WHAT DOES 4 CHANNEL ALPHA FEEDBACK DO TO WHOLE HEAD (8 CHANNEL) ALPHA ACTIVITY?

Society for Study of Neuronal Regulation
7th International Congress
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Eight channel EEGs (O1, O2, C3, C4, T3, T4, F3, F4) were recorded, filtered, and digitized for 17 right handed non-meditators, who received broad band alpha feedback simultaneously on 4 channels (O1, O2, C3, C4). Alpha feedback was both 4 auditory tones and 4 periodically presented digital integrated amplitude alpha scores. Auditory feedback on each of the 4 feedback channels was presented through 4 spatially separated speakers, and employed separate pitches for the tones which signaled activity at each of the 4 cortical feedback sites. Auditory feedback was driven by the envelope of the filtered, full wave rectified broad band alpha activity. Auditory feedback was presented to Ss sitting upright, eyes closed, in a totally dark, climate controlled, sound proof (Industrial Acoustics Corp.) chamber. Auditory feedback was continuous, except for an 8 second interruption every 2 minutes, during which 8 second interruption all the feedback tones shifted to resting pitches, which signaled the S to open his/her eyes to view the digital scores, which were illuminated only during these 8 seconds.

Training protocol was the standard Biocybernaut Process: Six Personality Tests administered twice before and once after the 7 consecutive days of EEG feedback training, with six daily administrations of three different mood scales, 8 channel EEGs, Frontal EMG, Heart Rate, and Temperature (Ambient and Left and Right Hands) data were continuously recorded, and there were daily baselines in eyes open and eyes closed conditions, also 16 minutes of daily alpha suppression feedback, and daily enhancement feedback which ranged from 60 minutes on days 1-2, 90 minutes on days 3-4, to at least 120 minutes on days 5-7. Also on days 5-7 Ss were offered the opportunity to do as much additional alpha enhancement feedback as they wished, and all Ss did additional training. At the end of each daily session there was a depth interview with a Trainer and a review of results.

EEG polygraph records were screened for artifacts, and the BIOCAL software package was used to incorporate pre- and post-session calibration records to correct the digitized EEG scores for gain nonlinearities in the amplifiers, and for gain drift across time, to screen out mechanical artifacts, and to convert EEG scores to true microvolts. The daily integrated amplitude broad band alpha scores in microvolts were then studied with descriptive statistics:

Mean, Maximum, Minimum, Standard Deviation, Kurtosis, Skewness, and Slope. Statistical Comparisons were made with t-tests between an appropriate Day 1 eyes closed baseline and the alpha enhancement scores (Mean, Max, Min, etc.) on each of the 7 days of training.

MEANS: The alpha enhancement feedback Means were significantly higher on each of the 7 days of training than during the Day 1 baseline. This was true for the 4 feedback sites and also the four non feedback sites. Surprisingly, there were strong upward trends in the Means even though alpha enhancement training times lengthened across the 7 days.

MAXIMA: The alpha enhancement feedback Maxima were significantly higher on each of the 7 days of training than during the Day 1 baseline for all cortical sites except the Temporals (T3, T4). There were strong uptrends in the Maxima at the Occipital, Central and Frontal sites.

MINIMA: The alpha enhancement feedback Minima were significantly higher on each of the 7 days of training than during the Day 1 baseline for all cortical sites except the Left Temporal (T3). There were no clear uptrends in the Minima across the 7 days, perhaps because the fatigue of longer sessions would cause downturns at least once during a long session.

STANDARD DEVIATIONS: Standard Deviations of alpha scores were significantly lower during each of the 7 alpha enhancement feedback periods than during the Day 1 baseline. This was true for all cortical sites except O1, O2 and T3 (T3 missed unanimous significance by only one day). The Standard Deviation of T3 alpha scores was significantly lower than Day 1 baseline on all days except Day 7. The two Occipital sites had significantly lower Standard Deviations of alpha enhancement scores (feedback compared to Day 1 baseline) on days 4, 5, and 6. It is quite remarkable that significantly increasing Means, Maxima, and Minima could be associated with significantly reduced Standard Deviations, which shows the power of the feedback setting to constrain variability.

KURTOSIS: The Kurtosis effects of feedback were less wide spread. Kurtosis of alpha scores was significantly lower in alpha enhancement feedback (compared to Day 1 baseline) for days 2-7 at O1, with 2 significantly lower days for F4 and 1 significantly lower day for C4.

SKEWNESS: The Skewness of alpha scores was significantly higher in alpha enhancement feedback than on Day 1 baseline for all 7 days at O1, O2, C3, and T3. The other 4 cortical sites had from 1-3 days of significantly higher Skewness than the baseline.

SLOPE: The Slope was significantly higher in alpha enhancement feedback than on Day 1 baseline for all 7 days at O1, O2, C3, C4, and T3. And 6 days of significantly higher Slope was seen during enhancement feedback at T4 and F3.

Feedback produces many shifts in the baseline EEG patterns, and use of 4 simultaneous channels of feedback reduces or eliminates development of localization of control. Further studies should consider changes in higher order patterns involving multiple channels (cortical sites).