000	1,768E8	4,409E8
		Gamma	1,446E8	4,688E7	,044	2174769,3	2,870E8
	Alpha	Delta	7,213E9	1,019E9	,000	4,117E9	1,031E10

		Theta	6,891E9	1,016E9	,000	3,806E9	9,977E9
		Beta	7,200E9	1,021E9	,000	4,098E9	1,030E10
		Gamma	7,036E9	1,017E9	,000	3,946E9	1,013E10
	Beta	Delta	1,298E7	1,325E7	1,00	-2,727E7	5,323E7
		Theta	-3,088E8	4,346E7	,000	-4,409E8	-1,768E8
		Alpha	-7,200E9	1,021E9	,000	-1,030E10	-4,098E9
		Gamma	-1,642E8	2,714E7	,000	-2,467E8	-8,179E7
	Gamma	Delta	1,772E8	3,144E7	,000	8,169E7	2,727E8
		Theta	-1,446E8	4,688E7	,044	-2,870E8	-2174769
		Alpha	-7,036E9	1,017E9	,000	-1,013E10	-3,946E9
		Beta	1,642E8	2,714E7	,000	8,179E7	2,467E8
F8	Delta	Theta	2,441E10	5,659E9	,002	7,220E9	4,161E10
		Alpha	2,412E10	5,657E9	,002	6,939E9	4,131E10
		Beta	2,446E10	5,659E9	,002	7,272E9	4,166E10
		Gamma	2,426E10	5,654E9	,002	7,081E9	4,143E10
	Theta	Delta	-2,441E10	5,659E9	,002	-4,161E10	-7,220E9
		Alpha	-2,885E8	2,887E7	,000	-3,762E8	-2,008E8
		Beta	5,156E7	9412525,825	,000	2,296E7	8,015E7
		Gamma	-1,560E8	3,730E7	,002	-2,693E8	-4,266E7
	Alpha	Delta	-2,412E10	5,657E9	,002	-4,131E10	-6,939E9
		Theta	2,885E8	2,887E7	,000	2,008E8	3,762E8
		Beta	3,400E8	3,164E7	,000	2,439E8	4,361E8
		Gamma	1,325E8	3,460E7	,006	2,737E7	2,376E8
	Beta	Delta	-2,446E10	5,659E9	,002	-4,166E10	-7,272E9
		Theta	-5,156E7	9412525,825	,000	-8,015E7	-2,296E7
		Alpha	-3,400E8	3,164E7	,000	-4,361E8	-2,439E8
		Gamma	-2,075E8	3,753E7	,000	-3,216E8	-9,353E7
	Gamma	Delta	-2,426E10	5,654E9	,002	-4,143E10	-7,081E9
		Theta	1,560E8	3,730E7	,002	4,266E7	2,693E8
		Alpha	-1,325E8	3,460E7	,006	-2,376E8	-2,737E7
		Beta	2,075E8	3,753E7	,000	9,353E7	3,216E8
C3	Delta	Theta	8,618E8	9,921E7	,000	5,604E8	1,163E9
		Alpha	5,145E8	1,055E8	,000	1,941E8	8,350E8

		Beta	-2,147E10	8,281E9	,147	-4,663E10	3,682E9
		Gamma	8,347E8	9,620E7	,000	5,425E8	1,127E9
	Theta	Delta	-8,618E8	9,921E7	,000	-1,163E9	-5,604E8
		Alpha	-3,473E8	6,279E7	,000	-5,380E8	-1,565E8
		Beta	-2,234E10	8,275E9	,115	-4,748E10	2,803E9
		Gamma	-2,708E7	1,508E7	,831	-7,290E7	1,875E7
	Alpha	Delta	-5,145E8	1,055E8	,000	-8,350E8	-1,941E8
		Theta	3,473E8	6,279E7	,000	1,565E8	5,380E8
		Beta	-2,199E10	8,280E9	,127	-4,714E10	3,165E9
		Gamma	3,202E8	6,404E7	,000	1,256E8	5,148E8
	Beta	Delta	2,147E10	8,281E9	,147	-3,682E9	4,663E10
		Theta	2,234E10	8,275E9	,115	-2,803E9	4,748E10
		Alpha	2,199E10	8,280E9	,127	-3,165E9	4,714E10
		Gamma	2,231E10	8,276E9	,116	-2,834E9	4,745E10
	Gamma	Delta	-8,347E8	9,620E7	,000	-1,127E9	-5,425E8
		Theta	2,708E7	1,508E7	,831	-1,875E7	7,290E7
		Alpha	-3,202E8	6,404E7	,000	-5,148E8	-1,256E8
		Beta	-2,231E10	8,276E9	,116	-4,745E10	2,834E9
C4	Delta	Theta	-5,722E9	4,787E8	,000	-7,176E9	-4,267E9
		Alpha	2,625E8	3,420E7	,000	1,586E8	3,664E8
		Beta	1,526E8	2,917E7	,000	6,400E7	2,412E8
		Gamma	3,089E8	3,979E7	,000	1,881E8	4,298E8
	Theta	Delta	5,722E9	4,787E8	,000	4,267E9	7,176E9
		Alpha	5,984E9	4,751E8	,000	4,541E9	7,428E9
		Beta	5,874E9	4,740E8	,000	4,434E9	7,314E9
		Gamma	6,031E9	4,790E8	,000	4,575E9	7,486E9
	Alpha	Delta	-2,625E8	3,420E7	,000	-3,664E8	-1,586E8
		Theta	-5,984E9	4,751E8	,000	-7,428E9	-4,541E9
		Beta	-1,099E8	1,517E7	,000	-1,560E8	-6,385E7
		Gamma	4,642E7	1,431E7	,030	2938405,3	8,990E7
	Beta	Delta	-1,526E8	2,917E7	,000	-2,412E8	-6,400E7
		Theta	-5,874E9	4,740E8	,000	-7,314E9	-4,434E9
		Alpha	1,099E8	1,517E7	,000	6,385E7	1,560E8

	Gamma	1,563E8	1,841E7	,000	1,004E8	2,123E8
Gamma	Delta	-3,089E8	3,979E7	,000	-4,298E8	-1,881E8
	Theta	-6,031E9	4,790E8	,000	-7,486E9	-4,575E9
	Alpha	-4,642E7	1,431E7	,030	-8,990E7	-2938405
	Beta	-1,563E8	1,841E7	,000	-2,123E8	-1,004E8

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Bonferroni.