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Vocabulary for Understanding the EEG Brain Map Report

The signal that is recorded at the level of your scalp is digitally analyzed. It will be presented on two levels:

- 1) *Using the International 10-20 system*, a method for describing the location of where electrodes are placed on the scalp and its underlying area of cerebral cortex. The 10 and 20 refer to the distances between adjacent electrodes being either 10% or 20% of the total front-back or right to left distance of the skull.

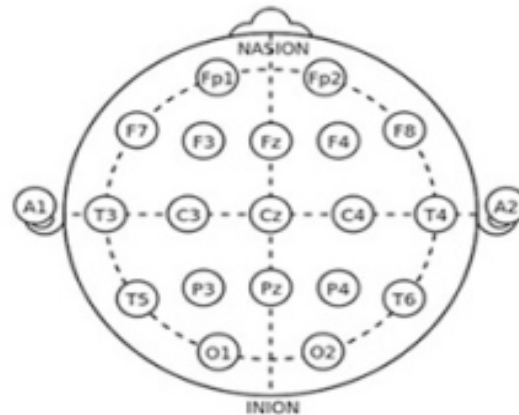
Each site has a letter to identify the lobe and a number to identify if the site is on the right or left hemisphere.

The letters:

Fp= pre-frontal, F= frontal, T= temporal, C= central, P= parietal, O= occipital

The numbers:

A “z” refers to an electrode placed on the midline. Even numbers (2, 4, 6, 8) refer to electrode positions on the right hemisphere and odd numbers (1, 3, 5, 7) refer to electrode positions on the left hemisphere.



- 2) **Using LORETA** an inverse solution that infers underlying activity from brain regions of interest and their corresponding Brodmann areas.

For more information on Brodmann areas see

<http://www.fmriconsulting.com/brodmann/Interact.html>

Recording states & Montages:

EYES OPEN at rest & EYES CLOSED at rest reveals different activity than AT TASK. The brain likes to be busy and we are recording it in neutral, at rest. AT TASK is also an option for recording and may include event related potential (ERP) testing.

LINKED EARS, LAPLACIAN and AVERAGE reference as well as LONGITUDINAL BIPOLAR are the montages used in analysis of the EEG brainwaves and rhythms. Finding the source or sources of the EEG activity is of clinical value in designing a therapy and training program.

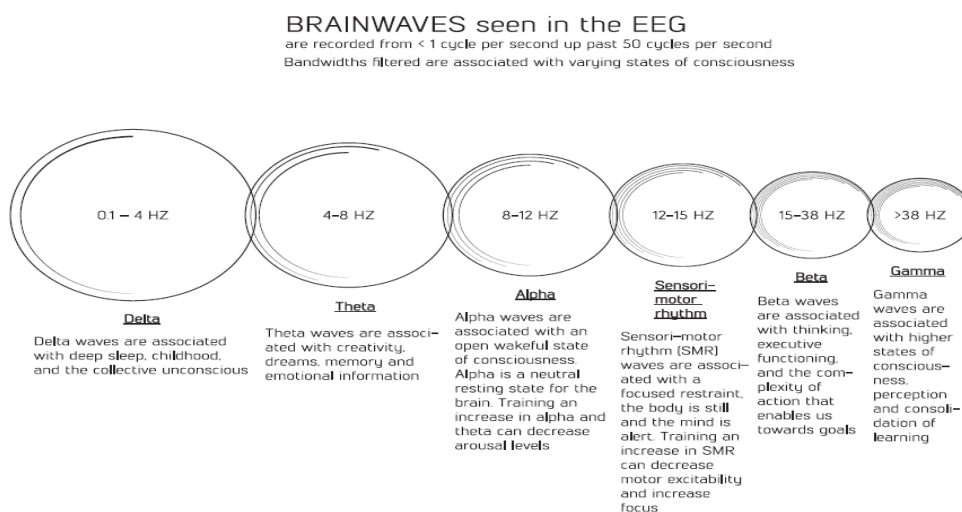
Perspective:

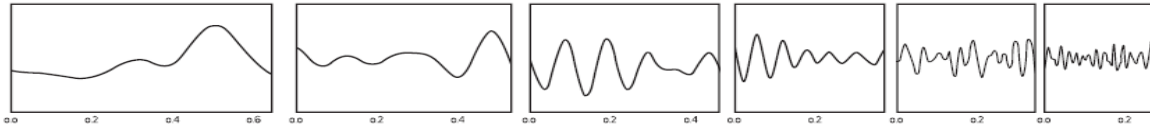
There are associated functions with the varying locations. Additionally, certain brainwave patterns would be expected at some locations and during certain

states. It is stated that 50% of the activity we see in the EEG at a specific site is from the neuronal synchrony at that location and the other 50% of the activity we see in the EEG is recruited from the interconnections with other neuronal groups synchronizing.

ICA independent component analysis

“EEG obtained from scalp electrodes is a sum of the large number of neurons potentials. The interest is in studying the potentials in the sources inside the brain and not only the potentials on the scalp, which globally describe the brain activity. Direct measurements from the different centers in the brain require placing electrodes inside the head, which means surgery. This is not acceptable because of the risk for the subject. Another possibility is to calculate the signals of interest from the EEG obtained on the scalp. These signals are weighed sums of the neurons activity, the weights depending on the signal path from the brain cell to the electrodes. Because the same potential is recorded from more than one electrode, the signals from the electrodes are supposed to be highly correlated. If the weights were known, the potentials in the sources could be computed from a sufficient number of electrode signals. Independent component analysis (ICA), sometimes referred to as blind signal separation or blind source separation, is a mathematical tool that can help solving the problem.”





SUMMARY OF TERMS:

EEG- electro-encephalography are the brainwaves.

Much of the language of EEG is concerned with power (pressure), speed (frequency and current) and connections (across fibers and through coherence and phase metrics) between locations. The meaning of these findings are often related to states of consciousness and what can be done to improve upon them.

Frequency- unit of measurement is hertz (hz) measuring cycles per second. This is the rate at which a particular waveform repeats (or neurons fire in synchrony to generate the waveform we see). It can be rhythmic or intermittent. This is the speed of the area of the brain being mentioned and can be thought of as a shutter speed, answering the question, "how much information is the person taking in or being subjected to in one second."

Amplitude- unit of measurement is microvolt (mv) references peak to peak measurements. This can be thought of as the power supply or volume or pressure in the speed.

Wave shape or morphology- ways of describing what the actual shape of the wave looks like.

Background Activity- This term denotes the general setting in which changes in frequency, amplitude, or morphology appear. Although the alpha rhythm may be the background activity in the tracings from the posterior regions, it is important to note that the term background activity is not synonymous with alpha rhythm; thus, over the frontal area, the activity may be mostly in the beta frequency band. The background activity may not always be a normal pattern; the term can also refer to abnormal patterns.

Both the background activity and the changes that appear in the features of the tracing are described in terms of frequency, amplitude, wave shape, connectivity and location.

Connectivity- mathematical representations of communication or information processing, between locations and networks. The main focus of connectivity training with neurofeedback is on coherence or phase.

Z-scores- standard deviations (SD) from the mean. QEEG results are compared to a large database of normal age-matched individuals and presented as z-scores. In the Neuroguide database z-scores range from -3 to +3. A z-score of 0 represents the mean. The Z-score power maps are color-coded and in what follows green= zero. Shades away from green, towards blue or red colors on the maps show extreme brainwave activity that is below or above the norm. The Z-score connectivity maps without lines between locations is representative of a normative amount of connectivity. Blue lines represent hypo-connectivity, meaning less than the norm and red lines represent hyper-connectivity meaning more than the norm. Diminished or excessive activity can be problematic. If this activity corresponds to complaints of function, we will attempt to modulate it via low level stimulation or biofeedback.

REFERENCE:

Ungureanu, M., Bigar, C., Strungaru, R., and Lazarescu, V. (2004). Independent component analysis applied in biomedical signal processing. *Measurement science review*. 4(2). Retrieved on 06/12/2020 @ <http://www.measurement.sk/2004/S2/UNGUREANU.pdf>