ORIGINAL CONTRIBUTION

The influence of panic activation through breath holding intervention towards QEEG of social bonding

Lisa Kurniawan[*]

University of Surabaya, Surabaya, Indonesia

Abstract. Many studies stated that carbon dioxide (CO_2) is connected with panic symptoms. The high level of CO_2 inside the brain can stimulate the respiration system and the unstable balance of acid and base, which develops into panic symptoms. In this experiment, the researcher uses a breath holding intervention to increase the level of CO_2. The high level of CO_2 generates the production of endocrine and significant emotional reaction or behavior. The connection between the emotional function and the panic symptom prompted the researcher to underline the role of social contact inside individuals. Based on the researches, the sensitivity of social influences also affects future panic symptoms. The chosen variable related to social contact is social bonding. The social bonding variable will be formed into the photos of closer relatives and non-closer relatives to the subject. To measure and analyze data, the researcher uses QEEG (Quantitative Electroencephalography) to record the brain waves when the subject sees and feels the bonding through photos shown.

INTRODUCTION

This research is trying to investigate the relation between panic emotion and social bonding. From the file of Indonesia Minister of Health, the prevalence of panic disorder in the world has a high rate of 13.8%. Panic disorder in mental health topic can not be disregarded. Previous researches show that about 50% panic disorder patient suffer severe separation anxiety [1] or traumatic experience associated with bonding or separation.

La Pierre [2] state that the function of attachment relationship is very important in individual social needs. Disregulation organization between body-brain-thoughts can impact in serious mental and physical health implications in long term and also affect the instability of neuochemistry which has programmed according to human basic needs. Many studies highlighted the connection fact between attachment towards brain, immunity system, and psychosomatic disorder. Psychosomatic symptom commonly happens in the form of changes in heart rate, breathing, muscle tension, and temperature which are all come as the result of fundamental emotion processing.

Emotional and behavior function can be related with social contact. Mawson [3] said the sensitivity caused by social influences is described as the characteristic connected to panic symptom. [4, 5, 6, 7] reviewed by Mawson [3] also support the evidence that social influences have a role as the main key of panic symptom. Unwanted separation by the child

[*]Corresponding author: Lisa Kurniawan
[†]Email: lisakurniawan88@gmail.com

from the parents which is happened from childhood to mid-adolescent can be defined as childhood parental loss (including death of parents, separation, divorce) can develop the risk of panic disorder in adulthood [9]. Separation and feeling loss is the key component of children separation anxiety. This hypothesis has long been disclosed by Klein [10], reviewed by Battaglia [9].

Many disadvantages factor resulting from panic disorder in relation to the life quality and work performance. Panic symptom related to neurotransmitter system which is produced by brainstem. The main system of neurotransmitter is norepinefrin, serotonin, dan Gamma-Aminobutyric Acid (GABA). Panic attack can last for minutes until hours and associated with a strong will to escape from the situation or location and even caused suicide.

To stimulate panic activation in this experiment, researcher use breath holding intervention. With breath holding intervention, the amount of carbon dioxide (CO_2) inside the brain will be increased then can stimulate panic activation to subjects. Freire *et al.* [11] also use two kinds of intervention to stimulate panic, such as 35% CO_2 challenge (exogenous) and breath holding (endogeneous). The sufficient CO_2 in subject, shows the increasing of anxiety and panic attacks of patient with panic disorder.

Many studies concerning this relationship are using PET or Functional Magnetic Resonance Imaging (FMRI) to observe and measure the activity inside the brain. But on this study, researcher prefer use Quantitative Electroencephalography (QEEG) to observe and measure the neuron activity which can prove the influence of panic emotion towards social bonding.

LITERATURE REVIEW

Child is biologically programmed to establish attachment with the others in order to survive. Bonding is an attachment between mother and child or child and mother after the birth. Bonding influences long term attachment and develop emotional well-being. Bowlby *et al.* [12] believed that attachment behavior is obtained from insting and can be activated through threaten conditions, such as separation, insecurity, and also fears. Failed to establish an attachment is led to maternal deprivation which refers to separation or loss of mother role in life.

Panksepp [13] underlined that panic system is elaborated with social-emotional process connected to attachment. Panksepp [13] cites other research and stated that the loss in childhood is the main factor of depression and panic attack in the future. Panksepp [13] said that one of the caused of depression and panic attack is permanent modification from emotion associated with separation distress. Panic neocircuit associated with separation distress can occur from past painful memory recorded inside the brain.

According to Diagnostic and Statistical Manual of Mental Disorder IV (DSM IV) panic attack symptom can be described as: (1) palpitations, pounding heart, or accelerated heart rate; (2) sweating; (3) trembling or shaking; (4) sensations of shortness of breath or smothering; (5) feeling of choking; (6) chest pain or discomfort; (7) nausea or abdominal distress; (8) feeling dizzy, unsteady, lightheaded, or faint; (9) derealization (feelings of unreality) or depersonalization (being detached from oneself); (10) fear of losing control or going crazy; (11) fear of dying; (12) paresthesias (numbness or tingling sensations); (13) chills or hot flushes [14], [15], [16], [17] reviewed by Yaunin [18]. The point of panic disorder cognitive-behavioral model is the misinterpretation catastrophic experienced by patient at the situation or the somatic sensation which leads to the feelings of danger associated with panic attack [19], [20]. The somatic sensation developed by the patient as-

sociated with panic attacks is part of body defense mechanism or alarm. Panic disorder patient have excessive respond to changes on carbon dioxide levels in the body. Klein [10] Freire *et al.* [21] suggests that panic attacks arise spontaneously when brain realize the suffocation false alarm system. This disfunction are marked by hypersensitivity respond of carbon dioxide in the body. Many studies suggest that respiratory system is the most powerful physiological signs to measure emotion [22, 23, 24] reviewed by Kinkead *et al.* [25]. The reduction of oxygen or the raise of carbon dioxide can activate endocrine and emotion reaction or significant behavior.

There are two types of carbon dioxide stimuli, such as endegenous and exogenous. Endegenous is activated through breath holding technique, while exogenous is activated trough inhalation technique using 35% carbon dioxide. Breath holding intervention is used on this research. This results in a CO_2 stimulus panic emotion which is affected by neurochemicals and neurotransmitter in the brain. Then measured by QEEG. The complete scheme as below:
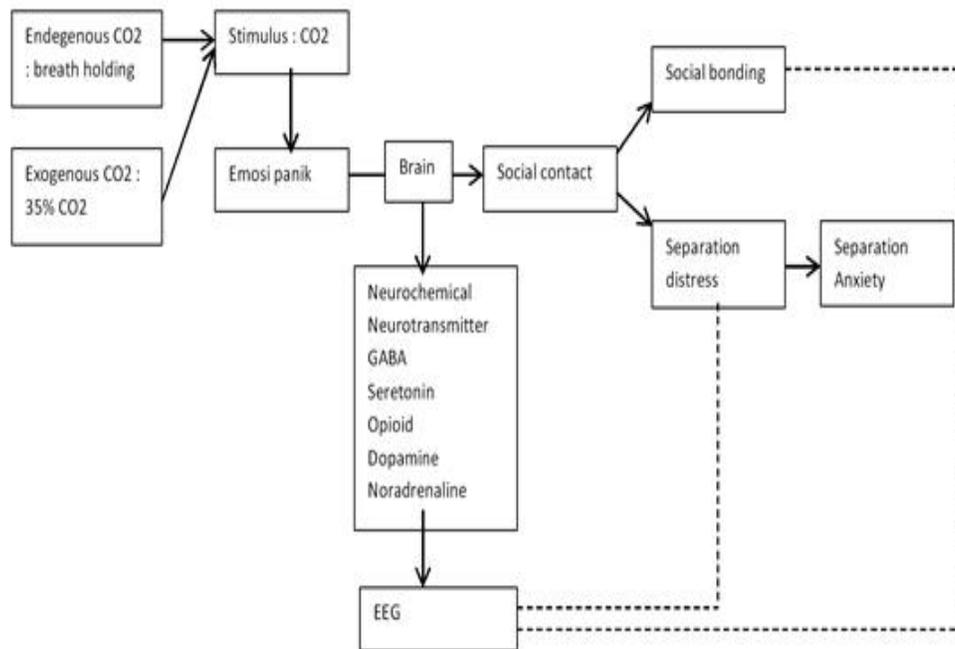
FIGURE 1 *.* Scheme of the research

The results using QEEG or Electroencephalograhy is line tracing or can be referred as brain wave. Commonly, QEEG is used to diagnose brain damage, epilepsy, and neurological disorder. For applied research, QEEG is used to identify the activity pattern in the brain related to certain behavior.

METHODOLOGY
Participants
Method of research using experimental A-B design because researcher using single subject. Experiment method aims to measure the behavior target on baseline phase and intervention phase. Participants are women aged 16-38 years old. The subjects are selected through exclusion criteria: (1) psychiatric disorder in cognitive, afective, or personality; (2) use medication for psychiatric disorder; (3) have ever experienced trauma or injury on the head.

Tools

Researcher use PSL (Panic Symptom List) Questionnaire with 13 items that screen for 13 panic symptoms with scale 1-4 (1 = do not feel anything, 4 = heavy). Also ASI (Anxiety Sensitivity Index) with 16 items that screen for anxiety sensation which have negative psychologycal impact [16, 26]. Previous study indicated that anxiety sensitivity associated with panic attack, and also closely related to agoraphobia [27, 16, 26].

To measure how anxious or uncomfortable perceived by subjects, researcher using VAS (Visual Analog Scale). VAS is an instrument which try to measure characteristic or behavior and believed to lie at a value that cannot be measure directly and easily. Operationally VAS is a horizontal line with length of 100 mm, and marked by word description in the end of each line. Subjects will give mark between the line to represent their perception at the moment. VAS score is determined by measuring the length of milimeter from left end into subject's mark point.

Procedure

Pre-experiment phase

In this phase, researcher do mini interview to screening the subjects related to gender, age, also the exclusion criteria which have been described above. Also researcher ask participants to fill in PSL, ASI, and VAS questionnaire. Then EEG Electrodes are mounted on subjects head. Subjects are asked not moving much to avoid misinterpretation in EEG result.

FIGURE 2 *.* EEG electrodes are mounted to the head

Experimental phase

Researcher prepare two kind of photos related to subjects relative, one kind is subject's close relative (family, best friend, spouse) and other kind is about subject's non-close relative (non-closer friend or non-closer relatives). Each kind (close and non-close relative) consist of 5 photos and display 10 seconds. Phases divided into two conditions, control condition and experiment condition.

In control condition, subjects do resting state while subjects see the picture of close and non-close relative. Resting state means subjects don't have to do breath holding intervention. Total time need for resting state is 20 seconds. Then social bonding which subject feel is recorded through QEEG.

FIGURE 3 *.* Subjects see the photo of close relative

In experiment condition, subjects do breath holding intervention while subjects see the picture of close and non-close relative. Total time need for resting state is 20 seconds. Then social bonding which subject feel is recorded through QEEG. The experiment paradigm can be arranged as:
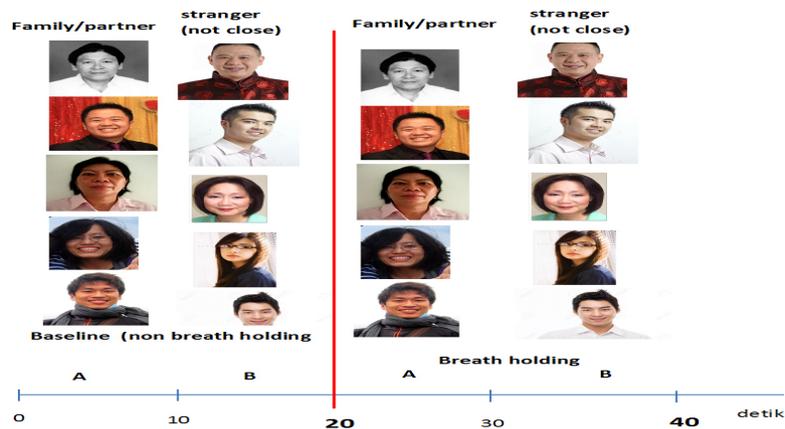

FIGURE 4 *.* Experimental paradigm

Post-experiment phase
Data collected from QEEG using EEG Brain Mapping Ceegraph IV Bio-Logic. Recorded area cover 21 channel which is: frontal pole (Fp1, Fpz, Fp2), frontal (F7, F3, Fz, F4, F8), central (C3, Cz, C4), temporal (T3, T4, T5, T6), parietal (P3, Pz, P4) and oksipital (O1, Oz, O2).
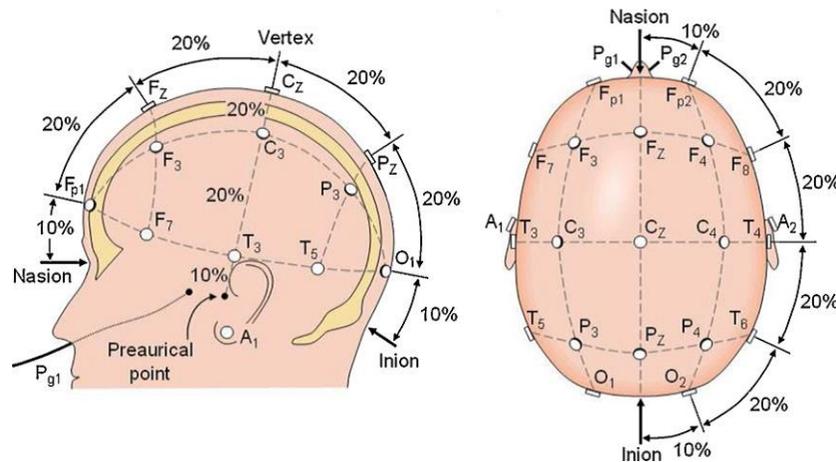
FIGURE 5 *.* Mounting points of EEG

TABLE 1 . The results of experiment

	Z	**Asymp. Sig. (2-tailed)**
Fp1_BHSGNSB_Delta-Fp1_BHSGSB_Delta	-.014a	0.989
Fp2_BHSGNSB_Delta-Fp2_BHSGSB_Delta	-.754a	0.451
F3_BHSGNSB_Delta-F3_BHSGSB_Delta	-1.828b	0.068
F4_BHSGNSB_Delta-F4_BHSGSB_Delta	-1.200b	0.230
C3_BHSGNSB_Delta-C3_BHSGSB_Delta	-1.577b	0.115
C4_BHSGNSB_Delta-C4_BHSGSB_Delta	-1.382b	0.167
P3_BHSGNSB_Delta-P3_BHSGSB_Delta	-1.186b	0.236
P4_BHSGNSB_Delta-P4_BHSGSB_Delta	-1.577b	0.115
O1_BHSGNSB_Delta-O1_BHSGSB_Delta	-.754b	0.451
O2_BHSGNSB_Delta-O2_BHSGSB_Delta	-2.233b	0.026
F7_BHSGNSB_Delta-F7_BHSGSB_Delta	-2.596b	0.009
F8_BHSGNSB_Delta-F8_BHSGSB_Delta	-2.400b	0.016
T3_BHSGNSB_Delta-T3_BHSGSB_Delta	-1.786b	0.074
T4_BHSGNSB_Delta-T4_BHSGSB_Delta	-2.037b	0.042
T5_BHSGNSB_Delta-T5_BHSGSBB_Delta	-2.107b	0.035
T6_BHSGNSB_Delta-T6_BHSGSB_Delta	-2.079b	0.038
Fz_BHSGNSB_Delta-Fz_BHSGSB_Delta	-.795b	0.426
Cz_BHSGNSB_Delta-Cz_BHSGSB_Delta	-1.591b	0.112
Pz_BHSGNSB_Delta-Pz_BHSGSB_Delta	-1.549b	0.121

*BHSGSB: Breath holding with social bonding stimuli
*BHSGNSB: Breath holding with non social bonding stimuli
*Bold font: The significant channel in Delta wave

Researcher process the QEEG data using EEG Suite Insight II from Persyst to get the total value of each Delta, Theta, Alpha, Beta. Then using SPSS to analyze the statistic with *t*-test and if the data is not normal using non-parametric which is Wilcoxon Sign Rank Test.

RESULTS

After analyzing the data, the result is the data is not normal. Since then, researcher use Wilcoxon Sign Rank Test to compare Breath Holding with Social Bonding Stimuli and Breath Holding with Non Social Bonding Stimuli in 4 waves, which are Delta, Theta, Alpha, and

Beta. The channel is significant if the value of $p < 0,05$. From the statistic, the significant channel only located in slow wave, such as : Delta and Theta.
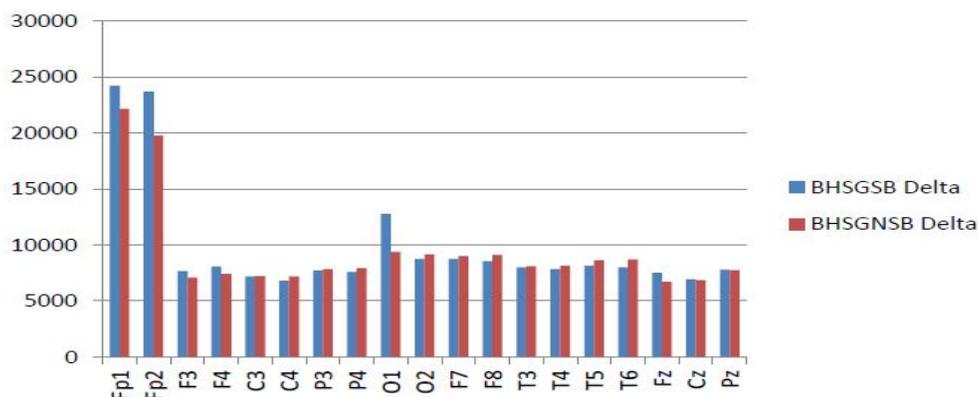
In Delta wave, the significant channel is on O2, F7, F8, T4, T5, T6, and Fz. While in Theta only significant in F7. From these result, we can conclude that in Delta and Theta wave, the value is significant on O in occipital, F in frontal and T in temporal lobe. Here is the result:

TABLE 2 . The results of experiment in Theta wave

	Z	Asymp. Sig. (2-tailed)
Fp1_BHSGNSB_Theta-Fp1_BHSGSB_Theta	-1.061a	0.289
Fp2_BHSGNSB_Theta-Fp2_BHSGSB_Theta	-.740a	0.460
F3_BHSGNSB_Theta-F3_BHSGSB_Theta	-1.158a	0.247
F4_BHSGNSB_Theta-F4_BHSGSB_Theta	-.907a	0.364
C3_BHSGNSB_Theta-C3_BHSGSB_Theta	-1.172a	0.241
C4_BHSGNSB_Theta-C4_BHSGSB_Theta	-.321a	0.748
P3_BHSGNSB_Theta-P3_BHSGSB_Theta	-1.382a	0.167
P4_BHSGNSB_Theta-P4_BHSGSB_Theta	-.684a	0.494
O1_BHSGNSB_Theta-O1_BHSGSB_Theta	-1.535a	0.125
O2_BHSGNSB_Theta-O2_BHSGSB_Theta	-1.200a	0.230
F7_BHSGNSB_Theta-F7_BHSGSB_Theta	-2.107a	0.035
F8_BHSGNSB_Theta-F8_BHSGSB_Theta	-1.675a	0.094
T3_BHSGNSB_Theta-T3_BHSGSB_Theta	-1.326a	0.185
T4_BHSGNSB_Theta-T4_BHSGSB_Theta	-1.368a	0.171
T5_BHSGNSB_Theta-T5_BHSGSBB_Theta	-1.507a	0.132
T6_BHSGNSB_Theta-T6_BHSGSB_Theta	-1.354a	0.176
Fz_BHSGNSB_Theta-Fz_BHSGSB_Theta	-1.102a	0.270
Cz_BHSGNSB_Theta-Cz_BHSGSB_Theta	-.907a	0.364
Pz_BHSGNSB_Theta-Pz_BHSGSB_Theta	-1.298a	0.194

*BHSGSB: Breath holding with social bonding stimuli
*BHSGNSB: Breath holding with non social bonding stimuli
*Bold font: The significant channel in Delta wave

From the total value of Delta and Theta wave, the comparation of Breath Holding with Social Bonding Stimuli and Breath Holding with Non Social Bonding Stimuli are showed through the chart below:

FIGURE 6 . The comparison chart in Delta wave

From the total value in Delta wave, we summarize the value into chart. In Delta wave, the significant channel is in O2, F7, F8, T4, T5, T6, Fz. In these channels, most of the chart of Breath Holding with Social Bonding Stimuli is lower than Breath Holding with Non Social Bonding Stimuli.
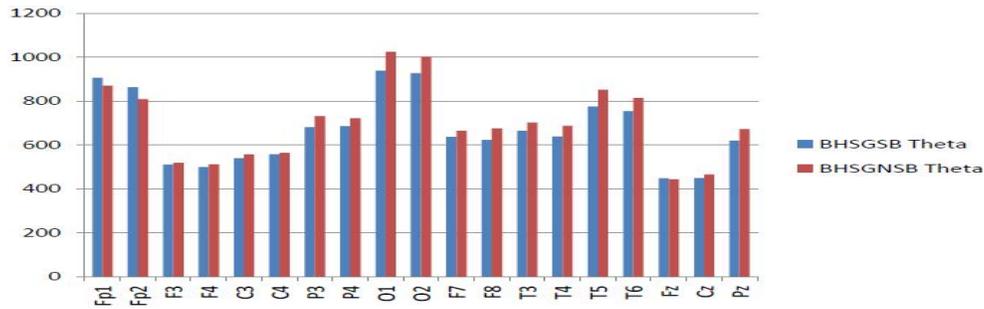

FIGURE 7 *.* The comparison chart in Theta wave

In Theta wave, the significant channel is only in F7. In F7, the chart of Breath Holding with Social Bonding Stimuli is lower than Breath Holding with Non Social Bonding Stimuli. Also most of the chart of Breath Holding with Social Bonding Stimuli lower than the chart of Breath Holding with Non Social Bonding Stimuli.

These are the comparation of brain map spectrum which are recorded through EEG:
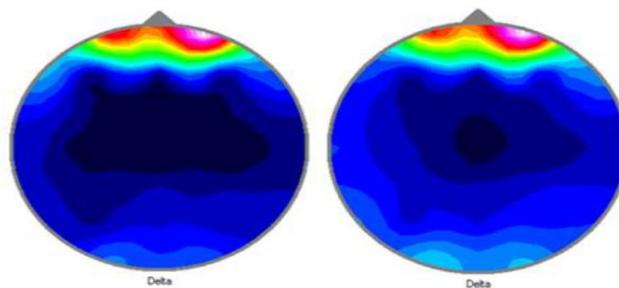

FIGURE 8 *.* 1) The comparation of brain map between social bonding stimuli without breath holding with breath holding with social bonding stimuli at Delta wave
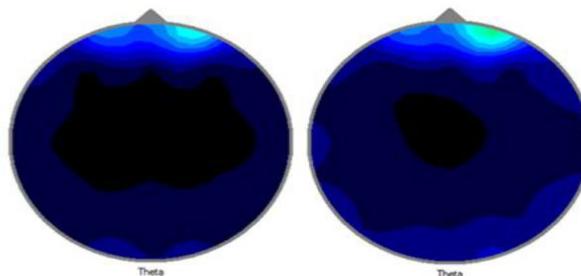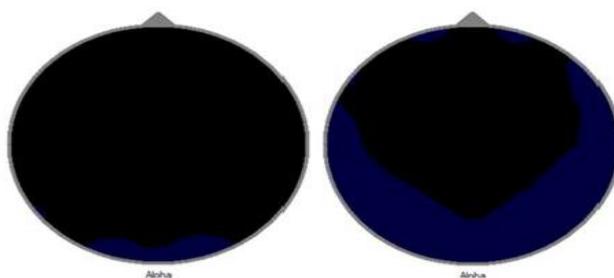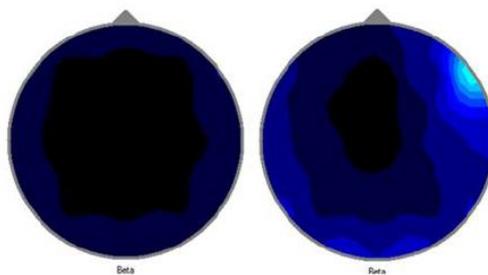

FIGURE 9 *.* 2) The comparation of brain map between social bonding stimuli without breath holding with breath holding with social bonding atimuli at Theta wave

FIGURE 10 *.* 3) The comparation of brain map between social bonding stimuli without breath
holding with breath holding with social bonding stimuli at Alpha wave

FIGURE 11 *.* 4) The comparation of brain map between social bonding stimuli without breath
holding with breath holding with social bonding stimuli at Beta wave

DISCUSSION AND CONCLUSION

The channels are significant only in slow waves, Delta and Theta wave. Delta wave is in the state of unconscious mind where the deep sleep, deepest meditation, and dreamless sleep are located. Healing process are stimulated in this state. While Theta wave in the state of subconcious mind which are lead to intuition, learning, and memory. This is where human hold fears, trouble history, and nightmare. In Alpha wave, relaxation, visualization, creativity, and super learning are on this state. In Beta wave, brain is on the state of conscious mind where concentration, focus, and cognition are located. Memory and deepest meditation are saved in Delta and Theta wave and this is the reason why the brain channels are only significant in these two waves.

From the research, the significant channels of Delta and Theta wave is located on O, F, and T channel. Channel O is located on Occipital Lobes which is associated with interpreting visual stimuli and and information and located on the back part of the brain. Channel F is located on Frontal Lobes and associated with reasoning, planning, part of speech and movement, emotions, and problem solving. Channel T is located on Temporal Lobes and associated with perception, recognition of auditory stimuli, and memory. According to these functions of each lobes, all are associated with memory and emotions. And that is the reason why the datas are significant in these 3 channel and lobes. As we see from the chart, we get the data of the total value that Breath Holding with Social Bonding Stimuli is lower than Breath Holding with Non Social Bonding.

This is showed that panic emotions which are appeared as the result of breath holding intervention, can be reduced by Social Bonding Stimuli. This stimuli are showed by the photos of the family, bestfriend, and spouse. It gives the participants relaxation feeling to see their close relatives photos when they faced panic emotions inside the brain. The

same work as opioid system which is act as a healing role in the human emotions. As the researcher still developing the research, there may some shortage in this research. EEG is very vulnerable with the movements outside the neuron, for example eye blinks, head movement, and any other movements. Participant who have panic disorder are not allowed in this research because if the participants have panic attacks, they will move their muscle and make the EEG record unstable. Replication are needed because the sample size of this research is small enough, about 39 participants.

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— This article does not have any appendix. —