Modifying one's brain activity through meditation

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It has been known for some time that meditation and relaxation generate extraordinary health benefits. Herbert Benson et al., have shown in the 70s that what they coined *the relaxation response* resulted in a decrease in the activity of the sympathetic nervous system and an increase in the activity of the parasympathetic nervous system. Subsequently, numerous clinical applications have been used on patients suffering from various health-related problems, such as hypertension, migraines, insomnia, anxiety, etc[1].

More recently, research on the benefits of meditation has exploded and a single search on the PubMed website, using "meditation and health" as keywords, will generate more than 800 scientific publications and nearly 300 when using "meditation and brain" as keywords. Out of the numerous scientific studies carried out on volunteers who practice meditation, we come across the Laboratory for Affective Neuroscience (UW-Madison**) whose director is Richard Davidson, PhD.**

Richard Davidson and his colleague, Antoine Lutz, have investigated the brain of a group of Tibetan monks who had practiced meditation for a minimum of 10,000 hours. They have noticed several functional changes in the brain of these participants. Furthermore, as a researcher at Massachusetts General Hospital, neurobiologist Sara Lazar has been looking at how the practice of yoga and meditation affect emotions and cognitive performance and found a significant activity in the prefrontal cortex as well as the insula — a region near the frontal portion of the brain — of long-term meditators who participated in a 1-week intensive meditation retreat[2].

One region of the brain that has particularly caught the attention of the researchers is the left prefrontal region[3]. They have observed a greater activation of the left prefrontal brain compared to the right part of the brain during meditation, and more so when the meditation focused on loving-kindness and compassion.

Why the left prefrontal region?

The lateralization of emotional states has been the subject of a number of studies since the beginning of the 80s. And one who has been a pioneer in this field is none other than Richard Davidson. Indeed a large number of scientific publications support the notion that there is an asymmetry that exists in the prefrontal cortex and that is linked to emotions. In short and simply put, we can state with relative confidence that positive emotions are associated with a greater activity in the left prefrontal region, while negative emotions are

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[1] Benson H, Greenwood MM, Klemchuk H., *The relaxation response: psychophysiologic aspects and clinical applications*, Int J Psychiatry Med. 1975;6(1-2):87-98.

[2] Lazar SW, Kerr C, Wasserman RH, Gray JR, Greve D, Treadway MT, McGarvey M, Quinn BT, Dusek JA, Benson H, Rauch SL, Moore CI, Fischl B. *Meditation experience is associated with increased cortical thickness*. NeuroReport, 2005; 16: 1893-1897.

[3] Barnhofer T, Chittka T, Nightingale H, Visser C, Crane C. *State Effects of Two Forms of Meditation on Prefrontal EEG Asymmetry in Previously Depressed Individuals.* Mindfulness (N Y). 2010 Mar;1(1):21-27. Epub 2010 Mar 18.
And
Engström M, Söderfeldt B. *Brain activation during compassion meditation: a case study***.** J Altern Complement Med. 2010 May;16(5):597-9.

linked to a greater activity in the right prefrontal cortex[4]. Several observations support this hypothesis. Here are a few examples:

Greater activity in the left prefrontal region.	Greater activity in the right prefrontal region.	Source
While watching enjoyable movies	While watching unpleasant movies	Tomarken, A. J., Davidson, R. J., & Henriques, J. B. (1990). [5]
Among happy people	Among depressed people	Henriques, J. B. & Davidson, R. J. (1991)[6]
Among people who express positive emotions (smile, joy, love…)	Among people who express negative emotions (anger, disgust, sadness, fear…)	Ekman & Davidson (1993) [7] Davidson, R. J., Shackman, A. J., & Maxwell, J. S. (2004)[8]
Better evaluation of enjoyable stimuli	Better evaluation of unpleasant stimuli	Sutton & Davidson (2000) [9]
Better perception of joyful facial expressions	Better perception of sad facial expressions	Reuter-Lorenz, P. & Davidson, R. J. (1981)[10]

Based on the principle that meditation brings about a state of well being, it was reasonable to expect to see a greater activity in the left prefrontal cortex among meditation practitioners compared to non-practitioners. And even if this has been confirmed by several studies, many other studies need to be carried out in order to better understand the link between meditation and the activation of the left prefrontal cortex.

Blood flow in the prefrontal region during meditation

Very few studies have been carried out to measure the blood flow and heat variations in the prefrontal region during meditation.

Of all the techniques used to measure these variations, one that stands out is the single

[4] Interested readers can access the publications on this topic on R. Davidson's website: http://psyphz.psych.wisc.edu/web/pubs/pubs_articles.html#1993

[5] Tomarken, A. J., Davidson, R. J., & Henriques, J. B. (1990). Resting frontal brain asymmetry predicts affective responses to films. *Journal of Personality and Social Psychology, 59*, 791-801.

[6] Henriques, J. B. & Davidson, R. J. (1991). Left frontal hypoactivation in depression. *Journal of Abnormal Psychology, 100*, 535-545.

[7] Ekman, P. & Davidson, R. J. (1993). Voluntary smiling changes regional brain activity. *Psychological Science, 4*, 342-345.

[8] Davidson, R. J., Shackman, A. J., & Maxwell, J. S. (2004). Asymmetries in face and brain related to emotion. *Trends in Cognitive Science*, 8(9), 389-391.

[9] Sutton, S. K. & Davidson, R. J. (2000). Prefrontal brain electrical asymmetry predicts the evaluation of affective stimuli. *Neuropsychologia , 38*, 1723-1733.

[10] Reuter-Lorenz, P. & Davidson, R. J. (1981). Differential contributions of the two cerebral hemispheres to the perception of happy and sad faces. *Neuropsychologia, 19*, 609-613.

photon emission computed tomography, or SPECT. This brain imaging technique requires the injection of trace amounts of a gamma-emitting radioisotope into the bloodstream of the participant resulting in its binding to oxygen molecules. The greater the activity in a region, the more oxygen that region uses and this means more blood flows in that region.

Andrew Newberg used SPECT to measure the brain activity of Tibetan monks at rest and during a meditation. In 2001[11], he observed that these participants showed a greater activity in the left and right prefrontal regions during meditation than at rest (see Figure 1a). In 2010[12], he carried out a similar experiment, but this time using subjects with memory loss problems who were given an 8-week meditation program. Once this program was completed he observed a blood flow increase in several regions of the brain, including the frontal region (see Figure 1b).

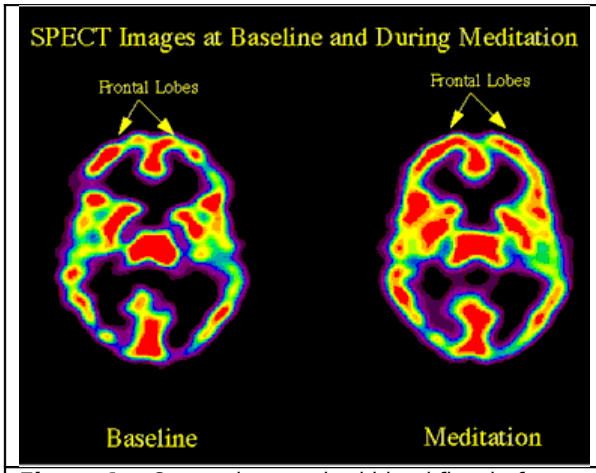

Figure 1a. Comparing cerebral blood flow before and during a meditation.
Newberg A.B. & Iversen J. (2001).

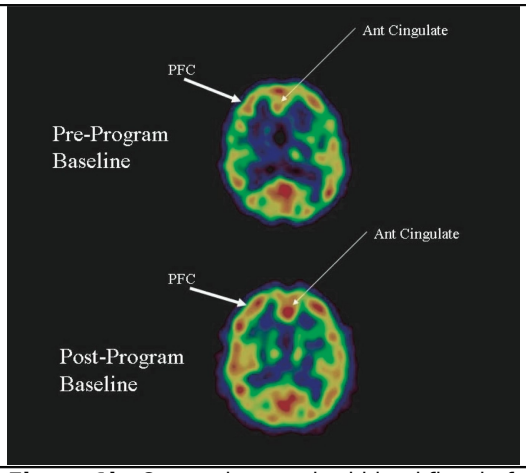

Figure 1b. Comparing cerebral blood flow before and after an 8-week meditation program.
Andrew B. & Newberg A.B., et al. (2010).

Other researchers have used Infrared (IR) Spectroscopy, a much less invasive technique compared to SPECT and one that consists in measuring oxygenation levels in any one region of the brain and determine its degree of activity. These researchers were able to show that during meditation the blood flow increases in the prefrontal[13] regions, and more specifically, the left[14] prefrontal region.

The majority of the studies mentioned until now measure brain activity at rest and during meditation and compare the results under these two conditions. To our knowledge, no research has been conducted to determine if it is possible to stimulate the blood flow at will in the left prefrontal region during meditation.

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[11] Newberg AB, Iversen J. (2001). The neural basis of the complex mental task of meditation: Neurotransmitter and neurochemical considerations. *Medical Hypothesis 61(2): 282-291, 2003.*

[12] Newberg AB, Wintering N, Khalsa DS, Roggenkamp H and Waldman WR (2010) Meditation Effects on Cognitive Function and Cerebral Blood Flow In Subjects with Memory Loss: A Preliminary Study *Journal of Alzheimer's Disease 20 517–526*

[13] Litscher, G., Wenzel, G., Niederwieser, G., & Schwarz, G. (2001). Effects of qigong on brain function. Neurological Research,

[14] Cheng, R. W. F., Borrett, D. S., Cheng, W., Kwan, H. C., & Cheng, R. S. S. (2010). Human prefrontal cortical response to the meditative state: A spectroscopy study. *International Journal of Neuroscience*, *120*(7), 483-488.

Teachings of a contemporary meditation Master

A few years ago, Maitreya Rael – a contemporary spiritual leader who is renown worldwide for teaching meditation and the awakening of consciousness – proposed a specific type of meditation to increase our happiness and target the left prefrontal region of the brain. This is how He formulated this meditation exercise: "Concentrate on your brain's power and strength and its exceptional ability to harmonize itself and to choose happiness, by visualizing the blood flow and the heat that is created in the left frontal region, where happiness lies."

This past November 6th, during a speech given in Okinawa, Japan, before many people, Maitreya Rael added this:

«Remember to always focus on the front left side of your brain. Right here. Where the happiness centre lies. Every time you are happy, more blood comes here. At the same time, each time you send blood here through meditation, you are happier. So you can create happiness by feeling this part more than the rest of your body. Feel it. Feel this part becoming hotter, like a little fire inside. Happiness centre. And you will have a beautiful life. Never stop feeling it…»

Maitreya Rael, Novembre 6th 2011

Up until now, researchers have observed that meditation could increase the activity and the blood flow in the left prefrontal cortex. The exercise proposed by Maitreya Rael, on the other hand, is very particular because it invites the meditation practitioner himself to visualize and stimulate the blood flow and the heat that it creates in this happiness zone. In other words, just as several therapeutic visualization exercises that invite the subject to visualize the healing of a specific organ, or the scarring of a wound, or the strengthening of the immune system, Maitreya Rael invites the meditation practitioner to intentionally stimulate the blood flow in the left prefrontal region of the brain in order to increase the level of happiness that it generates.

To our knowledge, no scientific research has shown it was possible to target the left prefrontal cortex and intentionally stimulate the blood flow in that area.

Consequently, I have decided to explore that possibility. To do so, I used a device marketed by the company Thought Technology: the TT-pIR and Procomp Infinity Device[15]. Thought

[15] This system, also called Passive Infrared Hemoencephalography (pIR HEG), is an adaptation of the Near Infrared Spectrophotometry (NIRS) HEG system. Sensors detect infrared (IR) emissions, which essentially correspond to the heat generated by the brain. This heat is recorded by the pIR HEG and represents the thermal energy generated by the activity of the neurons and the variations of the blood flow in the cortex. More specifically, the heat represents metabolic activity (energy is the result of metabolized sugars) and indicates blood flow.
Blacket, G. Hemoencephalography : a New Form of Neurofeedback, York *Biofeedback* Center.

Technology's latest innovation provides easy measurement of forehead infrared temperature emissions. The headgear incorporates two very sensitive and highly accurate passive infrared sensors 3.8cm apart and mounted on a headset to provide responsive monitoring and training of heat radiated from the forehead, i.e., the prefrontal lobes of the brain (see Figure 2).
What makes this technology interesting is that it is possible, through neurofeedback, to measure and even train the prefrontal region of the brain without worrying about background noise from muscle contractions or even blinking, which can affect the electroencephalogram (EEG) and make the recording of electrical activities in this important region of the brain difficult, to the point of skewing the results.

Figure 2. TT-pIR HEG sensors and locations where heat is measured.

First observations

Originally, the basic program for the TT-pIR provided by Thought-Technology records the heat in the left and the right prefrontal regions, and calculates the average between both. Therefore, the resulting value only indicates the average between the left and the right side of the prefrontal regions. But thanks to a modified version of the program available from the company, I was able to record the heat generated from each side of the prefrontal cortex separately. Hence, it becomes possible to obtain three measurements: heat in the left prefrontal region, heat in the right prefrontal region, and the average value from both regions together.

I have to admit that it required several trials in order to generate more heat in the left prefrontal region than the right. And, as shown in Figure 3a, my first experimentation was not very persuasive. The graph in green corresponds to the heat measured in the left prefrontal region and the red graph corresponds to the heat measured in the right prefrontal region. We can observe that the heat was greater in the right than in the left. I should add that I was playing two roles simultaneously: the experimenter, i.e., the one who supervises, examines, and analyzes the situation, and the subject, the one who is part of the experiment.

www.york-biofeedback.co.uk, reviewed on December 21 2011.

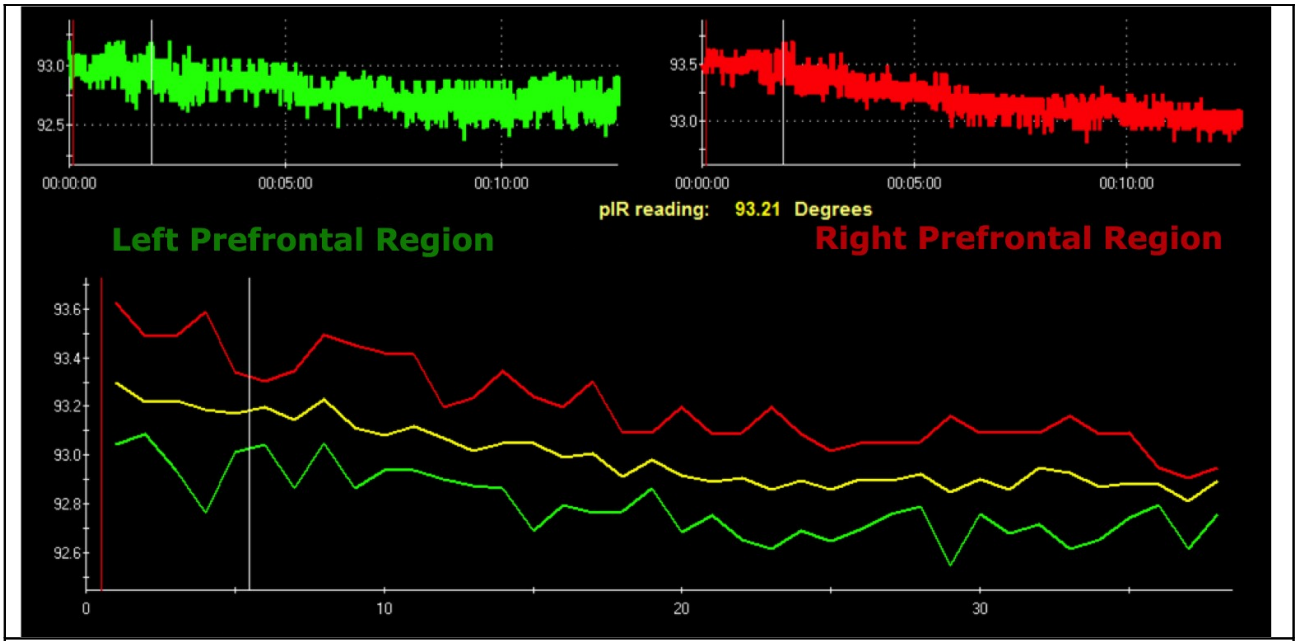

Figure 3. First experiment. Heat (in °F) is a function of Time (in minutes). The experiment lasted 11 minutes during which time two observations can be made: 1) More heat is generated in the right prefrontal region (in red) than the left prefrontal region (in green). 2) The level of heat decreases with time.

What makes it all the more interesting is that this HEG measurement enables to see the changes within us in real time.

Developing a good mastery of how to use the equipment has enabled me to abandon myself to the meditation exercises without having to focus on the technical aspects of the experiment. Figure 4 shows an improvement compared to the first experiment shown in Figure 3. Despite that there is still more heat generated in the right than in the left prefrontal region, we can see an increase in the heat generated in the left prefrontal region to the point of matching the levels generated in the right prefrontal region and exceeding these levels for just a few seconds.

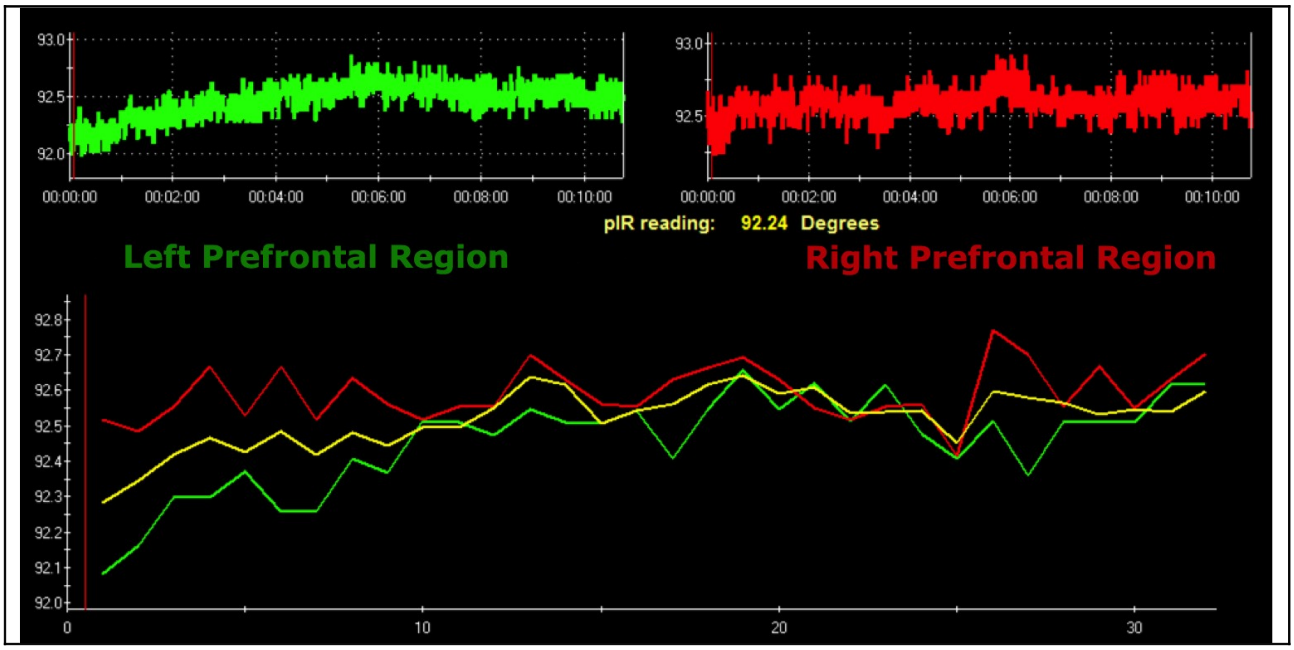

Figure 4. Second experiment. Heat (in °F) is a function of Time (in minutes). In the beginning of the experiment, we can observe a sizable difference between the heat generated in the right prefrontal (in red) and the heat generated in the left prefrontal (in green). But as the experiment progresses, we can observe that the heat generated in the left prefrontal gradually increases, reaches the level of heat generated in the right prefrontal, and exceeds the right prefrontal levels for just a few seconds.

This indicates how important and significant training can be. Figure 5 shows a 30-minute meditation, with eyes opened. In the very beginning, we see that the heat was higher in the right prefrontal region than in the left. But quickly, the heat in the left prefrontal region gradually increased throughout the exercise and surpassed the heat in the right. The sensations of inner well being were very powerful. In fact, the meditation exercise consisted in generating a state of great inner well being, while visualizing the blood flow in the left prefrontal area. With my eyes opened, I could simultaneously use the visual feedback from the graphs in order to stimulate the progression.

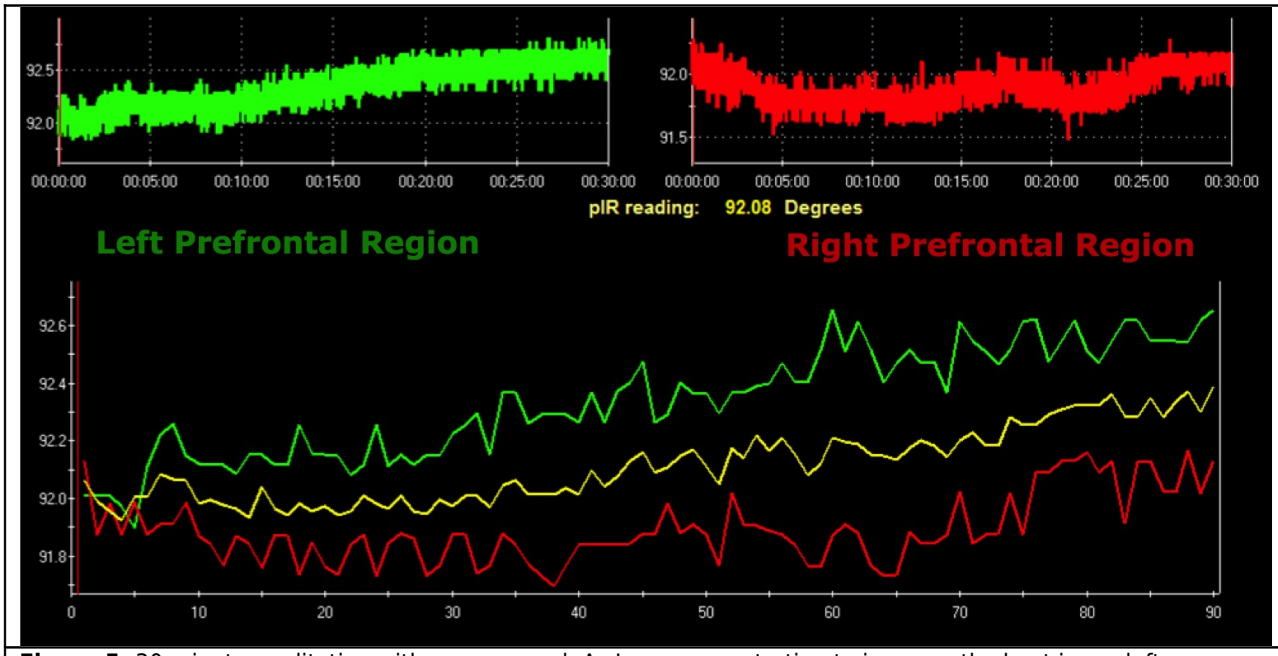

Figure 5. 30-minute meditation with eyes opened. As I was concentrating to increase the heat in my left prefrontal area, I watched the graph progress as it was sending me a direct feedback (known as Neurofeedback). In essence, I could monitor my own progression throughout the exercise.

Several times, I was able to reproduce the same results as those shown in Figure 5. I was also able to do the exercise with my eyes closed, thanks to an auditory feedback where I would listen to relaxing background music and the sound would increase proportionally to the heat generated in the left prefrontal region.

But, as in any type of meditation, a few traps awaited me. For instance, the one of “wanting too much” and being too analytical of what was happening. Indeed, as we can see in Figure 6, at the beginning, there is more heat in the right prefrontal region than in the left. After meditating for approximately 10 minutes, I was able to increase the heat in the left prefrontal region to the point of generating slightly more heat on the left than on the right. But as all the teachings on consciousness indicate “the more one thinks, the less one is.” Parasitic thoughts and “wanting too much” caused the heat to gradually dissipate during the remainder of the exercise.

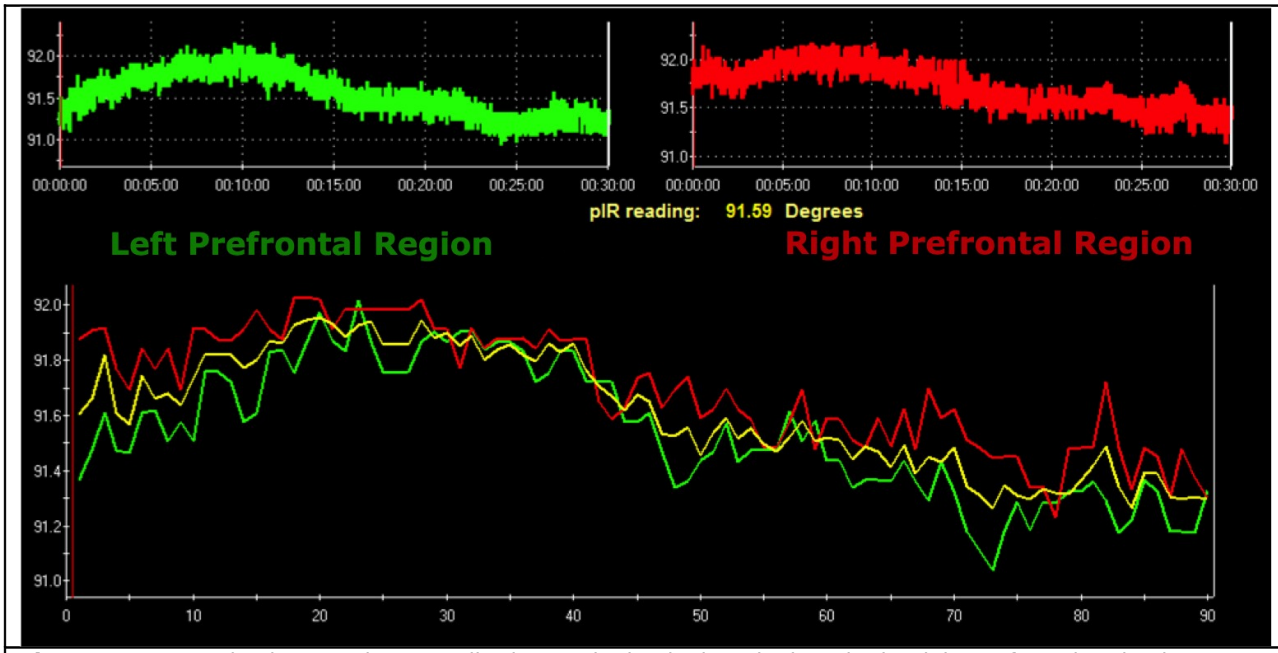

Figure 6. Non-productive 30-minute meditation. In the beginning, the heat in the right prefrontal region is greater than in the left prefrontal region. During the first ten minutes, the progression of the heat in the left prefrontal region is superior to the heat in the right prefrontal region and ends up surpassing it slightly. But parasitic thoughts and "wanting too much" caused the heat to decrease on both sides.

While examining my results, I remembered Maitreya Raël's teachings about how meditation, happiness, and awakening are states of mind. "We cannot do happy, we cannot know happy, we cannot have happy. We can only BE happy because happiness is a state of mind and not something we can own, do or know," as Maitreya Rael said and taught us for years. And the evidence of this was unfolding before my very eyes. When I would see myself "do" rather than "be," nothing would be working.

So, I repeated the exercise for 10 minutes. This time, I was doing nothing, trying nothing, wanting nothing. I wasn't engaged in any type of activity. I was simply letting myself be in the moment, feeling a tremendous sensation of well being and a feeling of love. Throughout the meditation, I could hear the sound of my wonderful background music increase and I could feel the heat in my left prefrontal region intensify, which indicated I was on the right track. Figure 7 shows what I am describing and if we compare the graphs from Figures 6 and 7, we witness an entirely opposite progression that takes place in the left prefrontal region.

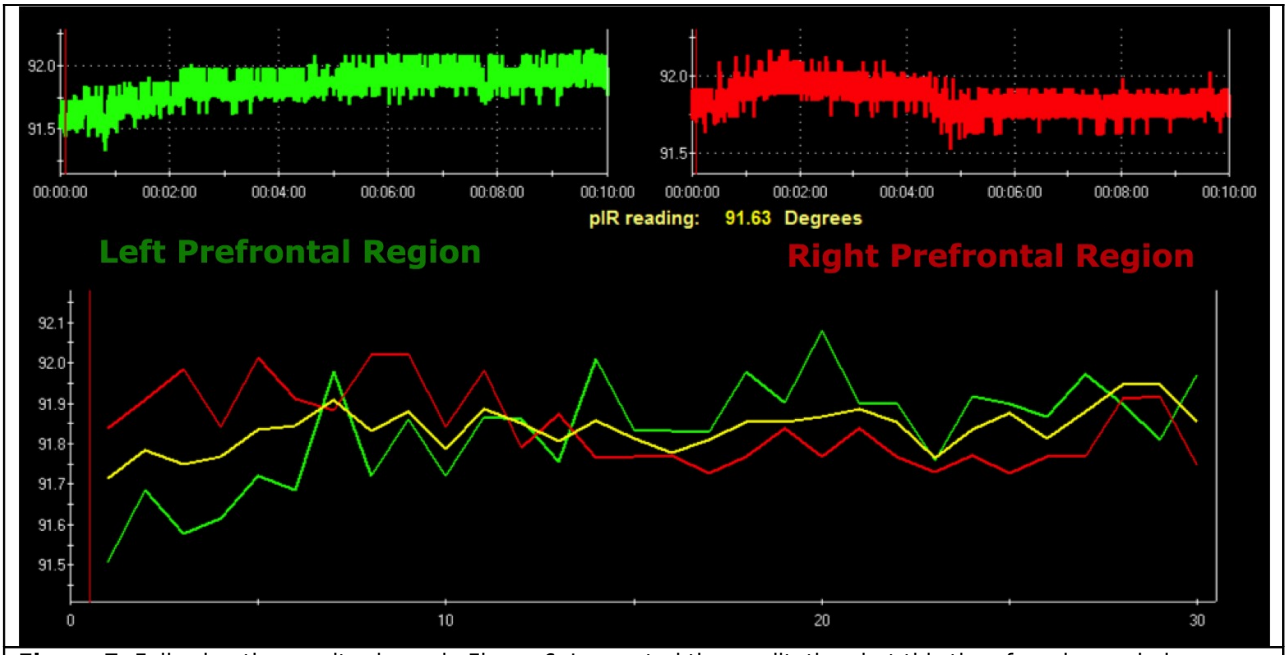

Figure 7. Following the results shown in Figure 6, I repeated the meditation, but this time focusing on being (rather than doing) and love. We can observe a bone fide progression of the heat in the left prefrontal region that eventually trumps the signal from the right prefrontal region.

Validation of the HEG measurement

Although several procedures should be undertaken to fully validate that inner well being is indeed responsible for the temperature increase in the left prefrontal region, compared to the right prefrontal region, and not the result of chance or other factors, I decided to do a first simple test. The idea was to see if there were any other types of intense pleasures that could also produce a temperature increase in the prefrontal region. If, as previously observed and as other studies have shown, inner well being and other positive emotional reactions are associated with a temperature rise and an increased activity in the left prefrontal region more so than the right, I reasoned that it should, at least in theory, be the same for any sexual pleasure. So, I verified my hypothesis and the results are exactly as anticipated. The progressive increase in temperature in the left prefrontal region is greater than in the right and reaches a peak during climax. It is then followed by a decrease in temperature. What I found particularly interesting was how the graph of the brain activation during a sexual activity (see Figure 8a) was very similar to the human sexual response cycle described by Masters and Johnson in the mid-1960s (see Figure 8b).

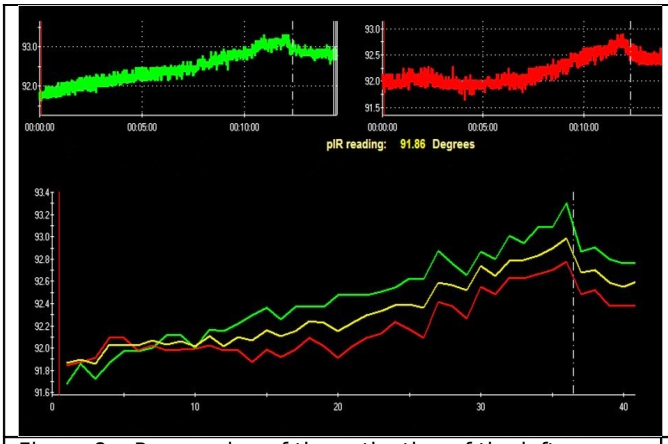

Figure 8a. Progression of the activation of the left prefrontal region during a sexual activity (masturbation). The peak indicates the moment of climax followed by a resolution.

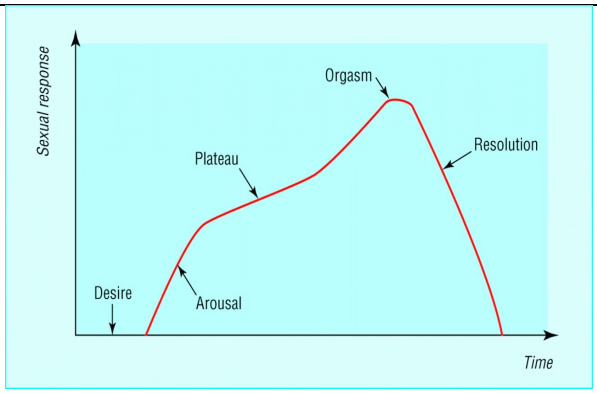

Figure 8b. Sexual response cycle described by Masters and Johnson.
Masters WH, Johnson VE. *Human sexual response*. Boston, MA: Little, Brown, 1966.

Conclusion

It is important to note that despite the promising nature of the observations just presented, and despite all the precautions taken and the utmost objectivity I have tried to maintain while carrying out these experiments, we must honestly recognize that the method used does not meet the rigorous and strict criteria outlined in the scientific method. Although my approach was empirical and exploratory, it was unfortunately not scientifically sound. Several criteria needed to be implemented. Firstly, the experimenter could not simultaneously be the subject of the experiment. Secondly, the research protocol needed to be well defined and follow each step of the scientific method, namely, the need for more participants and the need for at least two groups, control and meditation (independent variables). Thirdly, it would be critical to apply strict controls on the various factors likely to impact the readouts (the dependent variable), etc…

Nonetheless, as observed in past studies on various natural phenomena, it is my hope that the present study will stimulate the interest of other researchers who have access to more sophisticated equipment and research funds. And even if the previous observations were not made by following a rigorous scientific methodology, they still support the teachings of Maitreya Raël who stated that it is possible to intentionally stimulate the blood flow in the left prefrontal area through meditation and to feel its beneficial effects.

Several teachings by Maitreya Raël as well as information contained in the Message given to Him by the Elohim have already been confirmed by science. Both represent a true gold mine of information and will inevitably be subjected to more extensive scientific research in the years to come. It is my firm conviction that any researcher who will accept to submit them to the rigorous scientific method will be amazed by the remarkable discoveries that will ensue and consequently, by his or her enormous contribution to scientific progress and Humanity's well being.