

A Look at
**Brainwave
Entrainment**



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**By Dr. Tim Ong
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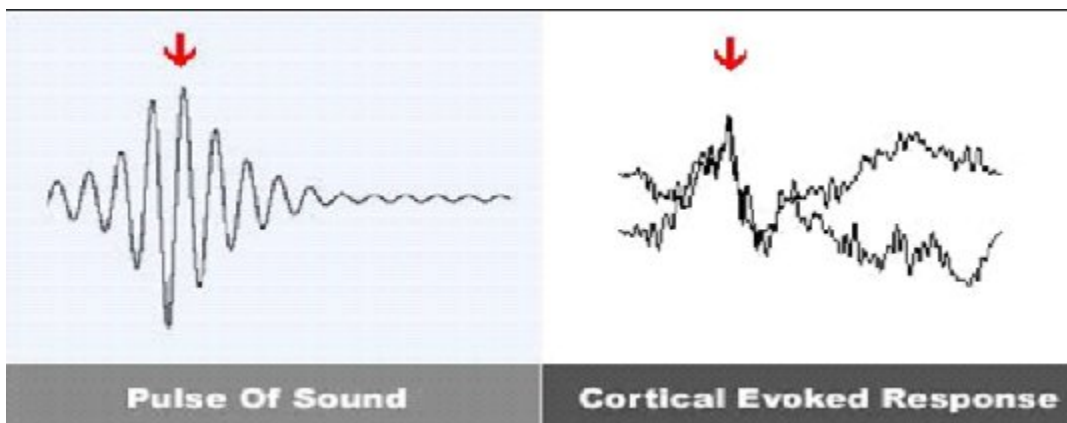
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What is Brainwave Entrainment?

Brainwave entrainment refers to the brain's electrical response to prolonged and rhythmic sensory stimulation, such as pulses of sound or light, that resulted in the synchronization of the brainwaves to the external stimuli.

This is why brainwave entrainment is also sometimes called brainwave synchronization.

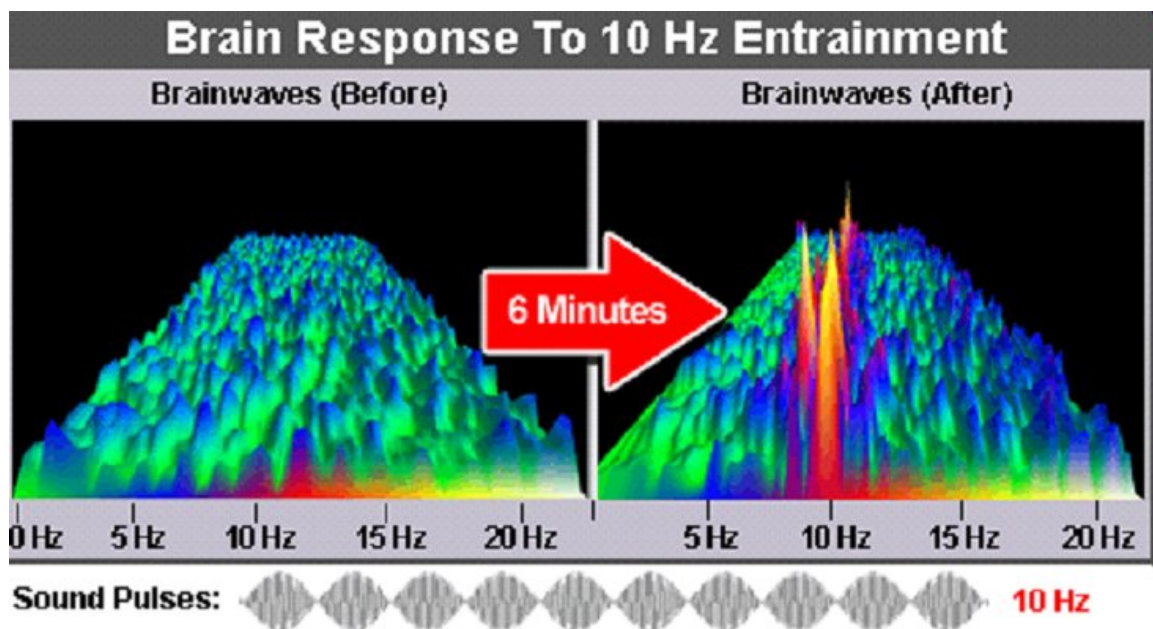
When a brain is given a single stimulus, such as a pulse of sound, it responds by emitting a corresponding electrical discharge. This corresponding electrical discharge is called the cortical evoked response.



This electrical activity in the brain can be measured using a machine called an electroencephalograph (EEG) and sensitive electrodes attached to the scalp.

When the brain is presented with a rhythmic stimulus, e.g. drum beats, the rhythm is reproduced in the brain in the form of these electrical impulses. When the rhythm becomes fast and consistent enough, our brain electrical impulses start to synchronize with the rhythm. This is called the Frequency Following Response (FFR).

This frequency following response can be used beneficially because scientists have noted that the states of our brainwaves are very much related to our psychological mental states.



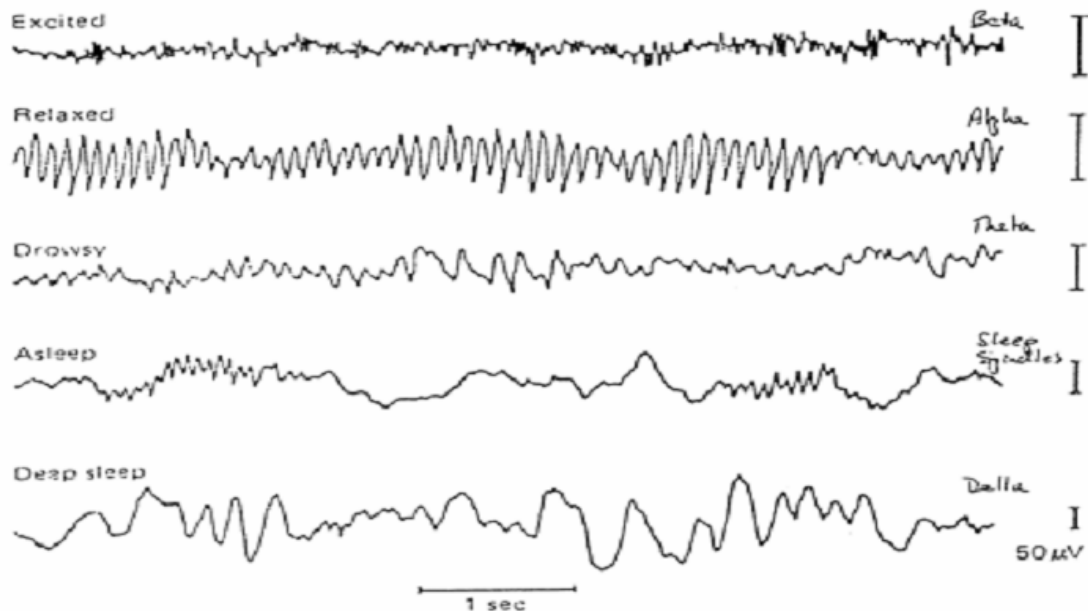
In other words, if we can produce a certain types of brainwaves in our brain, we can alter our psychological mental state of mind. For example, someone with excessively high beta brainwaves can be guided to have a more relaxed and receptive alpha brainwaves that is more similar to a meditative state of mind.

Following this reasoning, we can in fact determine exactly the kind of mental states we desire simply by synchronizing our brainwaves to the appropriate mental states.

Types of Brainwaves

Generally, scientists have classified our brainwaves into 4 types – beta, alpha, theta and delta. Here is a simplified description of each of them:

Type	Range	Quality
Beta	13 Hz -	Wide awake, attentive, concentrate, energetic
Alpha	8 Hz – 13 Hz	Awake but relaxed, e.g. hypnagogic states; Meditative, receptive and absorbent; Good for learning, hypnosis and mental programming
Theta	4 Hz – 8 Hz	Extreme relaxation, light sleep
Delta	0.1 Hz – 4 Hz	Deep, dreamless sleep; Usually not conscious; Healing



Beta brainwave is our normal waking brainwave state. When we are highly stressed or emotionally charged such as anger, we get high beta brainwaves, e.g. 30 Hz – 48 Hz.

We experience *alpha brainwave* usually when we first wake up in the morning from sleep or as we are about to fall asleep at night. These are called *hypnagogic states* and are best for mental programming and hypnosis as they are very receptive to suggestions. This also explains why many people find it easy to meditate first thing in the morning.

Theta brainwave occurs in light sleep. This is also the range where lucid dreaming and out of body experiences occur. It is also believed that this state is more intuitive and is closely connected to the collective unconscious.

Delta brainwave occurs in deep, dreamless sleep. Generally, people are not conscious when they are in this state. However, some exceptional individuals practicing certain specific meditation techniques can stay conscious while in this state. Our body and mind heal well in this state.

The Science behind Brainwave Entrainment

Historically, ritual drumming and rhythmic prayer are found in cultures throughout the world and are used in religious ceremonies to induce trance states. They are, in fact, different forms of brainwave entrainment in action.

The first recorded entrainment phenomenon was noted by the Dutch scientist, Christian Huygens, in 1665. He observed that a number of pendulum driven clocks in a room fell into synchronization with each other over time. However, no records of further investigations or studies were done on this unique phenomenon until the 1900's.

In the early 1900's, Hans Berger did the first systematic study of the electrical activities in the human brain. The first recorded EEG using a prototype EEG machine was achieved in 1924. In 1929, Hans Berger discovered the alpha waves.



The first alpha waves tracing

Not long after this, researchers noted that flickering lights can alter brainwave patterns. This is called photic stimulation.

In 1959, Chatrian observed that sound stimulation can lead to brainwave synchronization (auditory entrainment).

By 1960s, scientists were experimenting with brainwave entrainment as a tool for various procedures and treatments. M.S. Sadove, an anesthesiologist, used photic stimulation to reduce the use of anesthesia in surgery. Bernard Margolis, in an article on the use of brainwave entrainment during dental procedures, noted that less anesthesia was required. There were also less gagging, less bleeding and a general reduction in anxiety during the entire procedure.

In 1968, Joe Kamiya published an article in *Psychology Today* on neurofeedback (biofeedback). He noted that EEG frequency states correspond to psychological states, and thus was the first person to introduce the idea that people can be trained to voluntarily control their brainwaves.

In 1973, Elmer Green even took a portable EEG to study the brainwave patterns of Eastern mystics and yogis. He later wrote a book called "Beyond Biofeedback".

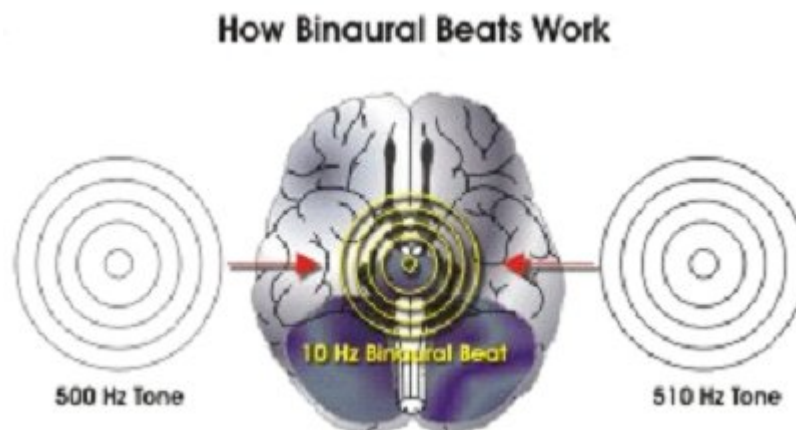
Soon, various programs touting the benefits, uses and achievements of alpha brainwave state became available. These alpha control programs were touted as electronic technologies for consciousness expansion and personal transformation.

Unfortunately, these were also the times of the psychedelic and hippy cultures of the 1960s and 1970s where people were freely experimenting with new lifestyles, drugs, consciousness expansion and sex. Putting the alpha control programs together with these new developments only resulted in a backlash from the scientific community. Thus, researches in brainwave entrainment and biofeedback went underground by the mid 1970s.

Fortunately, the researches on brainwave entrainment did not die out completely like the hippy and psychedelic cultures but continued on quietly in the background of mainstream scientific researches.

Binaural Beats

In 1973, Dr. Gerald Oster of Mount Sinai Medical Center published a report in the *Scientific American* called "*Auditory Beats in the Brain*". In it, he explained that when tones of different frequencies were presented separately to each ear, pulsations called binaural beats occurred in the brain, which resulted in the whole brain becoming entrained to the internal beat and resonating to that frequency.



Dr. Oster's binaural beats was able to be reproduced by Robert Monroe of the Monroe Institute of Applied Sciences and Dr. Lester Fehmi, director of the Princeton Behavioral Medicine and Biofeedback Clinic.

In the 1980s, Tsuyoshi Inouye (Dept. of Neuropsychiatry, Osaka University Medical School) found that photic stimulation produced "cerebral synchronization". Later, Dr. Norman Shealy confirmed the effect, finding that photic stimulation can produce cerebral synchronization in more than 5,000 patients in his studies.

Other researchers such as Dr. Norman Shealy, Dr. Glen Solomon and others experimented on brainwave entrainment for headache relief, serotonin and HGH release and general relaxation.

In 1981, Michael Hutchison wrote *MegaBrain*, outlining the many possible uses of brainwave entrainment from meditation to super-learning. This book did for brainwave entrainment what Daniel Goleman's book "Emotional Intelligence" did to EQ, bringing it to the attention of the general public, albeit with less prominence.

Harold Russel (Ph.D.) and John Carter (Ph.D.) of the University of Houston used brainwave entrainment to treat Attention Deficit Disorder (ADD) and other learning disorders, testing IQ before and after treatment. They noted that their subjects showed a consistent 5 to 7 point increase in their IQ score.

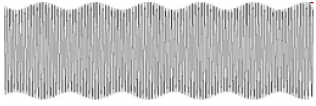
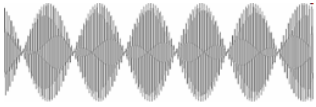
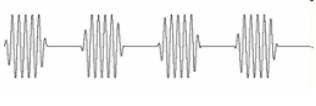
By now, brainwave entrainment has been used in extensive researches to treat various conditions such as learning disability, behavioral and personality change, alcohol abuse, drug addiction, anxiety and even depression.

Brainwave Entrainment Today

Brainwave entrainment products can be easily produced. With the right equipment and technical knowledge, you can even create your own brainwave entrainment products without spending too much money.

Today, brainwave entrainment products come in various forms. They are being sold over the Internet and packaged as some forms of workshops or weekend getaway experiences. Some are digitally downloadable while others are shipped physically. Some use only sound while others combined sound and light.

Nowadays, brainwave entrainment products come not only in binaural beats but also monaural beats and isochronic tones. Here are some of their main differences:

Type	Description	Headphone	Quality
Binaural beats 	Used 2 different tones, one to each ear. Binaural beats effected inside the brain.	Required	Generally, the sound produced is more pleasant to the ears.
Monaural beats 	Two tones are combined outside the brain.	Not required	Louder, coarser sound is produced.
Isochronic tones 	One single tone only and from the outside.	Not required	Generally regarded as producing more powerful entrainment

Does Brainwave Entrainment work?

We have seen that a lot of real scientific researches have been put into the study of brainwave entrainment, what it is, how it works and what one can use it for.

Most of the evidences show that brainwave entrainment works and works beautifully. There are a few things to note.

Firstly, positive results do not come overnight although there have been reported cases of users benefiting from their use almost immediately. Positive results come with consistent and prolonged usage.

It takes time for the brain to become habituated with the new brainwave state. So in the initial stage, one can expect to fluctuate between one's "normal" brainwaves and the desired brainwave state. With consistent and prolonged use, usually for at least a month, one can gradually see and feel the difference in mental state.

Secondly, not all brainwave entrainment products are the same. They are not. The care, professional knowledge and quality that go into the production of these products do make a great difference to the outcome and effectiveness of the end products.

So, how do you know which products are reliable and which are not?

The scientific way to do this is to directly measure the results of using the brainwave entrainment product with an EEG machine. For example, if a product says it can produce an alpha brainwave state, then it would be good to actually be able to measure the alpha brainwaves in your brain when you used it.



Before using a BWE product, our brainwaves are mostly in Beta state.



After using a BWE product that produces alpha brainwave state, we can note the increased in alpha brainwave activities in the graph above. The two brain hemispheres are also more balanced.

However, EEG machines are costly and beyond the reach of most people. There are some commercial machines which can do the job of measuring brainwaves equally well but most of these are still quite expensive.

So the next best thing is to insist that the brainwave entrainment products come with some evidence to support their effectiveness. To date, none of the brainwave entrainment products available in the market have taken the trouble to provide such scientific evidence along with their products – evidence that are specific to their own products.

Under such circumstances, the best we can do is to look at the feedbacks, testimonials and reviews from people who have used these products. Products with good history of fast and appropriate support for their users, together with a strong company history, are more likely to be more trustworthy.

Lastly, and to be fair to the brainwave entrainment products, we must follow the instructions on the use of these products carefully. Some require the use of headphone to be effective while others do not. There is usually also recommended duration of time to use the product, as well as the frequency of use. Before we can say whether the product actually works or not, we must give it a fair chance by using it according to instructions.

More on Brainwave Entrainment

For more information on brainwave entrainment and mind science, go to:

1. Mind Science 101 – <http://mindscience101.com>
2. The Self Improvement Site – <http://theselfimprovementsite.com>
3. Brainwave Entrainment Products –
<http://theselfimprovementsite.com/bwe/products.html>
4. Brainwave Entrainment free downloads –
<http://theselfimprovementsite.com/bwe/freedloads.html>