SWISSBIONIC SOLUTIONS
LIFESTYLE

Brainwave Entrainment

How to bring your mind
to the next level

Author:
Dr. med. Lukas Barwitz

What are brainwaves?

The human brain is without a doubt a fascinating construct. It is made up of approximately 100 billion nerve cells called neurons and trillions of connections between them. That means there are more neural connections in a single cubic centimeter of brain tissue than there are stars in the Milky Way galaxy!

This immense neural network is responsible for anything and everything related to your reality. From your sense perceptions to your thoughts, to all functions of your body - it's all driven by data flowing through your brain's neural web. And this data is passed from one neuron to the next through electricity. When millions of neurons are communicating at the same time, this generates a significant amount of electrical activity which can be detected using an EEG (electroencephalograph). This combined electrical activity in the brain is known as a brainwave pattern due to its wave-like shape.
Brainwaves are measured in Hertz (Hz), representing the frequency of electrical cycles per second. Brainwave frequencies can be grouped into categories that are linked to various mental, emotional, and even physical states. For example, slow brainwaves are associated with relaxation and sleep, while faster brainwaves are associated with alertness and increased energy. By looking at one's brainwaves, you can imply the state of one's consciousness.

- **Beta (38hz - 12hz)** - Normal waking consciousness occurs in the beta range. This category is associated with cognitive tasks such as problem solving, decision making, verbal communication, and general mind wandering. Higher levels of beta brainwaves can be linked to stress, anxiety, and panic.

- **Alpha (12hz - 8hz)** - Awake, but deeply relaxed. Simply closing your eyes will produce alpha brainwaves. This category is associated with daydreaming, visualization, imagination and light meditation.

- **Theta (8hz - 3hz)** - Light sleep, dreaming, REM sleep, creativity, access to unconscious material, access to long-term memory, emotional healing, intuition, deep reverie, and spiritual wisdom. Hypnotists have found theta to be the range of hyper-suggestibility, where one can program or reprogram beliefs.

- **Delta (3hz - 0.2hz)** - Deep, dreamless sleep, trance, deep hypnosis. Brainwave expert Judith Pennington calls it the doorway to Universal Consciousness.

- **Gamma (100-38hz)** - Last discovered and least explored, associated with higher learning, strong focus and concentration, high flow of information, mystical and transcendent experiences. Gamma waves are being researched in the context of focused meditation.

How to modify brain waves to control your mind

The brain is a complex system, and every area of its network fires off various types of brain-waves at once. It is the combination of these brain waves, which can give a deeper insight into a person's state. For example, someone who has low levels of beta waves and elevated levels of alpha / theta waves, tends to suffer from attention deficit disorder (ADD). Those that have elevated levels of beta waves and low levels of alpha waves tend to suffer from anxiety.
Brainwave entrainment is a powerful technology that allows us to have greater control over our brain waves, and in turn greater control over our mental states. For example, ADD sufferers can use BWE technology to decrease theta brain waves, increase beta brain waves, resulting in a more focused mind. Those suffering from anxiety can turn down their beta brain wave production, which can result in feelings of relaxation and wellbeing.
Utilizing BWE technology gives you the closest thing to a dial control over your brain. Many longterm entrainment practitioners have said BWE allows them to enter any desired state at will - from deep tranquility, to creative insight, to focused attention

What does Entrainment mean?

Entrainment is a physics principle in which one rhythmic system falls in synchrony with another rhythmic system. If you've ever found yourself moving your body to the beat of your favorite song, then you've experienced entrainment in its most basic form. Apart from music, this principle can be found all around you, probably more than you realize. Here are a few examples:

- Fish in the ocean coming together to swim in synchrony
- Your circadian rhythm synchronizing to the rise and fall of the sun
- Women living or working closely naturally matching their menstrual cycles
- Breathing patterns and heart rates of couples matching when being close together

Why does entrainment occur? From a physics standpoint, less energy is required when one system falls in sync with a more powerful rhythmic system. Picture yourself swimming in a flowing river. How much more difficult is it to swim against the current versus swimming alongside it? It takes far less energy when you swing with the flow of the water.
From the stars in the sky to the fish in the ocean, endless systems fall under this same principle - including the human brain.

What is Brainwave Entrainment?

Think of a tuning fork. A tuning fork can be used to tune a guitar string to the right pitch. In the same way, brainwave entrainment uses specialized sound and light technology to tune your brainwaves to specific frequencies, and in turn, give you greater control over your mind. As explained billions of neurons throughout your brain communicate with one another through electricity. These electrical pulses are rhythmic in nature and just like any other rhythmic system, it can be subject to entrainment.

For example, if you stare at a strobe light flashing at a consistent and slow enough rate, your brainwaves will eventually begin to fall into that same rate. This process is called brainwave entrainment, which occurs when the electric rhythms of your brain begin to synchronize with the same rhythms of an external source. This source could come in the form of pulsing light, sound, touch, or even electrical signals.

Exposing ourselves to light or sound pulsating at specific frequencies, we can modify our brainwaves to the same rhythm and in effect, control our mental, emotional, and physical states at will.

What are the benefits of Brainwave Entrainment?

Mental Benefits

- Treating Attention Deficit Disorder / improving focus
- Improving academic performance
- Inducing dissociation / meditation enhancement
- Improving memory

Emotional Benefits

- Alleviating short-term stress
- Alleviating long-term stress
- Improving mood

Physical Benefits

- Alleviating pain
- Alleviating headaches

The Science of Brainwave Entrainment

hen you are presented with flashes of light, neurons in your eyes become excited and send electrical signals to the thalamus. The thalamus is an area of the brain that takes in sensory input from your environment and sends that data to different areas of the brain.

When electrical signals from your eyes hit the thalamus, it then sends the signal to your visual and cerebral cortex. As the visual cortex receives constant and repetitive signals from the pulsing light, its neural activity starts to synchronize to that same frequency.

Brainwave entrainment has begun and as it becomes stronger in the visual cortex, other areas of the brain follow suit and synchronize to the same source frequency. Not only the visual cortex, but also the whole brain can be stimulated through flashing light.

Brain Lateralization

The brain consists of two hemispheres, connected with a structure called the corpus callosum. The left hemisphere is associated with things such as analytical thought, logic, reasoning and language. The right hemisphere is associated with things like creativity, imagination, intuition, insight, and emotions. Most people have unbalanced brains, where one hemisphere shows greater activity than the other. This condition is called brain lateralization.
In his book Thresholds of The Mind, binaural beat expert Bill Harris writes about the problems associated with brain lateralization:

"Because the brain filters and interprets reality in a split-brained way, we tend to see things as separate and opposed, rather than as connected and part of the oneness spoken of by the great spiritual teachers (and, in the last few decades, by quantum mechanical physicists). Thus, at a deep level, the dual structure of our brain, in conjunction with brain lateralization, predisposes us to see and experience ourselves as separate from, and often in opposition to, the rest of the world-instead of experiencing the elegant interconnectedness between us and everything else. Our childhood associations and programming build on this inborn tendency by training us to seek this and avoid that, to move toward pleasure and away from pain, to do good and not bad, and so on. The greater the lateralization in the brain, the greater the feelings of separation - and the greater the feelings of separation, the greater the fear, stress, anxiety, and isolation."

Hemispheric Synchronization and Brainwave Entrainment

In the 1970s, neuroscience researchers found that when experienced meditators were deep in practice, harmonious activity between both hemispheres of the brain started to occur. This phenomenon is known as hemispheric synchronization.
When both hemispheres of the brain work in unison, this results in benefits such as creative insight, greater emotional stability, enhanced mental performance, better learning capabilities, deeper focus, increased connection with one's environment, and feelings of deep tranquility.
Traditional religious practices such as meditation, mantra, breathing exercises, and certain body movements were aimed to essentially counter the effects of brain lateralization, and move the mind towards a unified, synchronized system. However, only a percentage of practitioners are able to achieve these states consistently.
Brainwave entrainment is a reliable solution that can counter this problem. In 1980 Japanese researcher Tsuyoshi Inouye of Osaka University Medical School discovered that photic stimulation causes brain synchronization. Dr. Normal Shealy later tested over 5,000 of his patients with photic stimulation and came to the same conclusion.
Unlike traditional forms of meditation, brainwave entrainment is a reliable, predictable, and

consistent tool that allows you to harmonize various areas of your brain at will. With regular practice, new neural connections begin to be made between the two hemispheres and cumulative, long-term benefits start to take place.

Audio Entrainment

The deliberate use of sound to modify the mind has been long chronicled throughout history. Various indigenous cultures have used rhythmic patterns of clapping, chanting, and singing in ceremony to enter higher states of consciousness.
For thousands of years, instruments such as the aboriginal didgeridoo, Tibetan singing bowl, Native American flute, and the tribal drum have been revered as powerful tools of transformation.
In modern times, neuroscientists have found audio entrainment to bring about these same benefits. Binaural beats and isochronic tones have been shown to induce super learning, memory improvement, creativity enhancement, and even out of body experiences.

Auditory Beats

The most basic forms of audio entrainment are auditory beats, which form when two pure tones of a slightly different pitch are played together. For example, if two tuning forks at slightly different pitches are struck simultaneously, the pulsing "Wah-Wah-Wah" sound that you hear is the resulting beat. Auditory beats typically come in the form of binaural or monaural beats. In this great YouTube Video David SantoPietro explains the physics behind Beats plain and simple.

Binaural Beats: stereo headphones are used to play different high frequencies perceptible to the human ear in both ears. Their difference gives the target frequency value. If you want to tune your brain to 7hz, for example, you can play a tone with 207 Hz on the left ear and 200 Hz on the right one.

Monaural beats: two tones of the same intensity, but in different tone pulse patterns are played. The human ear perceives only a single beat. The sounds of the monaural beats can also be heard without headphones, whereby the technology works more effectively with the usage of headphones.

Isochronic Tones

Opposed to binaural and monaural beats, isochronic tones don't require two separate tones to form a beat. Rather, it uses a single tone, which turns on and off at an evenly spaced pattern. For example, if you want to create brain waves in the theta frequency range of 5hz, the sound will be played five times a second with five correspondingly long pauses. There are several types of isochronous tones, based on the transitions between sound and pause.

- **Sine wave:** Sine wave isochronic tones involve a smooth transition between on and off. Sine waves are the smoothest sounding tone, and most often used for relaxation.

- **Square wave:** Square wave isochronic tones involve instantaneous transitions between on and off. It is a harsher and yet also more powerful tone.

- **Saw tooth Wave:** Instead of playing only one note at a regular interval with pause, the saw tooth wave allows you to play a whole pulse package in a timed order with defined pauses. Thus, number of harmonics increase per pulse package, thereby improving the biological resonance factor (= higher probability).

Visual Entrainment: Photic Stimulation

Like sound, light has been used by various cultures throughout history to enter higher states of consciousness. From civilization's earliest days, individuals such as medicine men, shaman, and priests learned to use the flickering of light coming from fire as ways to transcend reality and enhance their mental powers.
Visual brainwave entrainment (also known as photic stimulation) is a method of using constant, repetitive light pulses to entrain the brain. These flashes of light can be delivered in a number of ways: television or computer screens, strobe lights, LED eye sets, and even virtual reality goggles. Studies have shown visual entrainment more effective than audio entrainment. One of the reasons this is true is the brain's visual cortex being much larger than the auditory cortex. When the visual cortex becomes entrained, it can affect a greater portion of surrounding brain regions more easily.

Audio-visual Brainwave Entrainment

Audio-visual brainwave entrainment (AVE) is the simultaneous use of rhythmic sound and light to entrain the brain. Although visual entrainment is more effective than audio entrainment, combining the two together can create even more powerful effects. Since both the auditory and visual cortex are stimulated simultaneously, greater portions of the brain are susceptible to entrainment. The iSLRS / OmniBrain are devices that combine rhythmic sound and light stimuli in harmony with the biological organ clock to achieve the best possible brainwave entrainment.

How To Safely Use Visual Brainwave Entrainment

Since visual brainwave entrainment can stimulate large areas of the brain, there are certain people who shouldn't use this technology:

- hose who suffer from photosensitivity
- Those who have history of seizures (especially epileptics)

- Those who experience headaches/migraines from bright lights
- Those who suffer from psychosis or brain damage
- Pregnant women (there is no mandatory medical advice for non-use, it is just a precautionary measure)

If you are under the use of medication (especially psychotropic substances), consult your physician before utilizing photic stimulation and those under the age of 18 should also consult with their physician.

According to the National Institute of Health, seizures from light stimuli are approximately 1 per 10,000. Those who have a history of epilepsy have a 2-14% chance of having seizures due to photic stimulation.

- Red light is linked to photo-convulsive response (PCR)
- Frequencies of 15-20 flashes per second cause peak PCR sensitivity
- Square wave photic stimulation can cause anxiety and panic attacks
- Unfiltered LED light could burn your retinas
- Photic stimulation alternating between the left and right eye could lead to nausea

When using photic stimulation device like the iSLRS / OmniBrain, it is not necessary to keep your eyes open. With your eyes closed, a suitable amount of neural signal will be sent to the visual cortex for entrainment to occur.

How Color Of Light Affects Brainwave Entrainment

Various colors delivered through photic stimulation have been shown to produce specific mental states:

- **Violet** - Violet is associated with wisdom and spirituality. Great for relaxation and pain relief.
- **Indigo** - Similar to violet, indigo is a great option for relaxation and pain relief.
- **Blue** - Calming color, great for relaxation. Known to enhance alpha activity. Good option for those who are photosensitive. Blue inhibits the production of melatonin, so avoid this color before bedtime.
- **Green** - Similar to blue, green is a soothing color excellent for relaxation sessions.
- **Yellow** - Best used to stimulate the brain in the beta range. Known to enhance creativity.
- **Orange** - n energizing color, which could increase beta activity. Orange has been associated with increasing the appetite.
- **Red** - Stimulating color, which is good for increasing beta activity. It can even suppress alpha brainwaves. Red is a great color to increase energy. Be especially careful with red lights as they are linked to photic induced seizures, panic attacks, and anxiety.
- **White** - Encompassing all colors, white is best used for visualization.

How long does it take to induce entrainment?

Although marketing materials in the entrainment industry claim you'll be able to enter deep states of meditation after pressing play, this is of course an exaggeration.
In reality, it typically takes 6 minutes to induce brainwave entrainment (if you are listening/watching to a high-quality entrainment session). This 6-minute marker is typical to induce alpha waves (12hz - 8hz). However, if you are looking to induce theta waves, it can take 30 minutes or longer for this to occur.
You can experience the benefits of the session for at least a few hours after it has ended. This is why it's important to choose your sessions wisely. Don't iniciate an energizing session before bedtime, or a relaxing session before an important work meeting.

How often should you consume entrainment sessions?

To get in shape, you wouldn't expect to see a sixpack after the first workout. Moreover, you would expect to get out of shape if you stop exercising altogether. The mind works very similar. If your aim is to see long-term results like anxiety relief, or greater emotional regulation - don't expect to see these results after your first BWE session.
Like getting in shape, it takes consistent effort over a period of time to see the benefits. A few weeks of regular BWE practice is required for your brain to produce new neural connections. Be patient during this time and stick with it. Once these new neural pathways are constructed, you can experience results much faster and deeper.
Consistency is key. You'll see far greater results listening to 10-minute sessions on 6 separate days of the week than a single 60-minute session once. Find a time of the day where you consistently have time to dive into a session. Right after waking up, or right before going to bed is one of the best times of the day for BWE.

What is the ideal environment for a BWE session?

It is important that you create the right environment while experiencing a brainwave entrainment session. Make sure your surroundings are quiet and distraction free. Be sure you are sitting/lying down in a comfortable position. It is common to fall asleep during alpha/theta sessions if you are lying down, so be sure to sit up if you don't want to end up snoozing. Lighting incense or diffusing essentials oils can also help enhance the experience.

Research & Further Reading

What follows is a series of peer-reviewed, controlled studies on brainwave entrainment, categorized by control type. I also commend to read "A Comprehensive Review of the Psychological Effects of Brainwave Entrainment" by Drs. Tina Huang from Transparent Corp's and Dr. Christine Charyton from the Newark Department of Psychology at Ohio State University.

Studies that compared different experimental conditions against each other:

Lane, J. D., Kasian, S. J., Owens, J. E. and Marsh, G. R., 1998. "Binaural auditory beats affect vigilance performance and mood." Physiol Behav. 63, 249-252.

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Rosenfeld, J. P., Reinhart, A. M. and Srivastava, S., 1997. "The effects of alpha (10-Hz) and beta (22-Hz) "entrainment" stimulation on the alpha and beta EEG bands: individual differences are critical to prediction of effects." Appl Psychophysiol Biofeed.

San Martini, P., Venturini, R., Zapponi, G. A. and Loizzo, A., 1979." Interaction between intermittent photic stimulation and auditory stimulation on the human EEG. Preliminary investigation through power spectral analysis." Neuropsychobiology. 5, 201-206.

Williams, J., Ramaswamy, D. and Oulhaj, A., 2006. "10 Hz flicker improves recognition memory in older people." BMC Neurosci. 7, 21.

Williams, J. H., 2001. "Frequency-specific effects of flicker on recognition memory." Neuroscience. 104, 283-286.

Studies with music as controls:

Joyce, M. and Siever, D., 2000. "Audio-Visual Entrainment (AVE) Program as a Treatment for Behavior Disorders in a School Setting." Journal of Neurotherapy. 4, 9-25.

Kliempt, P., Ruta, D., Ogston, S., Landeck, A. and Martay, K., 1999. "Hemispheric-synchronisation during anaesthesia: a double-blind randomised trial using audiotapes for intra-operative nociception control." Anaesthesia. 54, 769-773.

Padmanabhan, R., Hildreth, A. J. and Laws, D., 2005. "A prospective, randomised, controlled study examining binaural beat audio and pre-operative anxiety in patients undergoing general anaesthesia for day case surgery." Anaesthesia. 60, 874-877.

Wahbeh, H., Calabrese, C. and Zwickey, H., 2007a. “Binaural beat technology in humans: a pilot study to assess psychologic and physiologic effects.” J Altern Complement Med. 13, 25-32.

Wahbeh, H., Calabrese, C., Zwickey, H. and Zajdel, D., 2007b. “Binaural beat technology in humans: a pilot study to assess neuropsychologic, physiologic, and electroencephalographic effects.” J Altern Complement Med. 13, 199-206.

Wiwatwongwana, D., Vichitvejpaisal, P., Thaikruea, L., Klaphajone, J., Tantong, A. and Wiwatwongwana, A., 2012. “The effect of music with and without binaural beat audio on operative anxiety in patients undergoing cataract surgery: a randomized controlled trial.” Eye (Lond). 2016 Nov;30(11):1407-1414.

Studies with glasses, no photic stim as controls:

Kumano, H., Horie, H., Kuboki, T., Suematsu, H., Sato, H., Yasushi, M., Kamei, T. and Masumura, S., 1997. “EEG-driven photic stimulation effect on plasma cortisol and beta-endorphin.” Appl Psychophysiol Biofeedback. 22, 193-208.

Nomura, T., Higuchi, K., Yu, H., Sasaki, S., Kimura, S., Itoh, H., Taniguchi, M., Arakawa, T. and Kawai, K., 2006. “Slow-wave photic stimulation relieves patient discomfort during esophago-gastroduodenoscopy.” J Gastroenterol Hepatol. 21, 54-58.

Solomon, G. D., 1985. “Slow wave photic stimulation in the treatment of headache--a preliminary report.” Headache. 25, 444-446.

Berg, K., and Siever, D., 2009. “A controlled comparison of audio-visual entrainment for treating Seasonal Affective Disorder.” Journal of Neurotherapy 13.3 (2009): 166-175.

Other studies with controls (with no exposure):

Budzynski, T., Jordy, J., Budzynski, H., Tang, H. and Claypoole, K., 1999. “Academic Performance Enhancement with Photic Stimulation and EDR Feedback. Journal of Neurotherapy.” 3, 11-21.

Patrick, G. J., 1996. “Improved neuronal regulation in ADHD: An application of fifteen sessions of photic-driven EEG neurotherapy.” Journal of Neurotherapy. 1, 27-36.

Swiss Bionic Solutions Schweiz GmbH
Schulhausstrasse 17 | 8834 Schindellegi, Schweiz
Phone: +41 (62) 295 5951 | Fax: +41 (62) 295 5952 | E-Mail: ch@swissbionic.com

Swiss Bionic Solutions Deutschland GmbH
Biberacher Str. 87 | 88339 Bad Waldsee, Deutschland
Phone: +49 (7524) 996 950 | Fax: +49 (7524) 996 9518 | E-Mail: de@swissbionic.com

Swiss Bionic Solutions USA Inc.
12330 SW 53rd Street | Suite 703 & 704 | Cooper City | Florida 33330, USA
Phone: +1 (954) 766 4153 | Fax: +1 (954) 766 4156 | E-Mail: us@swissbionic.com

Swiss Bionic Solutions Canada Inc.
1195 North Service Rd W. Unit B8 | Oakville, ON, L6M 2W2, Canada
Phone: +1 (905) 465 0753 | Fax: +1 (1 866) 792 8182 | E-Mail: ca@swissbionic.com

Swiss Bionic Solutions Asia Ltd.
998 Canton Road | Mongkok | Kowloon | Hong Kong
Phone: +852 2337-8774 | E-Mail: asia@swissbionic.com

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