

University of Minho, Faculty of Psychology, 3-6 July 2006, 3rd European Conference on Positive Psychology, Braga, Portugal

Modulating the State of Consciousness through induced Microsynchronization of Sound Waves.

Phenomenology of the experience and application potentials.

Gubert Finsterle

SIPP – Società Italiana di Psicologia Positiva - Milano

AVS Research – Research and experimental Development in Psychology – Milan - Italy

[*Back*](#)

Abstract

Recent studies (Trzopek et al., 2002) detected a direct relationship between the listening of particular sound waves and the synchronizing of cortical waves on these signals.

Moving from this premise, we developed an audio technology based on a holophonic sound field obtained through the microsynchronization of two sound fields, which is a “virtual” reconstruction by an electro acoustic system of one sound field that is perceived as existing potentially all around the listener. The specific listening setting used for this study – labelled as “Setting α ” – involves the use of a fractalic structured sound stimulus ($a = 1/f$), which is perceived as a noise deprived from any recognizable form, thus resulting always identical in time and neutral in relation to mental events.

The phenomenology of the experience associated with this particular kind of listening session can be described as a diversion of attention and consciousness events, from “external” phenomena (the sound stimulus, the perception of the body), to an “internal” field created by the mind itself that has reality evidence for the subject, as happens in dreams.

The fact that participants are awake and conscious allows for a precise phenomenological description of the event, that reveals some structural regularities:

- the sound stimulus tends to disappear while forms begin to arise in the mental space. This transition of the state of consciousness is often perceived as normal and “obvious”;
- a contemplative dimension of the experience is reported, where participants observe without being involved by the emotions related to the scenes that unfold in the mental space;
- the events produced by the mind are usually related to specific personal issues; similarly to insight experiences, participants often get new ways to combine information in order to find answers and solutions, reporting a feeling of wonder;
- after the session, participants feels deeply relaxed and awake, with a spontaneous tendency to smile.

The existence of two neural circuitries – a high pathway and low pathway – involved in transmitting sound related bioelectrical information to the prefrontal cortex and to amygdale and hippocampus, respectively (LeDoux, 1996), can provide a neurophysiologic basis to this experience, also considering the increased amount of general cortical synchronizations during the session.

The microsynchronization of sound waves has proved useful in preliminary clinical applications for the treatment of affective disorders.

Modulating the State of Consciousness through induced Microsynchronization of Sound Waves.

Phenomenology of the experience and application potentials.

Recent studies (Larduner, Loew, Luttringshausen, Unterrainer, Trinkka & Trzopeck, 2002) detected a direct relationship between the listening of particular sound waves and the reduction or elimination of migraine symptoms. Trzopek discovered that this functional disorder can be modified through the listening of particular sounds obtained by the transformation (operated by a specific software) in chromatic tone sequences of the waves of a simplified EEG recorded during a normal, trouble free state.

This method is based on the general idea that brain fulfils some vital and basic functions during birth (respiration, hearth) and that during the course of development reactions and behaviour patterns are developed to deal with the requirements of everyday life. However, due to physical and psychic influences, patterns can be formed which are related to pathologic reactions (*functional disorders*) like migraine, sleep disturbances, burn-out syndromes, which are *not* caused by organic defects.

The general effect of the listening of these dissonant sound sequences is to reduce or cancel the patterns related to functional disorders, unless they are signals of organic disorders.

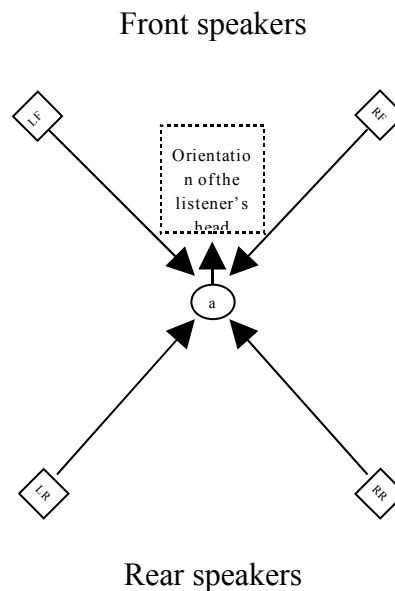
This method demonstrates that it is possible to induce a subject's brain to a different general state of "working", utilizing an amplitude modulated and a frequency-multiplied sonic stimulus that the brain itself recognizes, retuning its general way of working on these transformed EEG's information.

According with this premise that intends the hearing system the most direct way to interact with internal brain areas and considering the fact that the hearing system is active and interacts with brain activity from the third month of foetal life (Fornari, 1984; Tomatis, 1993), I tried to find a way to induce a general state of brain's working that activates foetal-neonatal original patterns.

The hypothesis is that acceding to this way of brain's working should have similar general effects towards the reduction or cancellation of dysfunctional patterns related to functional and affective disorders.

Therefore an audio technology has been developed, which structure is shown in Figure 1, based on the “construction” of a holophonic sound field obtained by the microsynchronization of two specular sound fields, one in front, the other behind the listener (Finsterle, 2003) .

Figure 1. Structure of AVS Virtual Audio Standard® sound reproducing system.



The integration of these two sound fields in a holophonic one is a particular mental operation that opens to a different space experience that has been defined “Primary Mental Space” (PMS) (Finsterle, 2006). The hypothesis is that the foetus and the child, for some months (Winnicott, 1971 & 1985) after the birth, perceive-construct their first mental events in this Primary Mental Space, that - following this conception - is also the one where unfolds dreams, or in general autopoietic constructions of the mind (hallucinations, ecstatic visions, see Margnelli, Bianchi, Bolelli, Campione, Gagliardi, Garzia & Rossin, 1993).

The specific listening setting used for this study – labelled as “Setting α ” – involves the use of a particular tuning of AVS Virtual Audio Standard®’s sound reproducing system (Finsterle,

2003), simulating the physical and phenomenological conditions (with closed eyes) of a listening via liquid without auricle, considered ontogenetically and phylogenetically a “primary” listening condition.

A fractalic structured sound stimulus known as *Pink Noise* ($a = 1/f$), which is perceived as a noise deprived from any recognizable form, thus resulting always identical in time and neutral in relation to mental events (Finsterle, 2006), has been chosen for its neutrality, its masking properties related to the ambient noise and because it is the electrical background noise emitted by the living systems which self organize their behaviour (Van Orden, Holden, Turvey, 2003).

Phenomenology emerging during PAT sessions

The phenomenology of the experience associated with this particular kind of listening session labelled “Psycho Acoustical Transitional” (PAT) session can be described as a diversion of attention and consciousness events, from “external” phenomena (the sound stimulus, the perception of the body), to an “internal” field created by the mind itself that has reality evidence for the subject, as happens in dreams.

Five general stages have been identified, classified considering the kind of autopoietic events produced (Varela & Maturana, 1985) and the kind of relation that the consciousness has towards these productions. The group of 26 participants was composed by neuroscientists, experts of altered states of consciousness, physicians and mathematicians, psychoanalysts, musicians, “normal” subjects and two psychiatric subjects (age range: 21-80; M: 15, F: 11).

Furthermore, the space experience that the subject elaborates during wake, sonically build by IID, ITD (Interaural Intensity Difference and Interaural Time Differences) and “Plausibility Hypothesis” (Evans, 1993) has been defined as “Secondary Mental Space” (SMP); “Transitional Mental Space” (TMS) has also been defined the sound space experience that unfolds when SMP and PMS fuse the one in the other.

Stage 0T: the subject perceives the sound-stimulus maintaining the usual stream of thoughts. No consciousness modulation. (0 = no autopoietic productions, T = presence of normal Thoughts).

Stage 0: the subject hears the sound-stimulus and in a specific moment the spontaneous streams of thoughts stops, bringing the subject in a condition of empty contemplation of the stimulus, in which he/she has a sensation of Being, well described by Winnicott's definition "sensation of Being before any identification" (Winnicott, 1971). We use the term "Self-Consciousness", in its meaning of nonthetic, nonpositional consciousness of the Self (Sarte, 1943).

Stage 1: the subject hears in the TMS the sound-stimulus that transforms itself in similar, known sound events (the sound of a waterfall, the hiss of an airplane, the whistling of the wind, the sea waves, etc.) which are associated by the listening subject to a "visual" mental representation (like a remembrance) and by synesthesia also to other events and senses of the experience, like the humidity of the waterfall, the chill of wind, etc.. Spontaneous infant remembrances, sensations and emotions can arise in the form of mental representations.

Stage 2: the subject hears the sound-stimulus and builds, in the PMS that unfolds itself in the TMS, sonic events which are different from the stimulus (music, car noises, bells, the closing of doors, the pure sinus tones, the voices in their phonetic/emotional dimension, etc.). These sonic events have the characteristic to be perceived from the outside, as it happens with dreams. The subject can decide whether paying attention to these events or not. During listening, some subjects "perceiving" only sonorous events, showed evident REM phenomena.

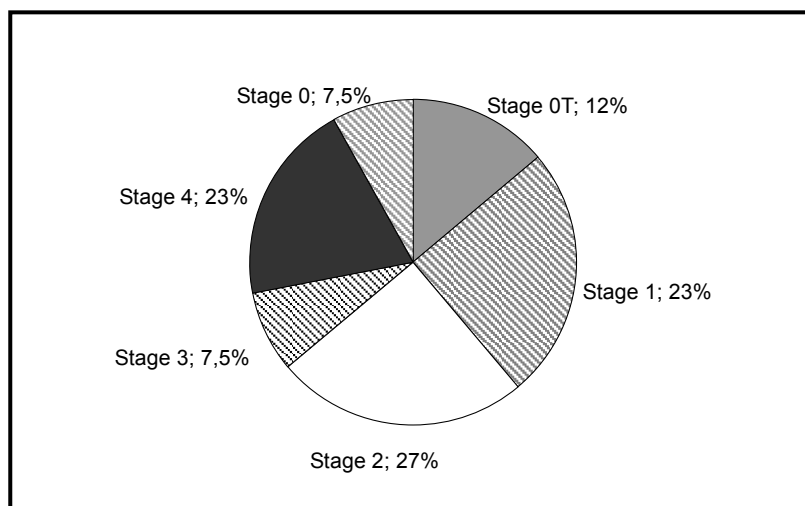
Stage 3: the subject does not hear the sound-stimulus and builds into the PMS visual events which are like holograms that forms themselves in the front and behind the listener. These visual forms have the characteristic of an endogenous brightness, which is a property also of the background (the PMS). These images appear and disappear like the changing of slides during projection.

Stage 4: the subject does not hear the sound-stimulus and builds complex events into the PMS (visual – acoustic – tactile – gustative – olfactory – coenesthetic – emotional) which resemble the animated scenes of a dream. The subject can interact with these events with a sense of realism near to that of a perception. His consciousness can come closer to an “object” using a sort of “zoom function” and he/she can “speak” with another “subject” which is a mind image that answers the listener’s consciousness independently from it.

In this condition the subject usually experiences a detachment from the body without losing the mental *imago* of the body. This last imago can move in this primary mental space.

When the sound-stimulus stops the disappearing of all the ecstatic – hallucinatory events is immediate. Once disappeared these phenomena can’t be reproduced by a voluntary act.

Figure 2. Autopoietic productions in Setting α : percentage of subjects that accede at each stage within the sixth session.



In these years it has been ascertained that the tendency to accede to stage 4 is near to 90% among the subjects that accede within the first six sessions to a modulated state of consciousness

(stage 0-4) and continue to do PAT sessions twice a week for at least three months (24 PAT sessions).

The fact that participants are awake and conscious allows for a precise phenomenological description of the event, that reveals some structural regularities:

1. the sound stimulus tends to disappear while forms begin to arise in the primary mental space. This transition of the state of consciousness is often perceived as normal and “obvious”;
2. a contemplative dimension of the experience is reported, where participants observe without being involved by the emotions related to the scenes that unfold in the PMS;
3. the events produced by the mind are usually related to specific personal issues; similarly to insight experiences, participants often get new ways to combine information in order to find answers and solutions, reporting a feeling of wonder;
4. after the session, participants feel deeply relaxed and awake, with a spontaneous tendency to smile.

Application potentials

The general effect is, from a phenomenological point of view, the tendency to induce a disidentification of the consciousness function from the field of autopoietic events that unfold in the PMS. This consciousness’ disidentification produces the consequence that the eventually negative emotions correlated to the events produced in the PMS (anxiety, fear, panic, sadness, etc.) are perceived as “external”, fundamentally not involving the Self-Consciousness that observes in a contemplative state.

The consciousness function, *not invaded* by emotional tensions, is able to integrate and elaborate the information expressed by autopoietic phenomena: this phenomenon happens spontaneously in subjects who have introspective abilities (competent subjects in psychical domain, as described in the example that follows), with the help of a specialist in case the subject is not able

to understand the logical relations and symbolic information expressed by autopoietic productions (Fornari, 1979, 1981, 1983). However, it has to be pointed out, that autopoietic events produced in this condition show “in themselves” new combinations of information that seems *different* from the one’s we can observe during dreams (Aiello & Finsterle, 2005). The fact that after PAT sessions the subject is usually deeply relaxed and less aggressive towards the acceptance of new relations between events and emotion, facilitates the insight process, even in absence of autopoietic events.

Example of spontaneous insight process: F, age 45, Psychotherapist.

The subject was disturbed by EEG.

The EEG’s electrodes produced pain at the end of the session and negatively influenced the autopoietic production..

“It was an event I didn’t experience during the other sessions without EEG recording, when I acceded quite immediately to the “perception” of a different field of events (*stage 4*). It was a sensation like when we awake the morning but we wish to sleep for some time longer, to change continuously from a sleeping to a waking state, observing some not relevant images like short dreams. I felt also to be unable to control my muscles: I observed a foot and a finger moving in a autonomous way.

I lived this state for a while, until, after approx. 10 minutes, I saw the only one clear image, totally independent and full of sense. I saw a big sunflower with the internal disc that look like a brown velvet with the petals around. This image appeared superimposed to a second one representing a stained glass window I remember to have often seen in an apse of the Duomo of Milan. In fact on a wide stained glass window of the left apse, among other drawings, there is represented a dark, black disc with a sort of yellow sun around. These two superimposed images were alternatively changing in front of me.

The image I saw in the Duomo made always a deep impression on me. I like it, but I never could understand what it resembled to. This superimposition of the two images let me think: this is what it

resembles! It resembles a sunflower! That's it. Then I continued to fluctuate in this kind of pre-sleeping state.

At a certain moment I began to feel the electrodes on the front. I noted that at the moment the sound stimulation stopped, the bothersome sensation of the electrodes transformed itself in pain.”

We think that these phenomena are to be related to an increase of computing abilities by the brain that in our opinion are correlated to the increase of synchronisation of neural cortical populations (Aiello & Finsterle, 2005) and the opening of a communication path through neocortical areas and older ones, that let emerge the activity of primary sense-creation's structures: it seems that the brain-system is generally more plastic and efficient during and after the session (Finsterle, 2006).

In a double blind research effectuated to determine cortical activity during PAT sessions, 15 EEG have been recorded, 10 in Setting α , 5 in stereo for control. The most interesting data that we observed (Figures 3, 4, 5 & 6) was a tendency to induce recurrent general cortical synchronisation, in some cases in all bands (α , β , δ , γ), correlated with an evident increase of in-phase neural cortical populations (Aiello & Finsterle, 2005).

Figure 3. Subject: F, age 32. Access to Stage 3. Example of recurrent synchronisation (40 seconds rec.) during PAT session.

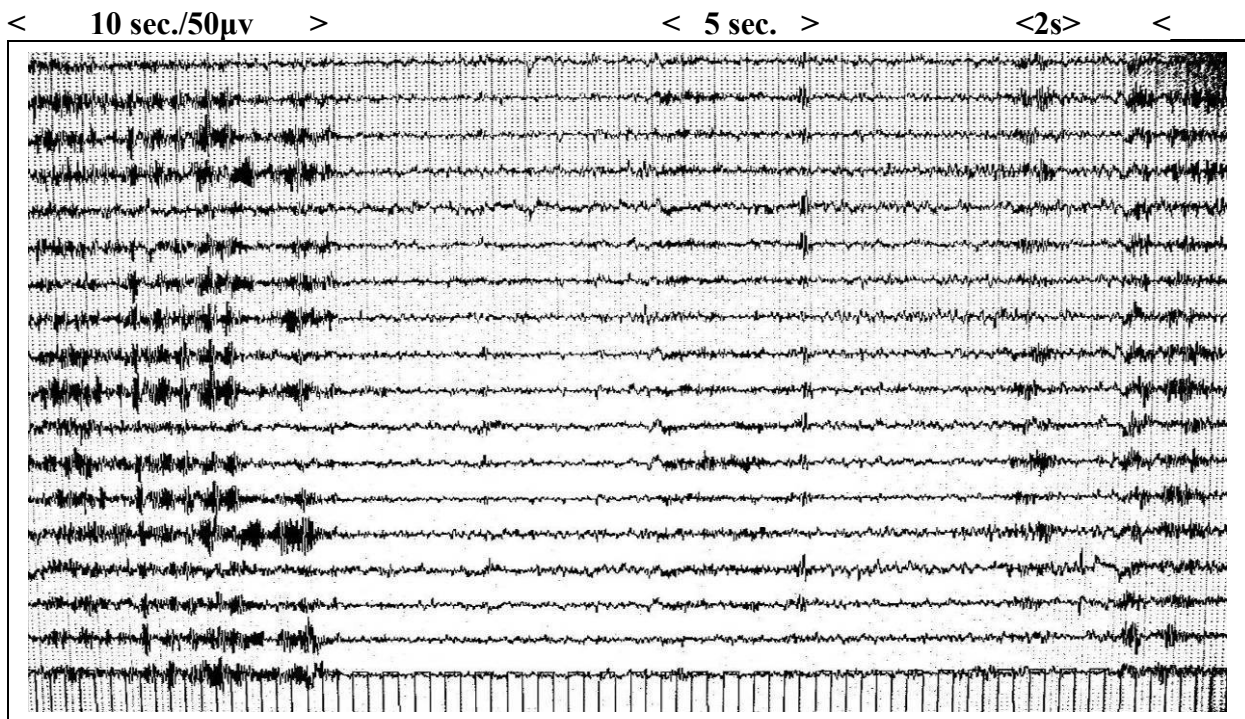


Figure 4. Example of 1 second of the first burst: in evidence the general cortical synchronisation in Setting α .

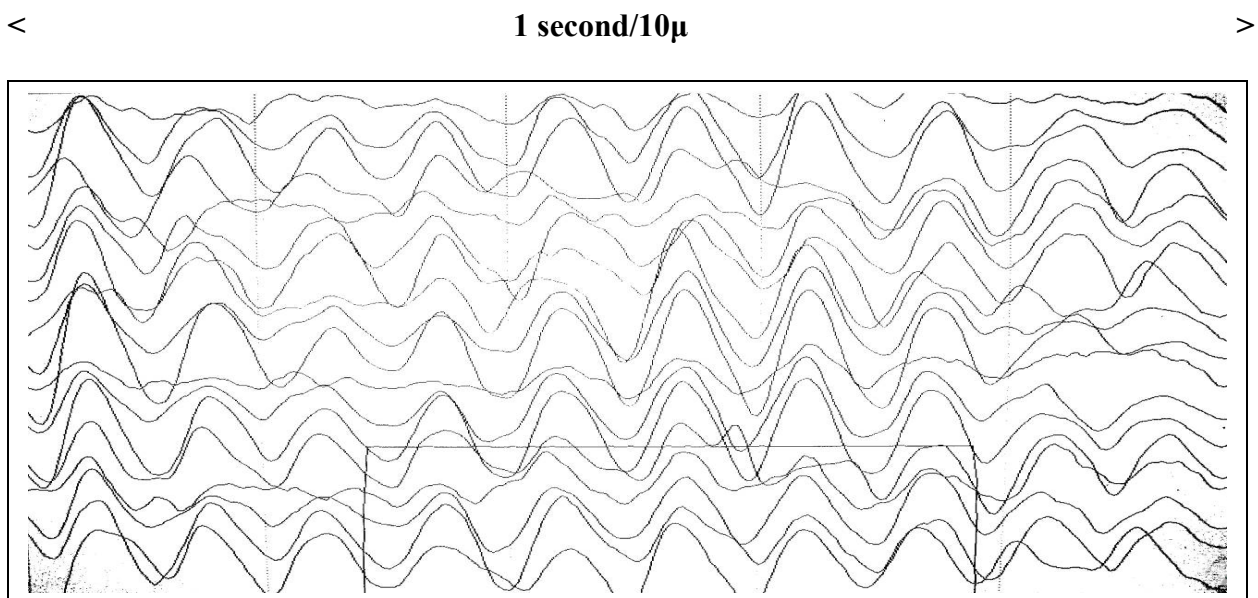


Figure 5. Space of phases. Grey triangles: representation of in phase neural population areas without stimulus, closed eyes. Black triangles: representation of in phase neural population areas with pink noise stimulus in stereo, closed eyes.

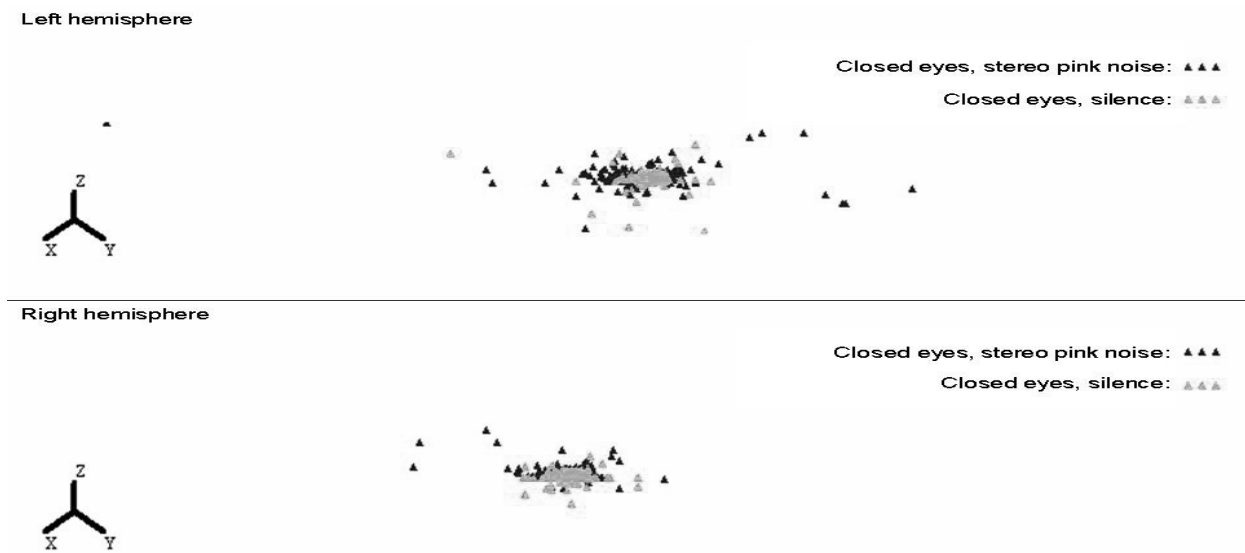
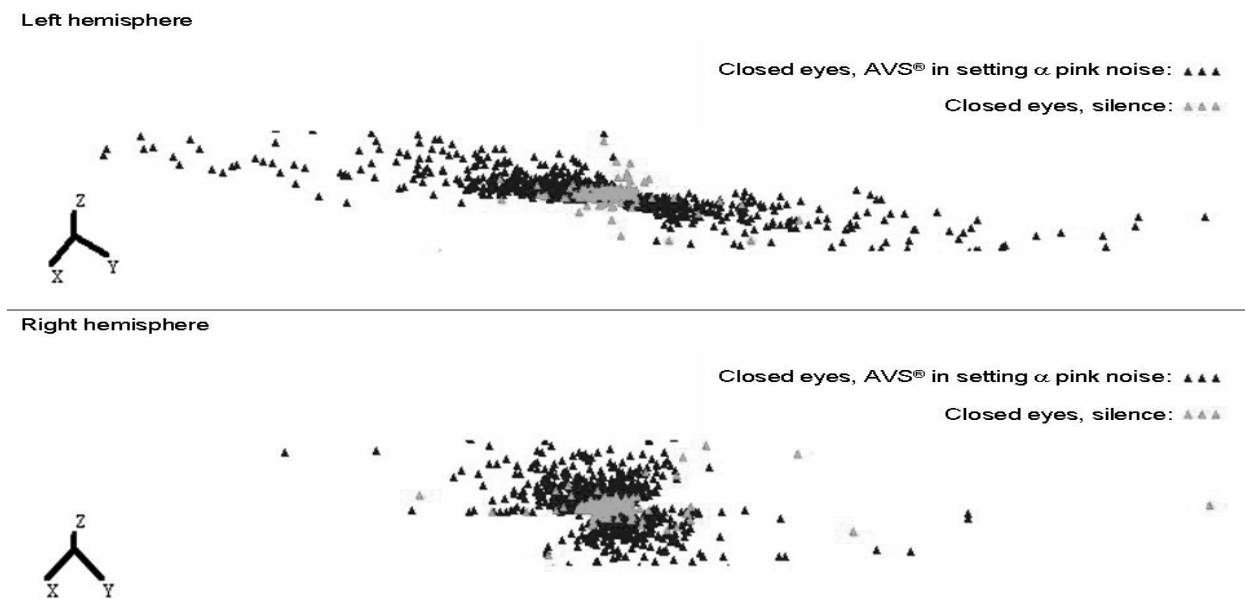


Figure 6. Space of phases. Gray triangles: representation of in phase neural population areas without stimulus, closed eyes. Black triangles: representation of in phase neural population areas with pink noise stimulus reproduced in AVS, Setting α , closed eyes, extremely wider than with stereo pink noise stimulation.



It is interesting to consider that the sound stimulus can be described also as a multigradients synchronized stimulus: a relation between this input and the cortical synchronisations seems plausible.

Furthermore, in these years, it has been verified that some typical effects lasts for 24-48 hours after the PAT session, independently from the dialogue-technique that may be used after the listening session.

It often occurs that subjects describe a clearness of mind and a physical improvement for 1-2 days after the session. We think that these improvements can have a relation with the opening of new neural communication paths that may be easier to activate, increasing the capability to elaborate information and improving the spontaneous control of the body, as described by the following example by a 36 old pianist, three days after a PAT session.

“After the early moments of uncomfortableness, that probably moved something inside me I voluntarily put aside, the sensation was “I want to see”: I was in front of a point of uncomfortableness, may be a state that scared me, a internal part of me that scared me. Bypassed this phase, the experience was surprising, unexpected, because I lived both something new and in a very natural, comfortable way, in a state of joy and wellbeing.

The perceiving of these voices, the presence of musical themes that I heard, the remembering of very definite situations that I developed the days after, surprised me and I didn't forget them. After the listening, in normal life, the strongest sensation was a different approach to the music: trying to play with this new dimension, I noticed two or three very clear points in the musical technical field. The most important feeling was this sense of uniqueness, to play a piece understanding in that moment that it must be so. It's like a musical conviction that isn't rise from thinking, but rises from a state of immediateness and comfortableness to the piano, the hands, the body. All happened in a faster way and this state lasted for 24-36 hours. Then, I felt the moment in which this state disappeared, and now I'm able to synthesize this state with the word “clearness”: all was faster, clearer. Even the reasoning, the applications, the evaluation of some persons, the usual

conversations with some persons had a new light: it was like I was magically able to interpret the thought of other people. Maybe, the intuition's sensation was stronger and also my language – I lived with a foreign woman and my language became poor – returned to a state of years ago, when I was able to better articulate my thoughts.”

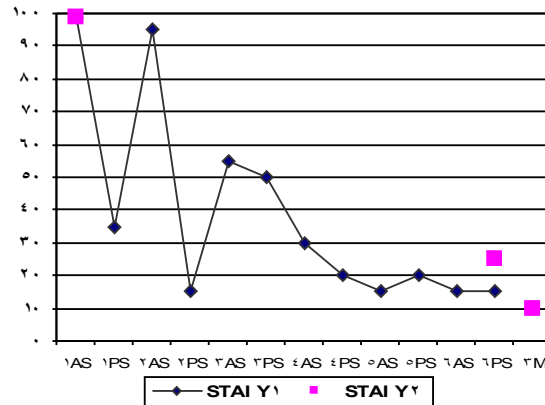
The existence of two neural circuitries – a high pathway and low pathway – involved in transmitting sound-related bioelectrical information to the prefrontal cortex, to amygdale and to hippocampus, respectively (LeDoux, 1996), may provide a neurophysiologic basis to this experience. In particular it is interesting to point out that the hippocampus seems directly involved in the elaboration of a space experience rather related to acoustics information than to visual ones (O'Keefe & Nadel, 1978). Furthermore, other authors (Eichenbaum & Otto, 1992; Rudy & Sutherland, 1992) point out that the hippocampus seems to have the function to establish a connection between different representations and/or to integrate these representations in a new configuration.

The disappearing of sound stimulus to subject's consciousness and the unfolding in a mental space of autopoietic events that may establish a connection or integrate different information of subject's past and/or of primary information (phylogenetic ones, like circle, lines, colours etc.) let us reasonably imagine a relation among this phenomenology and this way to conceive brain's function.

The microsynchronization of sound waves has proved useful in preliminary clinical applications for the treatment of affective disorders and pains, not related to organic disorders.

The Figure 7 shows the variation of the score measured with the State-Trait Anxiety Inventory (S.T.A.I.; Spielberger, 1989) during a treatment with PAT sessions: the subject is a student, age 17, with a diagnosis of panic attack (DAP) since 3 months. The treatment consisted in six PAT sessions twice a week with dialogue after the listening.

Figure 7. Variation of S.T.A.I.'s score in the different PAT sessions.



Note: AS: ante session; PS: post session; 1-6: number of sessions; 3 M: Follow up after 3 months.

Conclusions

This method of interaction with the mind's functions presents some interesting characteristics for the research in mental field.

1. It is a completely defined setting from a mathematical-physical point of view and doesn't need an interaction with an other subject to produce his effects.
2. The "informal" sound-stimulus bypasses the problems related to the subject's mother tongue and his musical culture.
3. The modulation of the state of consciousness occurs in a high percentage of subjects and are relatively independent from their conscious control.
4. The experience is usually perceived as pleasant.
5. The duration of the session is relatively short (20 min.).

The PAT session can therefore be defined as "primary", scientific intervention's methodology of possible universal application.

It can also be hypothesized, for the effects of increase of intrapsychical communication, plasticity and efficiency of the brain-system, an integration in setting and models of interaction with

mental functions of cognitive-behavioural, psychoanalytical and philosophical areas, so as an application finalized for obtaining a general improvement of the quality of life, because of the increase of mental and physical performances that can be obtained.

References

- Aiello, G. & Finsterle, G. (2005). Modulazione dello stato di coscienza mediante l'ascolto di una stimolazione sonora a struttura casuale in un campo olofonico: fenomenologia dell'esperienza, ipotesi teoriche e prime analisi elettroencefalografiche. *Atti XIII Congresso Nazionale AIAMC*, pp. 4-5, Milano.
- Eichenbaum, H. & Otto, T. (1992). The Hippocampus: What does it do? *Behavioural and Neural Biology*, n.57, pp. 2-36.
- Evans E. F. (1993). Basic Physiology of the Hearing Mechanism. AA.VV., *Proceedings of the Audio Engineering Society 12th International Conference*, pp. 11-21, AES, USA.
- Finsterle, G. (2003). Recording and play – back two channel system for providing a holophonic reproduction of sounds. *Acoustical Society of America Journal*, Volume 113, Issue 3, pp. 1196-1196. Retrivable on the WEB in *The NASA Astrophysics Data System*, Harvard. http://adsabs.harvard.edu/cgi-bin/nph-basic_connect?qsearch=Finsterle+Holophonic&version=1
- Finsterle, G. (2006). The “mirror effect” in sound’s fusion time: the integration of two specular sound fields in one mental-virtual holophonic sound field. Phenomenology and applications. *Atti International CIANS Conference*, pp. 28-29, Milano.
- Fornari, F. (1979). *I fondamenti di una teoria psicoanalitica del linguaggio*. Boringhieri, Torino.
- Fornari, F. (1981). *Il codice vivente*. Boringhieri, Torino.
- Fornari, F. (1983). *La lezione freudiana*. Feltrinelli. Milano.
- Fornari, F. (1984). *La psicoanalisi e la musica*. Longanesi.

Larduner, G., Loew, T., Luttringshauser, G., Unterrainer, J., Trinkla, v. E. & Trzopeck, H. G. (2002).

An auditory electrophysiological intervention on migraine: a randomized placebo controlled Add-on trial. *Journal of Neurotherapy*, Vol.6, nr. 2, pp. 21-30.

LeDoux, J. (1996). *Il cervello emotivo*. Raffaello Cortina Editore, Milano.

Margnelli, M., Bianchi, A., Bolelli, F., Campione, G., Gagliardi, G., Garzia, P. & Rossin, R. (1993).

La fenomenologia della coscienza normale e alterata. Theta Pubblicazioni, Milano.

O'Keefe, J. & Nadel, F. (1978). *The Hippocampus as cognitive map*. Clarendon Press, Oxford.

Rudy, J.W. & Sutherland, R.J. (1992). Configural and elemental associations and the memory coherence problem. *Journal of Cognitive Neuroscience*, n.4 (3), pp. 208-216.

Sartre, J.P. (1943). *L'essere e il nulla*. Il Saggiatore, Milano.

Spielberger, C. D. (1989). *State Trait Anxiety Inventory (S.T.A.I.) – Inventario per l'ansia di Stato e Tratto*. Organizzazioni Speciali, Firenze.

Tomatis, A. (1993). *Dalla comunicazione intrauterina al linguaggio umano*. Ibis, Como-Pavia.

Van Orden, G.C., Holden, J.G. & Turvey, M.T. (2003). Self organization of cognitive performance. *J. Exp. Psychol. Gen.*, Sep. 132(3), pp.331-350.

Varela, F. & Maturana, H. (1985). *Autopoiesi e cognizione: la realizzazione del vivente*. Marsilio, Venezia.

Winnicott, D.W. (1971). *Gioco e realtà*. Armando Giunti, Roma.

Winnicott, D.W. (1985). *Dalla pediatria alla psicoanalisi*. Martinelli, Firenze.

[Back](#)