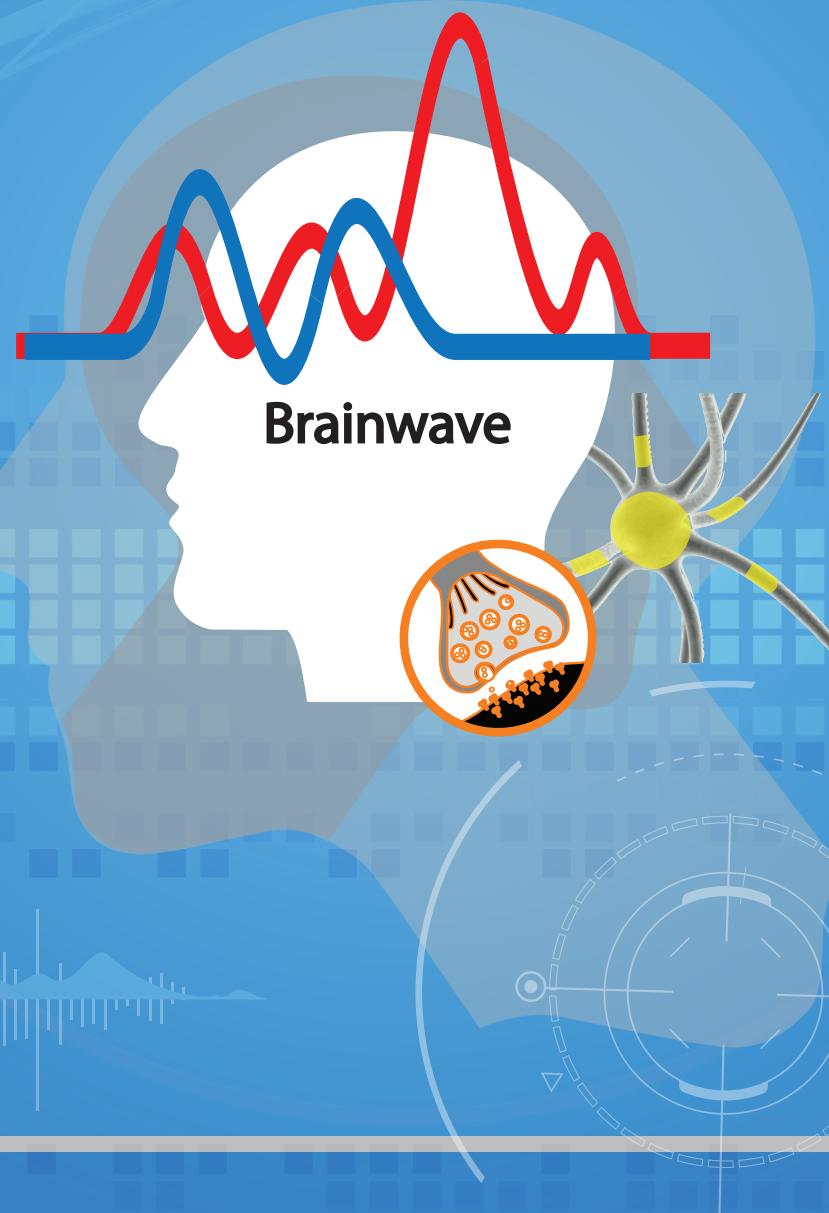


Neuro Science Report

Brain function analysis report



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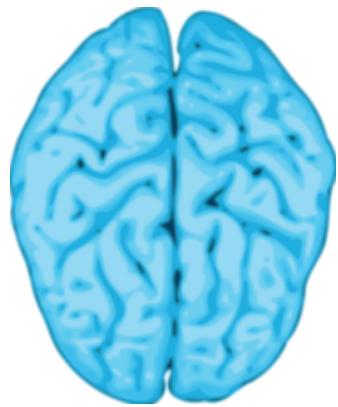


The Meaning of Brainwave Test

1

Brain Controls All Human Functions

All physical and mental activities of humans are processed through the brain. Learning occurs in the brain, the mind operates in the brain, and life-sustaining activities like breathing and heartbeat are all precisely controlled by the brain. Even the simplest activities like moving a finger happen when the brain sends a signal to the muscles via motor neurons.



The number of brain cells increase exponentially from the 4th week of conception, and by the time of birth, a baby has about a 100 billion brain cells, which is similar to a full-grown adult. Therefore, the health and condition of a baby's brain are determined by the mother's nutrition, emotional stability, stress, and environment during pregnancy. Following birth, brain cells and the neuronal system are developed depending on various factors including motor development, nutrition, heavy metals, relationship with parents, sleep, and environment.

2

Formation of Habit Circuit

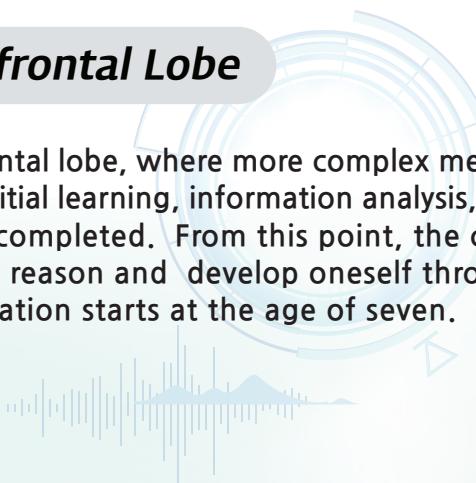


Around the age of three, more than 10 trillion nervous systems connecting brain cells are formed, eventually developing cognitive and behavioral modes. Thus, repeated or strong stimuli from vision, hearing, and experience up to the age of three develop into the form of habits. On the other hand, nervous connections that are not used frequently weaken and exerts less or no influence on personality and behavior.

3

Completion of Prefrontal Lobe

Around the age of six, the prefrontal lobe, where more complex mental processes like working memory, initial learning, information analysis, and judgement occur, is somewhat completed. From this point, the child develops an ability to judge with reason and develop oneself through learning. Hence elementary education starts at the age of seven.



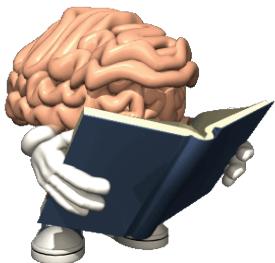


4 Change in Brain during Adolescence

Around the age of fifteen, one goes through adolescence and experiences resultant changes. Nervous systems only required at childhood disappear through, and new nervous systems form to become an adult. While the amygdaloid body, brain of emotion, is almost completed, nervous systems are still incomplete, leading to temporary incongruity in brain development and hence adolescence.



5 What Is the Difference between a Genius and an Average Person?

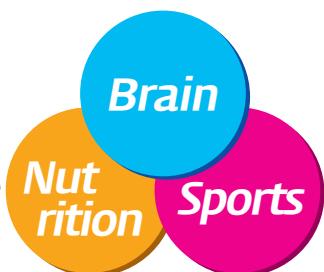


How do the brains of geniuses and those of average children differ? Why do students earn different grades after studying for the same amount of time? That depends on the present state of the brain.

In other words, a healthy child whose brain cells are healthy, has a well-developed brain nervous system, has no problem with nutrition or heavy metals, and is emotionally stable can earn good grades. If a be a reason

6 Factors that Inhibit Memory, Cognition, and Learning

- ▶ Deficiency in nutrition such as essential minerals and vitamins
- ▶ Excess of slow brainwaves in prefrontal lobe
- ▶ Bilateral imbalance in brain
- ▶ Omission of motor development stage
- ▶ Problem in living environment and developing personal relationships
- ▶ Accumulation of heavy metals such as lead, cadmium, aluminum, and mercury
- ▶ Over-activated brain due to excess beta waves
- ▶ Decrease in active rhythm of prefrontal lobe
- ▶ Abnormal expression of neurotransmitter
- ▶ Imbalance in body strength and form

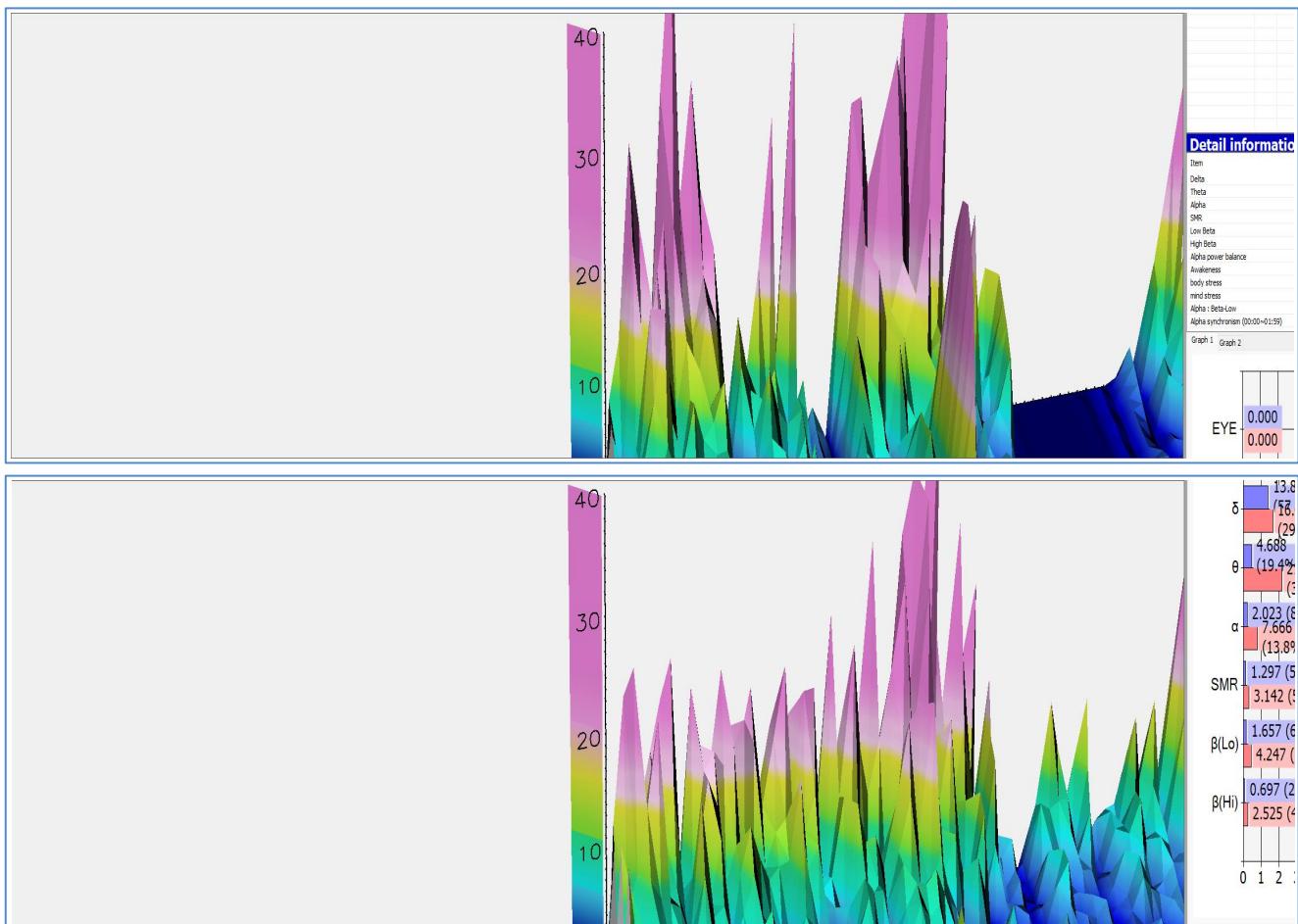


Factors that inhibit efficient brain activity can be tested and analyzed in the brain level, nutrition and heavy metal level, and motor development level. Based on the analysis of results, a solution can be found.

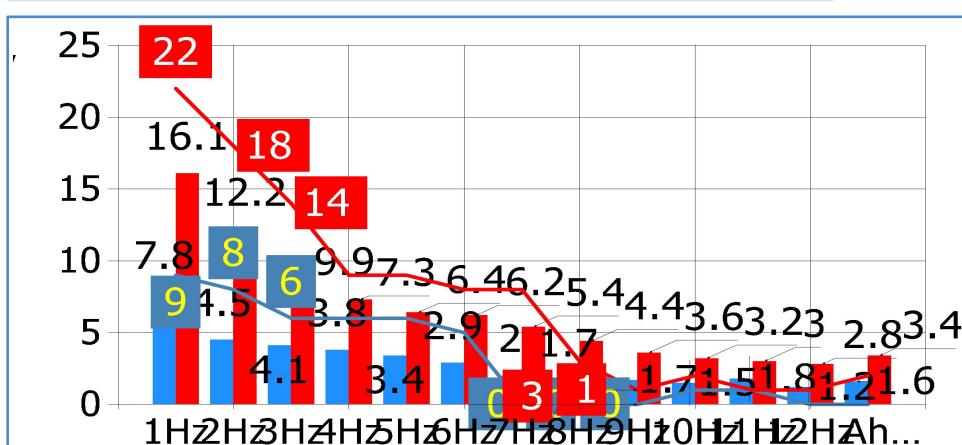




1 Brain wave graph



2 Frequency appearance rate and average amplitude



Standard frequency

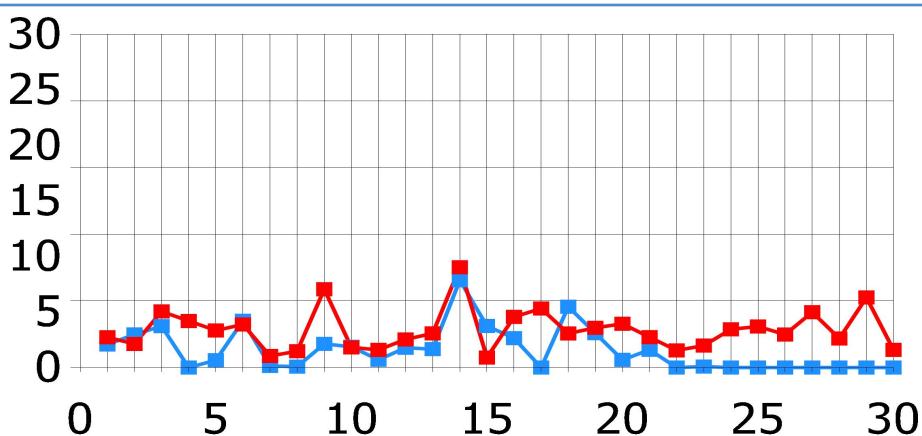
Age	Frequency
under 5	6 Hz
6~7	7 Hz
8~10	8 Hz
11~15	9 Hz
16~45	9~11 Hz
46~59	9 Hz
60~69	8 Hz
over 70	7 Hz

Left	Standard frequency	6Hz	Dominant frequency	5Hz	α relative power	12.6%
Right				5Hz		12.0%

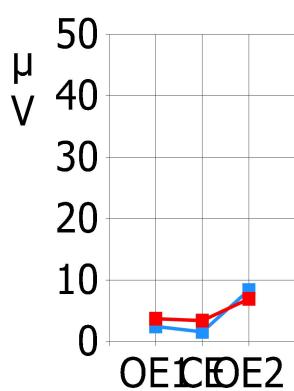
Frequency is the number of brain wave cycles per second. Frequency measured from the prefrontal lobe is a significant indicator of capacity of cognition, learning, working memory, analysis, judgement, and information processing.

The left brain manages calculation, language, analysis and inference, while the right brain manages abstract, artistic, emotional, and overall processing. The rate of frequency in either side affects these functions.

3 The change in power of alpha waves



O-C-O change



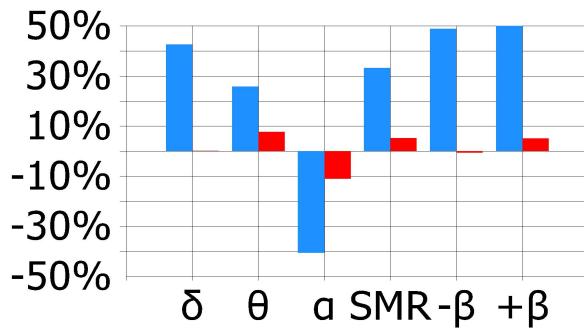
Left	α Avg.	1.6	Max.	7.9	Min.	0.0	Std. dev.	2.1	Max. dev.	7.9
Right	Amp.	3.4		9.0		0.9		1.8		8.1

Alpha waves are the most basic human brain waves. When eyes are closed, the amplitude should be about $5\sim10\mu\text{V}$ and flow in the same direction and height in both left and right brain for both sides of the brain to collaborate efficiently.

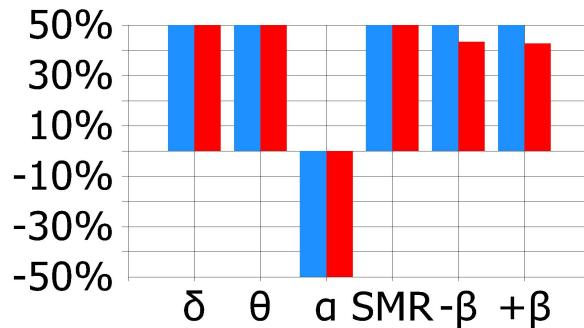
If alpha wave is too high, the prefrontal lobe may decline in function and lead to a woozy condition. If too low, ergasia may be stimulated but can cause fatigue and become vulnerable to stress.

4 Changes in EEG during opening and closing

OE1/CE



OE2/CE



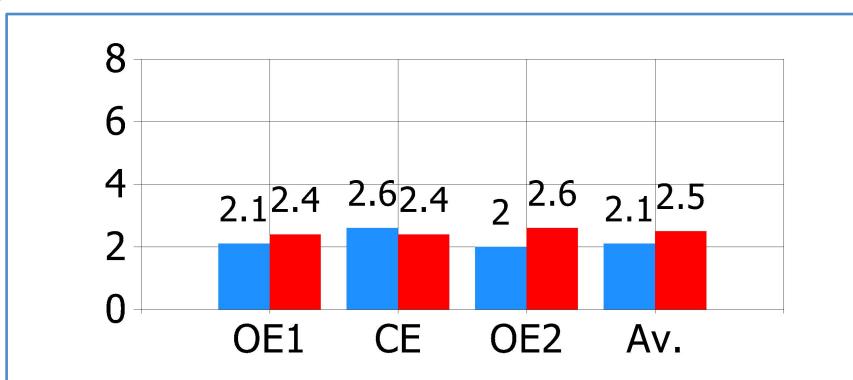
Div.		δ	θ	α	SMR	-β	+β
OE1/CE	Left	42.6%	25.8%	-40.6%	33.2%	48.8%	59.8%
	Right	0.0%	7.7%	-11.0%	5.3%	-0.6%	5.1%
OE2/CE	Left	81.7%	72.5%	-344.5%	77.4%	73.1%	78.5%
	Right	58.2%	56.7%	-100.4%	53.7%	43.4%	42.8%

When the eyes are closed, alpha waves become stronger, and brain waves of other bandwidths normally decrease. The graph above shows the difference between intensities of brainwaves from strongest to lowest in percentage. Average would fall between 10 and 40.

If the graph falls to negative, brain waves are not changing normally, and this implies that the ability to maintain brain and bodily levels has declined. It would be logical to analyze likewise when the difference is too high.

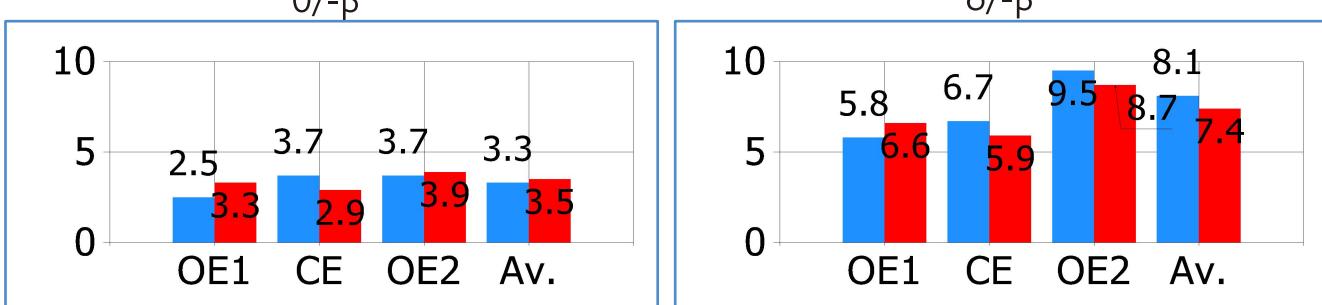


5 Brain arousal level (Θ/SMR)



Standard ratio

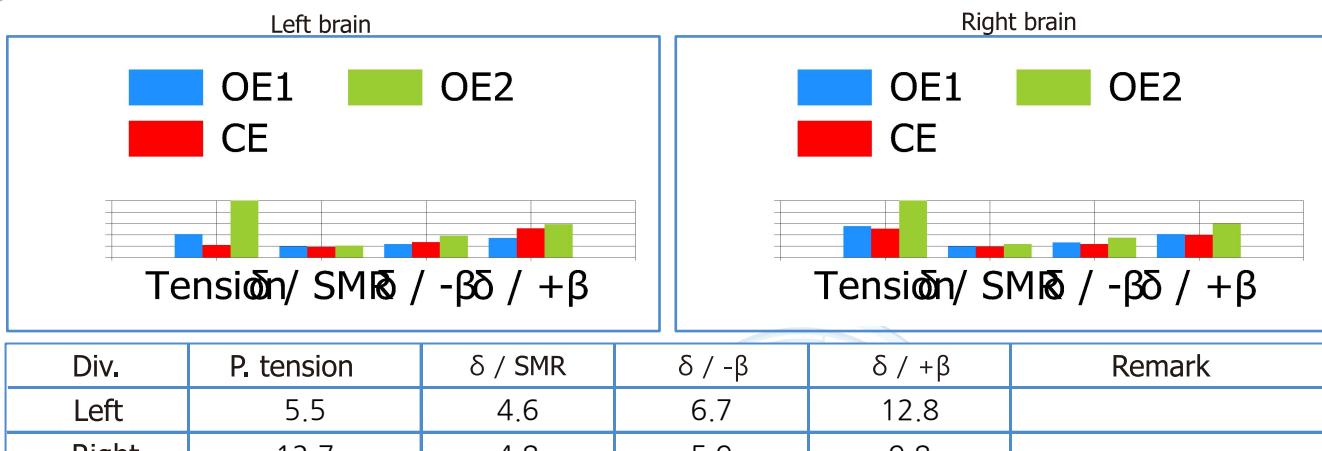
Age	Ratio
under 5	6
6	5
7~10	4
11~15	3
16~45	2
over 45	3



Brain arousal is calculated by comparing theta waves, which are slow waves observed when eyes are closed, with SMR, which are arousal brain waves. If this value turns out to be higher than the average ratio for the specific age group, slow brain waves and theta waves are too high to remain aroused, and this leads to distracted behavior.

High levels of θ waves and δ waves, alike β waves, lead to tension in body and distraction, which makes it difficult to remain aroused and use the brain efficiently.

6 Physical tension and stress

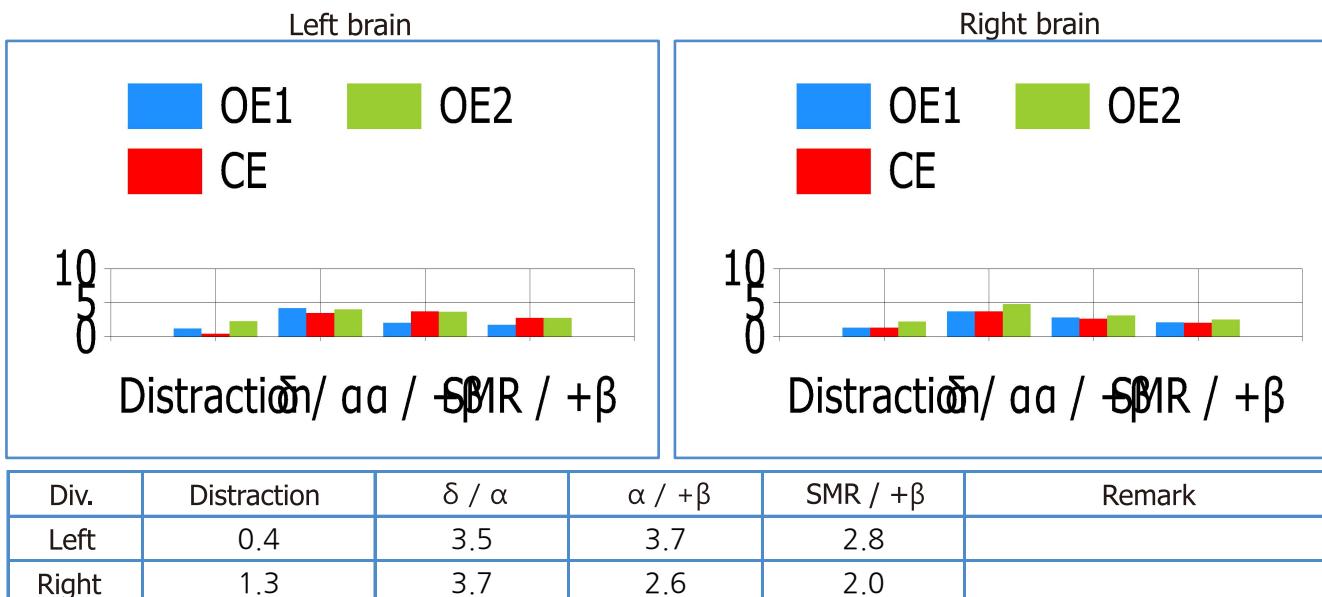


When eyes are closed, vision, which accounts for 70% of sensory information, disappears. This allows the brain and the rest of the body to relax and relieve tension.

Delta waves observed in the prefrontal lobe indicate physical tension and stress. Values lower than 5 indicate stability, and above 10 indicate physical tension and stress. The higher the value, the greater the tension and stress.

The amplitude decreases with faster activity rhythm of the brain, so it is normal that values of SMR, low beta, high beta compared to delta waves increase gradually.

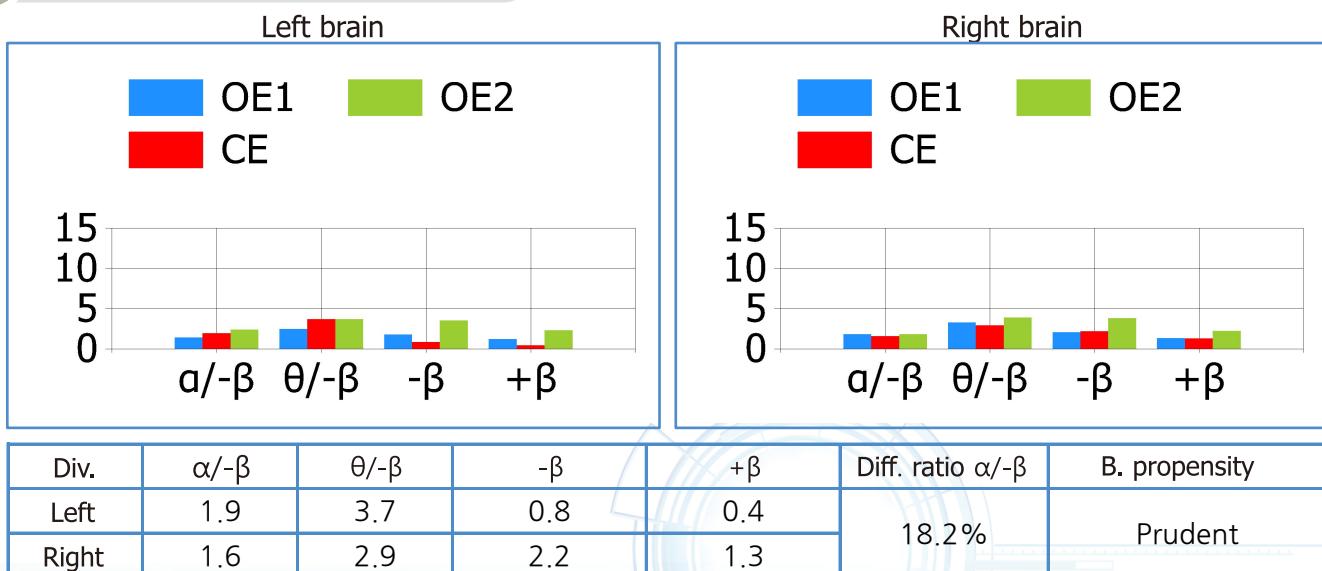
7 Mental distraction and stress



When the eyes are closed, all external visual information is shut off, hence decreased intensity of brain waves of fast rhythm. However, when the degree of distraction is greater than 1, the brain is in a state in which it is incapable of rest, and it is under mental stress from anxiety, tension, and distraction.

When the eyes are closed, the ratio of δ/α is normally below 1. If higher, it is an indication that the power of alpha waves is too weak, or there is too much physical tension. $\alpha/+β$ ratio should at least be 2 or higher, and if lower, it is an indication of stress.

8 Behavioral propensity ($\alpha/-\beta$)

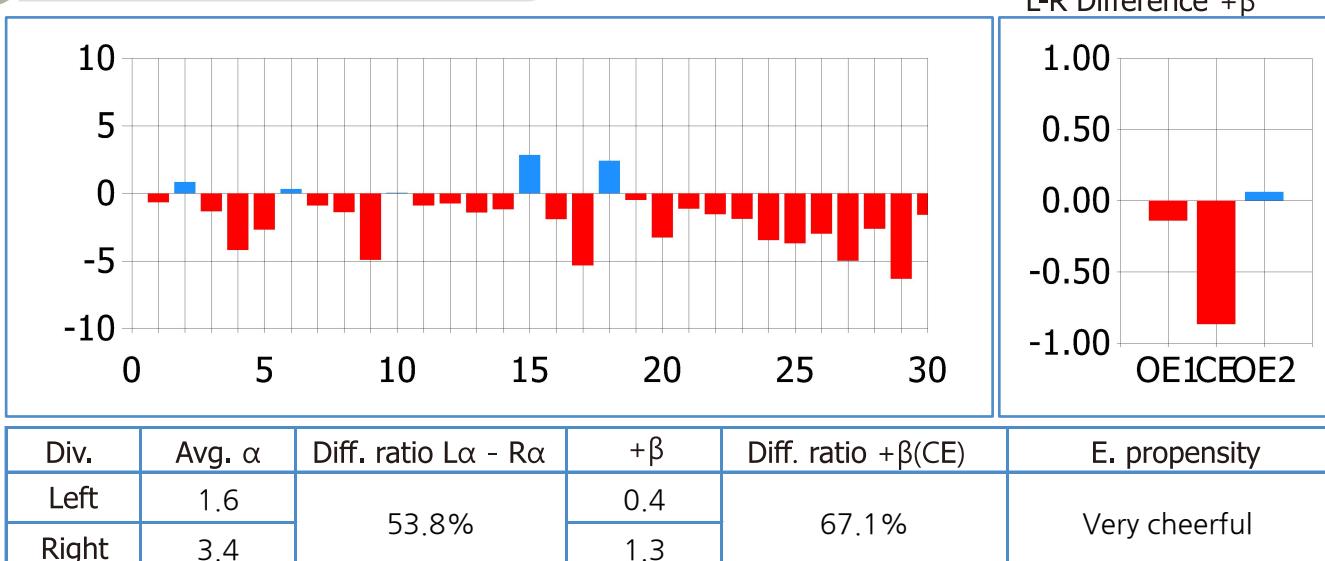


Alpha waves are rest brain waves, and low beta waves are activated when working or learning. When the ratio is too high due to high alpha waves during rest, it implies a decrease in brain activity.

Comparing alpha and low beta waves can evaluate behavioral tendency. If the left brain is higher, optimistic, positive, active, and progressive tendencies are observed. Higher levels in the right brain demonstrate passive, defensive, conservative, and prudent or negative behavioral tendencies.

9

Emotional propensity ($L\alpha - R\alpha$)

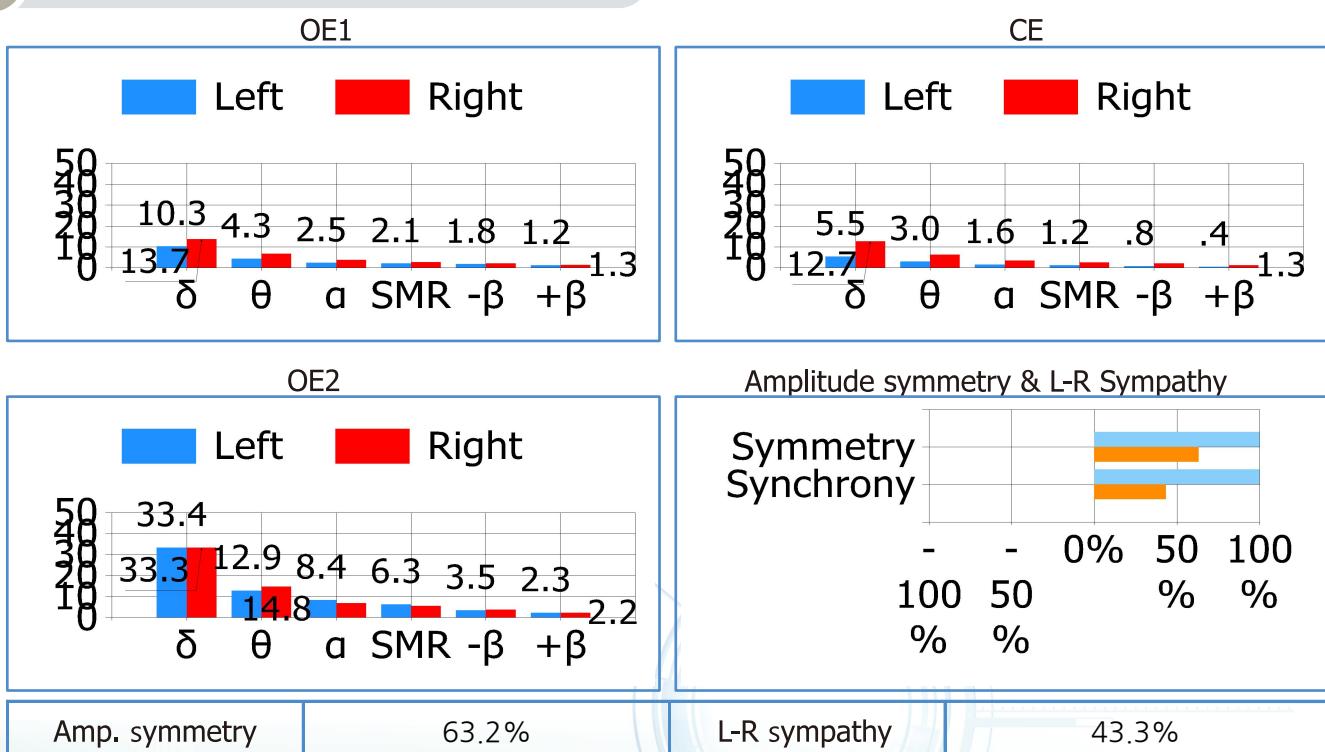


The difference between alpha waves of the left and right brains in arousal state indicates one's emotional tendency. If the difference falls between 5 and -5 in a graph, it can be concluded that one has a stable emotional tendency.

Upward graphs tend to represent depressed tendency, and downward graphs show cheerful emotional tendency. If this graph is overly skewed to one side, the emotional tendency can be observed more evidently.

10

Balance between left and right brain



The left and right brains are separated but are connected by a bundle of nerves called 'corpuscallosum', which allows them to communicate and process information.

The left brain mainly manages language, mathematics, calculation, logic, and analysis, and the right brain processes information related to integration, perception, abstract, and emotion.

Therefore, specific information can be processed efficiently when the brain waves of the left and the right brain form amplitude symmetry and alignment. When amplitude symmetry is greater than 80%, and alignment is higher than 50%, the two halves can collaborate well.

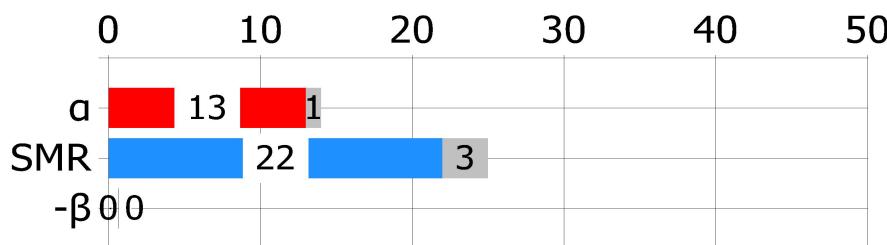




11 Self-feedback ability

The human brain controls and manages mental and physical activities in daily lives by creating necessary brain waves including alpha, SMR, and low beta.

Therefore, we can evaluate how efficiently it is being done by analyzing the default conditions of these three. It is important to have an overall balance between the feedback abilities rather than having a high value in one area.



Div.	Value
Sum.	35.0
Average	11.7
Max. dev.	21.7
Std. dev.	8.9

α

α waves range between 8~12Hz and is observed during rest. It is an indication of psychological stability, stamina for continuous activity, and mental fatigue.

If the ability to create such α waves is deficient, the brain cannot rest sufficiently, leading to difficulty in sleeping, bad temper, and fatigue. Also, it becomes difficult to study or work steadily.

On the other hand, if only α waves are too high, laziness is observed. One tries to avoid work and rest constantly.

SMR

SMR is a brain wave under arousal condition, with rhythm of 12~15Hz. It is also called attentiveness brain waves. Attentiveness is an ability of the brain to selectively focus its attention to what is necessary even in the presence of various visual and auditory stimuli. It is also referred as selective concentration.

It is related to observation of surroundings, adaption to society, speech ability, sociability, and leadership. The standard deviation is 25.

When SMR waves are not produced sufficiently, distracted behavior is observed and one cannot concentrate on learning and working because it is impossible to focus one's attention. If too much is produced, sociability and leadership are expressed, but one becomes overly conscious of others.

-β

Low β waves range between 16~20Hz and are activated when working or learning. It is called concentration brain waves.

Concentration is the ability of the brain to process visual and auditory information when working or learning. If this level is too low, it experiences difficulty in concentrating and also becomes prone to giving up.

While, if this value is outstandingly high, stubbornness is observed. Students of this kind tend to only study subjects they like, thus earning imbalanced grades.

Balance

If the maximum deviation of each factor in brain's feedback ability is below 5, it can be evaluated that the balance between control abilities is stable. If below 10, it is somewhat balanced, but when the maximum deviation exceeds 10, the balance between feedback abilities is broken. As a result, the highest factor is expressed most evidently, and emotional instability can also be noted.

If all factors in feedback ability exceed 30, their sum over 100 and standard deviation below 5, brain usage efficiency is extremely high.

