Affect Lab

Brainwave Mapping

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EMOTION
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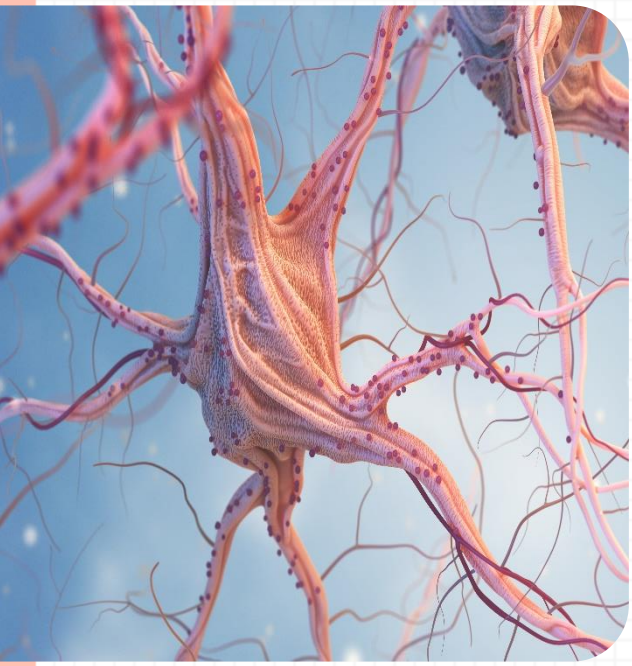
Brain Overview

EEG stands for electroencephalogram, a test commonly used to detect electrical activity in the brain. Detecting, recording and interpreting “brainwaves” began in the late 1800s with the discovery and exploration of electrical patterns in the brains of mammals, and the technology has evolved to enable applications ranging from the medical detection of neurological disorders to playing games controlled entirely by the mind.



To fully understand how EEG works, you must first understand how the human body conveys information between cells using electricity. Electricity: The Language of the Brain (and Body) Every function carried out by our brains and bodies is enabled by electrical signals. Everything is made up of atoms, which in turn are made up of protons, electrons and neutrons.

They all have different electrical charges:

Protons have a positive electrical charge
Electrons have a negative electrical change
Neutrons have a neutral electrical charge

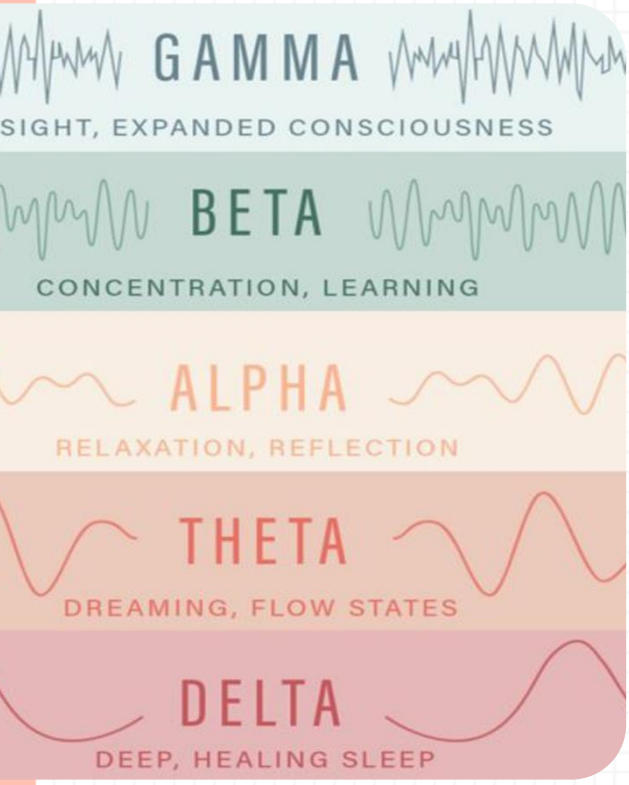
Here’s a simplified explanation of how cells communicate: when the electrical charge in an atom is unbalanced, the atom becomes either positively or negatively charged and allows electrons to flow from one atom to another to maintain equilibrium. This flow of electrons is what we all refer to as electricity. With about seven billion billion billion atoms in each human body, we have the capacity to generate significant and measurable amounts of electricity.

These electrical signals (or ” Impulses”) from atom to atom are what enables human cells to communicate with each other. Our nervous system conducts these impulses, allowing them to jump from cell to cell until they reach their intended destination. These are varying speeds of impulse transmission the fastest impulses can travel at speeds of about 250 miles per hour. This is why (for example) if you burn your hand, your brain is able to quickly remove it from the heat source before the pain even fully registers.

Brain cells work the same way as, say, the cells in your left pinky toe or your tongue. There is nothing “special” about brain cells—it’s the programming which allows humans to think, feel, and communicate. Just as a calculator can’t actually do math without programming and the external entry of numbers, the physical structure of your brain can’t do these things without a layer of sensory input and the context of past experiences and learnings.

However, when the brain—an infinitely intricate computer which has evolved over millions of years to be able to program and re-program itself in real time—works its magic, the basic components of brain function are still electrical signals, and they can be observed and measured

What are Brainwaves?



At the root of all our thoughts, emotions and behaviors is the communication between neurons within our brains. Brainwaves are produced by synchronized electrical pulses from masses of neurons communicating with each other.
Brainwaves are detected using sensors placed on the scalp. They are divided into bandwidths to describe their functions (below), but are best thought of as a continuous spectrum of consciousness; from slow, loud and functional - to fast, subtle, and complex.

It is a handy analogy to think of Brainwaves as musical notes - the low frequency waves are like a deeply penetrating drum beat, while the higher frequency brainwaves are more like a subtle high pitched flute. Like a symphony, the higher and lower frequencies link and cohere with each other through harmonics.

The descriptions that follow are only broadly descriptions - in practice things are far more complex, and brainwaves reflect different aspects when they occur in different locations in the brain. Brainwave speed is measured in Hertz (cycles per second) and they are divided into bands delineating slow, moderate, and fast waves.

Affect Lab Brainwave Headset

The family of Affect Lab Brainwave headsets is designed to be used by market research teams to get to market quickly with complete EEG-monitoring products.

The Affect Lab headset turns your computer into a brain activity monitor. The headset safely measures brainwave signals and monitors the attention levels of individuals as they interact with a variety of different experiences.

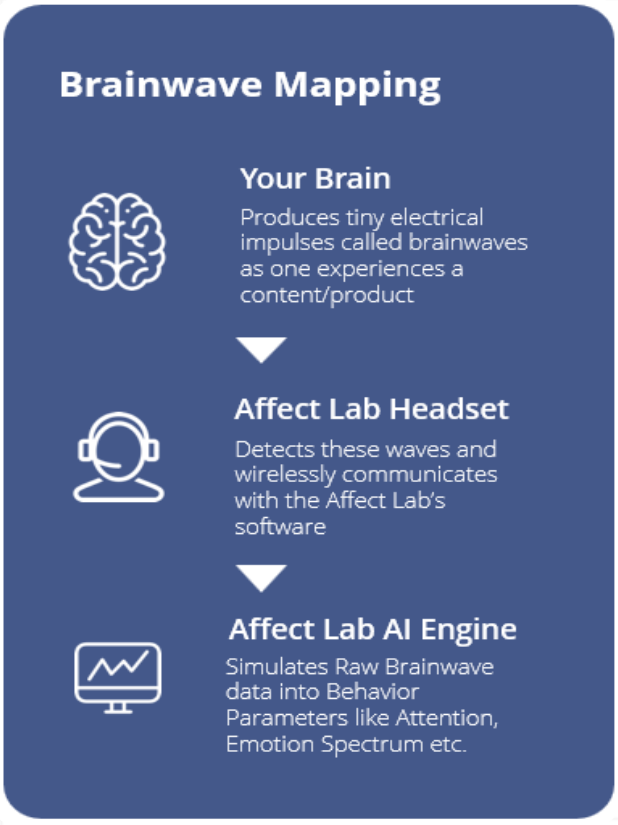
Hardware Overview:

Portable EEG
brainwave headset
TGAM1 module, with
TGAT1 ASIC Automatic
wireless computer
pairing Static headset
MAC address (ID)
Single AAA battery
6-8 hours' battery run time

Specs:

Lightweight
Wireless
Safe passive biosensors 8-hour
AAA battery life
Supports Windows XP / Vista / 7
Supports Mac OS X 10.5.8, 10.6.x, and 10.7.x

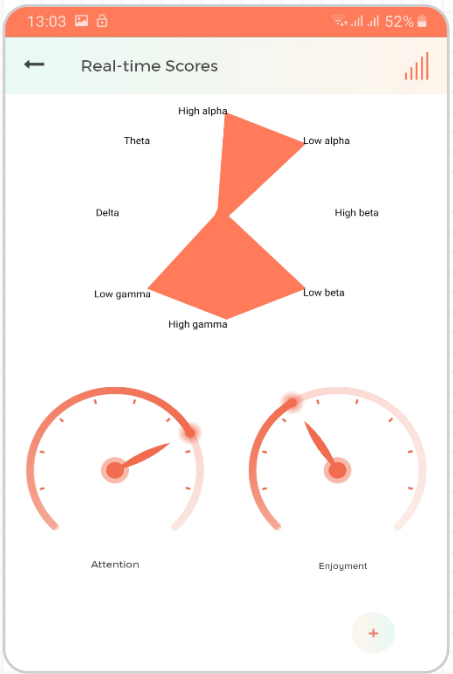
How it works?



Affect Lab EEG Headsets comprises of Dry electrodes that measure electrical impulse at different parts of right brain. An ear pin measures HRV and cognitive impulses consolidated at left half of a user brain.

These raw impulse signals are converted into Brainwave data points using EEG sensor, details of which has been mentioned in the in the hardware spec above

Interpretive Algorithms



Interpretive Algorithms allows to correlate between different frequency of Brainwave to final quantified data Parameters

Though the actual algorithms are tweaked and researched across complex scenarios, below is attached an overview of what each brainwave means and is clinically defined to be correlated to various Cognitive Parameters.

Infra-low (<0.5Hz)

Infra-Low brainwaves (also known as Slow Cortical Potentials), are thought to be the basic cortical rhythms that underlie our higher brain functions. Very Little is known about infra-Low brainwaves. Their slow nature make them difficult to detect and accurately measure, so few studies have been done. They appear to take a major role in brain timing and network function.

Delta Waves (0.5 to 3Hz)

Delta brainwaves are slow, loud brainwaves (low frequency and deeply penetrating, like a drum beat). They are generated in deepest meditation and dreamless sleep. Delta waves suspend external awareness and are the source of empathy. Healing and regeneration are stimulated in this state, and that is why deep restorative sleep is so essential to the healing process.

Theta Waves (3 to 8Hz)

Theta brainwaves occur most often in sleep but are also dominant in deep meditation. It acts as our gateway to learning and memory. In theta, our senses are withdrawn from the external world and focused on signals originating from within. It is that twilight state which we normally only experience fleetingly as we wake or drift off to sleep. In theta we are in a dream; vivid imagery, intuition and information beyond our normal conscious awareness. It's where we hold our 'stuff', our fears, troubled history, and nightmares.

Alpha Waves (8 to 12Hz)

Alpha brainwaves are dominant during quietly flowing thoughts, and in some meditative states. Alpha is 'the power of now', being here, in the present. Alpha is the resting state for the brain. Alpha waves aid overall mental coordination, calmness, alertness, mind/body integration and learning.

Beta Waves (12 to 38Hz)

Beta brainwaves dominate our normal waking state of consciousness when attention is directed towards cognitive tasks and the outside world. Beta is a ‘fast’ activity, present when we are alert, attentive, engaged in problem solving, judgment, decision making, and engaged in focused mental activity

Beta brainwaves are further divided into three bands; Lo-Beta (Beta1, 12-15Hz) can be thought of as a 'fast idle, or musing. Beta (Beta2, 15-22Hz) is high engagement or actively figuring something out. Hi-Beta (Beta3, 22-38Hz) is highly complex thought, integrating new experiences, high anxiety, or excitement. Continual high frequency processing is not a very efficient way to run the brain, as it takes a tremendous amount of energy.

Gama Waves (38 to 42Hz)

Gamma brainwaves are the fastest of brain waves (high frequency, like a flute), and relate to simultaneous processing of information from different brain areas. It passes information rapidly, and as the subtlest of the brainwave frequencies, the mind has to be quiet to access it. Gamma was dismissed as 'spare brain noise' until researchers discovered it was highly active when in states of universal love, altruism, and the ‘higher virtues’. Gamma is also above the frequency of neuronal firing, so how it is generated remains a mystery. It is speculated that Gamma rhythms modulate perception and consciousness, and that a greater presence of Gamma relates to expanded consciousness and spiritual emergence.

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