

The Peripheral Biofeedback and the Trichromatic Theory of Equilibrium of the Vegetative Nervous System

by
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In this introductory article I like to present the **Trichromatic Theory of Equilibrium of the Vegetative Nervous System** (T.T.E. of VNS) and its actual and potential applications about the *Peripheral Biofeedback*. This theory is a particular application of the **Trichromatic Theory of Equilibrium of Systems** (T.T.E.S.).

The **T.T.E.S.** states that *it's possible to observe, to analyze, to check, and to modify, in real time, the state of dynamic equilibrium of all Systems*. Essential condition for the application of this theory is the identification of *three specific representative parameters* of the general operation of the system that is to be analyzed.

These are the two principal sources of inspiration of the **T.T.E.S.** :

- 1) the **Trichromatic Theory of Vision of Colors** by *Young and Helmholtz*;
- 2) the **RGB Color Model**.

The Trichromatic Theory of Vision of Colors states that *it's possible to get all colors mixing three specific monochrome lights*.

The RGB (Red, Green, and Blue) Color Model reproduces all the visible colors mixing the *Primary Colors* and using three reference numbers.

The **Trichromatic Theory of Equilibrium of the Vegetative Nervous System** (T.T.E. of VNS) is a *new theory* and an *innovative method* derived from computerised processing of biofeedback data which establishes a real innovation in this field. This theory states that *it's possible to observe, to analyze, to check, and to modify, in real time, the status of the dynamic balance between the Sympathetic and the Parasympathetic section of the Vegetative Nervous System*. Essential condition for the application of the T.T.E. of VNS is the identification of *three specific representative physiological indexes* of the general equilibrium of the Vegetative Nervous System. With the real time values of these three specific representative physiological indexes an innovative psychophysiological profile can be compiled.

The *three specific representative physiological indexes* are: 1) **Skin Conductance** (GSR); 2) **Heart Rate** (HR); 3) **Skin Temperature** (THE).

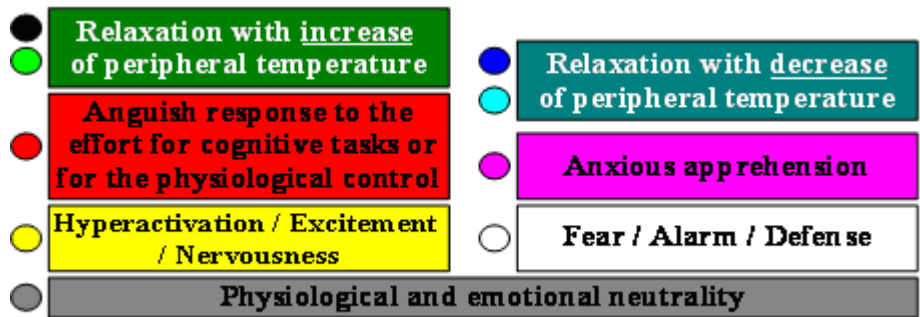
The method of the T.T.E. of VNS is based on the computerised analysis of data simultaneously collected from biofeedback activity of these three indexes.

The simultaneous variations of the values of these *three indexes* are subsequently converted into **8 Principal Codes** and for each Code a value of intensity of variation of three indexes is calculated.

These 8 Codes can be used to synthetically describe all possible functional states of the Vegetative Nervous System.

Besides, this theoretical model is used to represent *the status of the dynamic balance between the Anterior and Posterior section of Hypothalamus*.

In the picture No.1, the **correlated emotional states** to the physiological answer of 8 Codes are schematized.



Pict. 1

Conclusions obtained by the application of these *theory* and *method* indicate that they can be used either in *scientific research*, or for *diagnostic* and *psychotherapeutic* purposes.

The principal clinical applications of the T.T.E. of VNS concern *monitoring* of:

- exercises of physiological control;
- emotional answers;
- exercises of relaxation and meditation;
- cognitive tasks;
- dream and different phases of sleep;
- action of psychotropic drugs and other types of medicines;
- psychotherapeutic interventions (strengthening techniques as EMDR, Flooding, Systematic Desensitization, etc.);
- judicial evaluation ("poligraph").

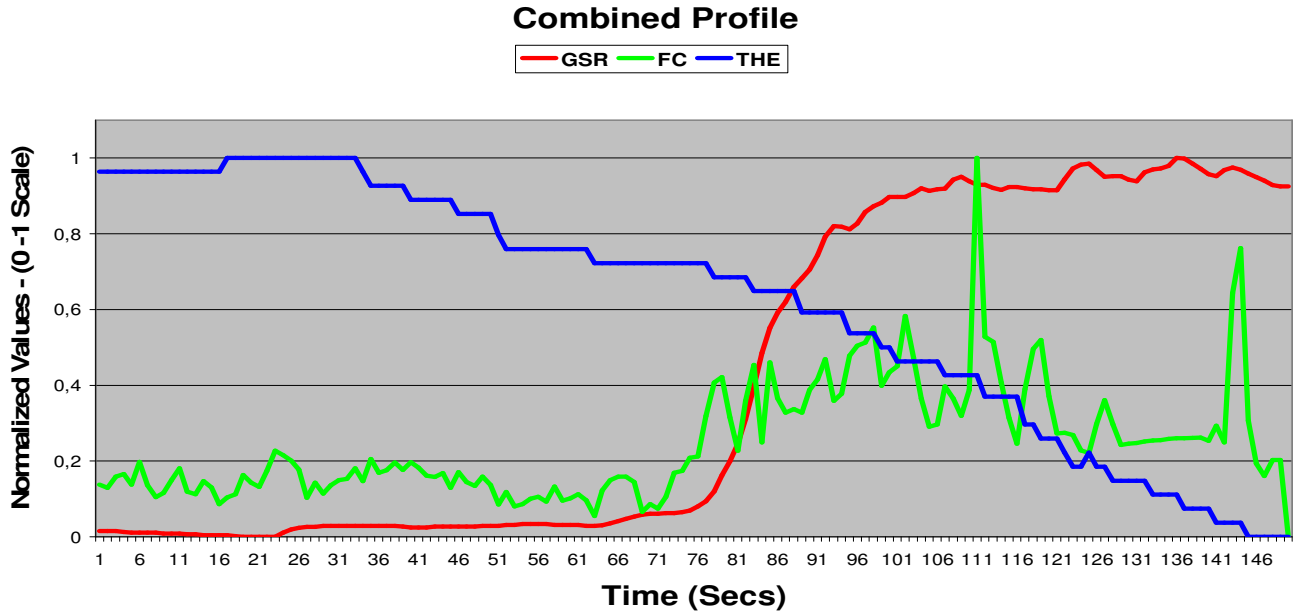
In this document I show you the results presented to ICCP 2008: **three psychophysiological profiles** related to the treatment with systematic desensitization and the cognitive restructuring of a case of ***Post-Traumatic Stress Disorder following a Sexual Assault***.

Before beginning the treatment, the 25-year-old patient was informed about the cognitive and behavioral therapy, and trained with the biofeedback to the muscular and visceral relaxation. The treatment with Systematic Desensitization lasted 8 sessions (40 minutes each, one session every week). The treatment with Cognitive Restructuring lasted 8 sessions (50 minutes each, one session every week). Altogether the symptomatic treatment lasted around 4 months.

The first profile has been in relief before the treatment; the second one in the middle of the treatment; the last one at the end of the treatment.

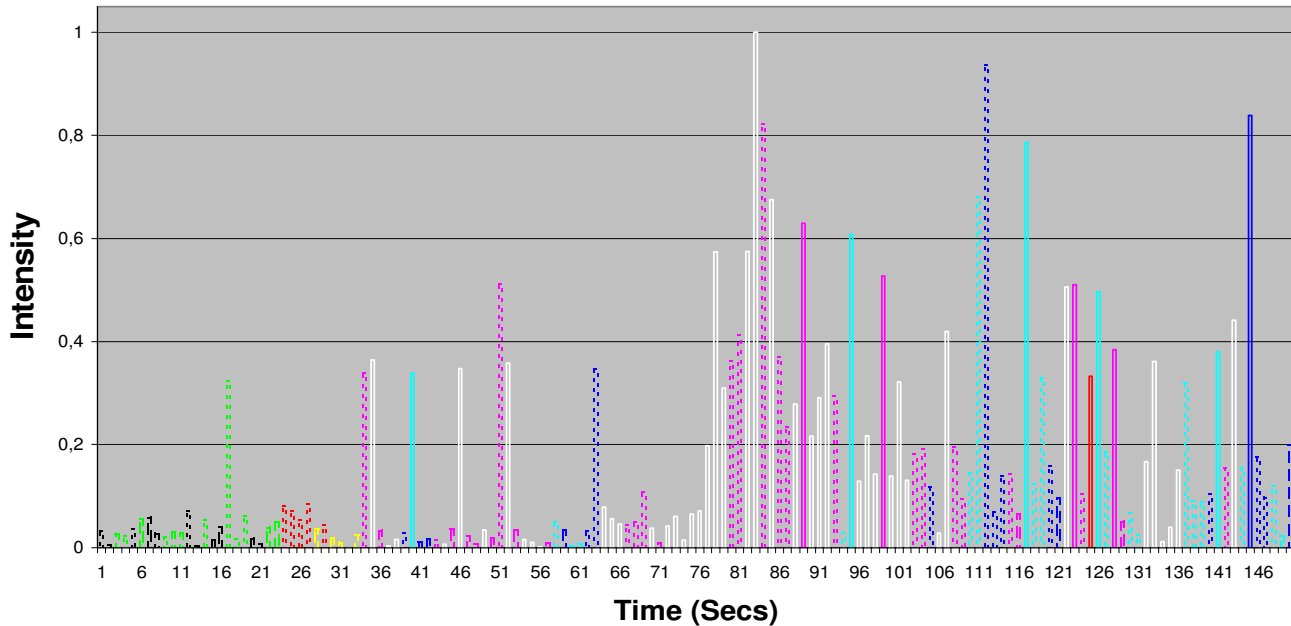
Profile n°1

This profile has been recorded after the completion of the training of muscular and visceral relaxation and before the beginning of the combined treatment with Systematic Desensitization and Cognitive Restructuring. The recording shows the patient's psychophysiological response to the request to recall the most dramatic moment lived during the sexual assault (Pict. No. 2, 3, 4, 5, 6).



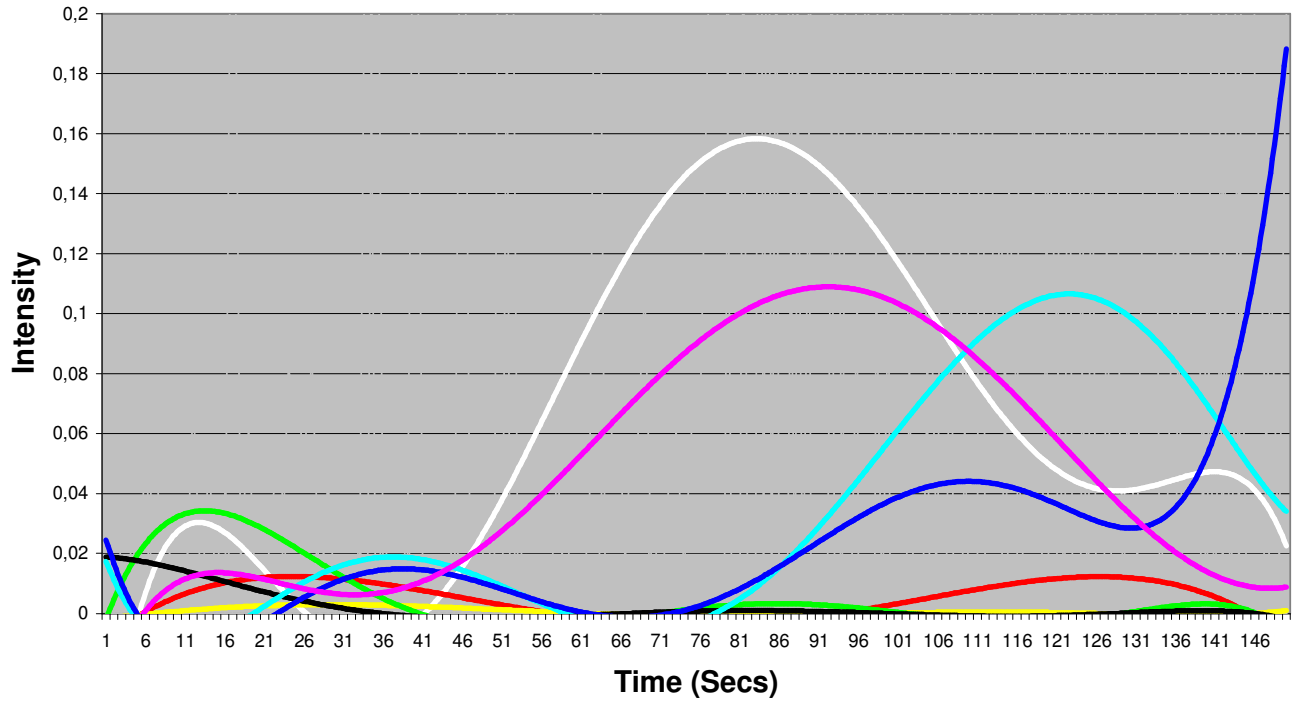
Pict. 2

Tonalities and Intensities of the 8 Codes



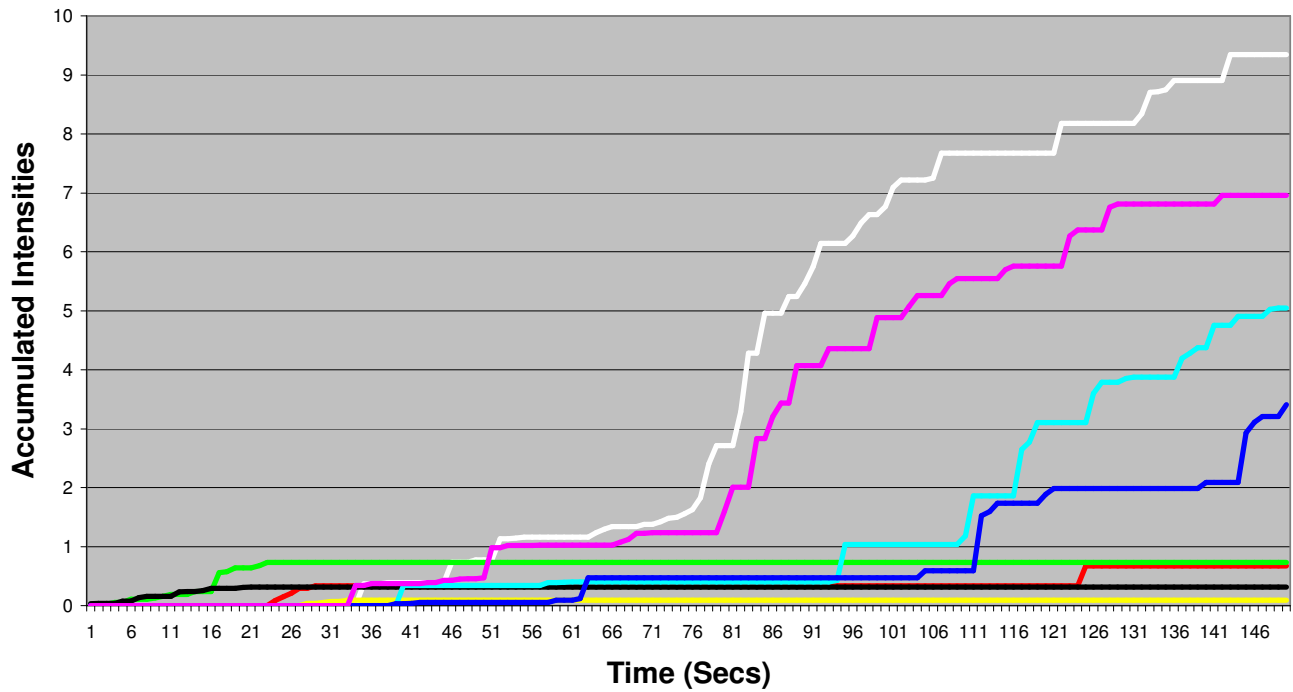
Pict. 3

Lines Polynomial Tendency of 6° order of the 8 Codes

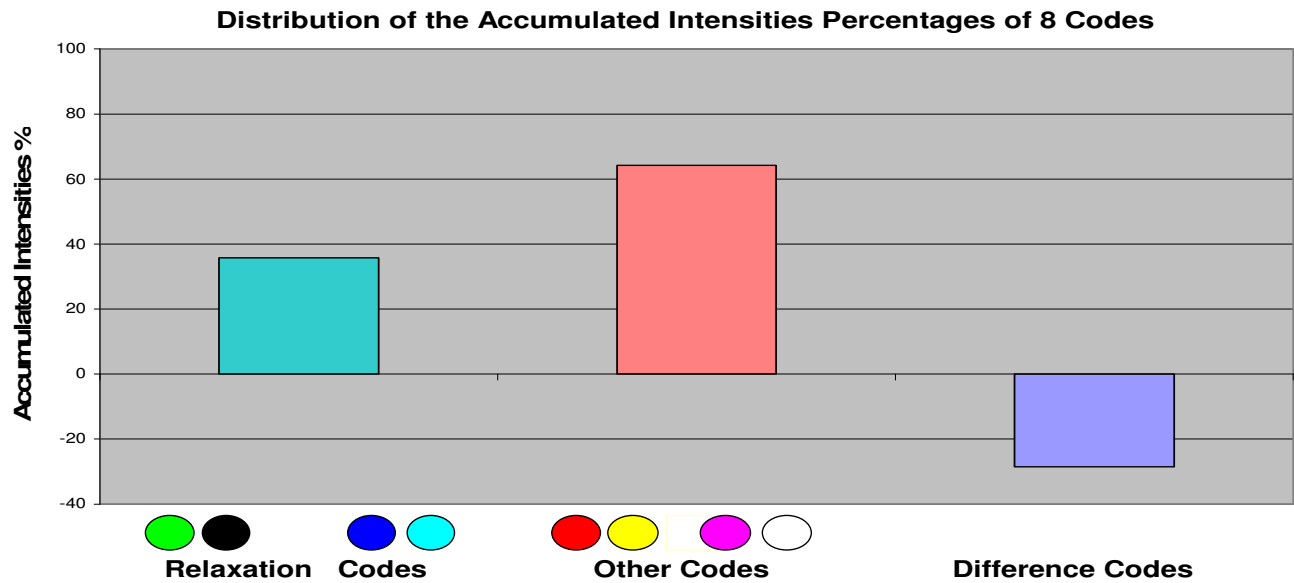


Pict. 4

Distribution of Accumulated Intensities of the 8 Codes



Pict. 5

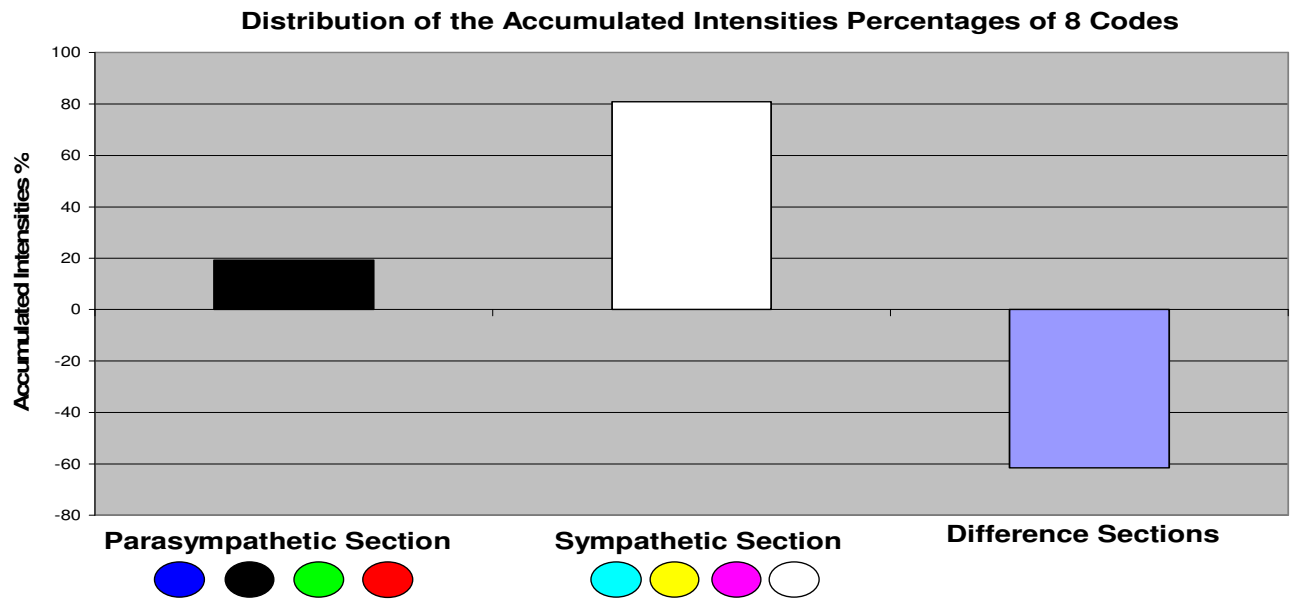


Pict. 6

Despite an initial difficulty to voluntarily recall the traumatic image, **the profile tends to progressively take on cold colorations** (Pict. No. 3, 4, 5). **White** and **Magenta** are the most evident colors.

White characterizes the *emotion of fear, the alarm and the answer of defense*. **Magenta** is typical in case of *anxious apprehension*. White and Magenta are present during the whole recording, but they reach their maximum frequency and intensity between 75 and 90 seconds after the beginning.

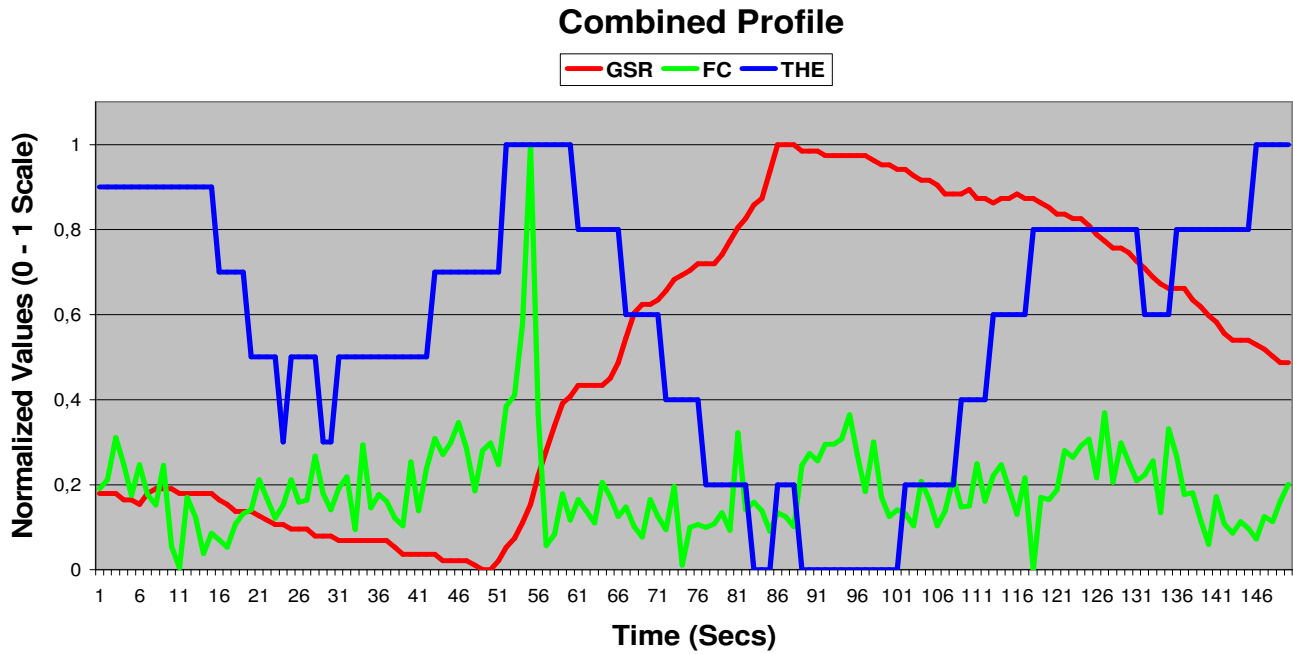
In conclusion, from this brief profile **a strong defensive emotional answer** comes out from the recall of the most dramatic moment lived during the sexual assault. In literature, this type of defensive emotional answer is attributed to a consistent activation of the *Posterior Hypothalamus and of the Sympathetic Section of the Vegetative Nervous System* (Cyan, Yellow, Magenta, and White) (Pict. No. 7).



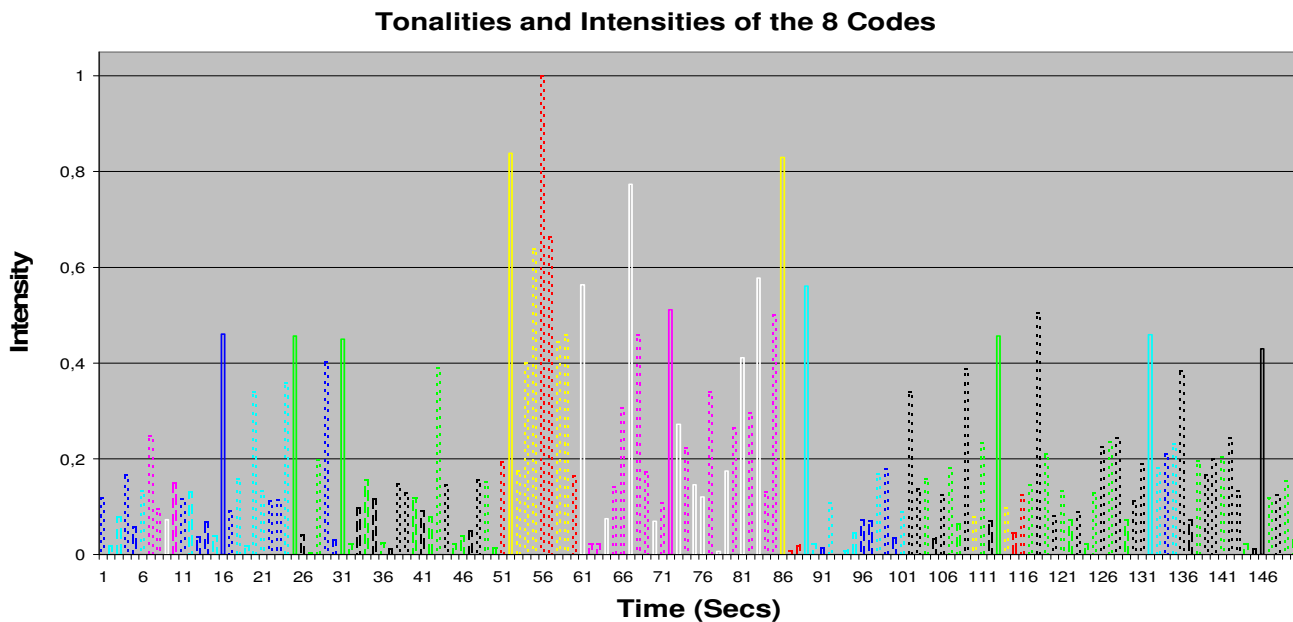
Pict. 7

Profile n°2

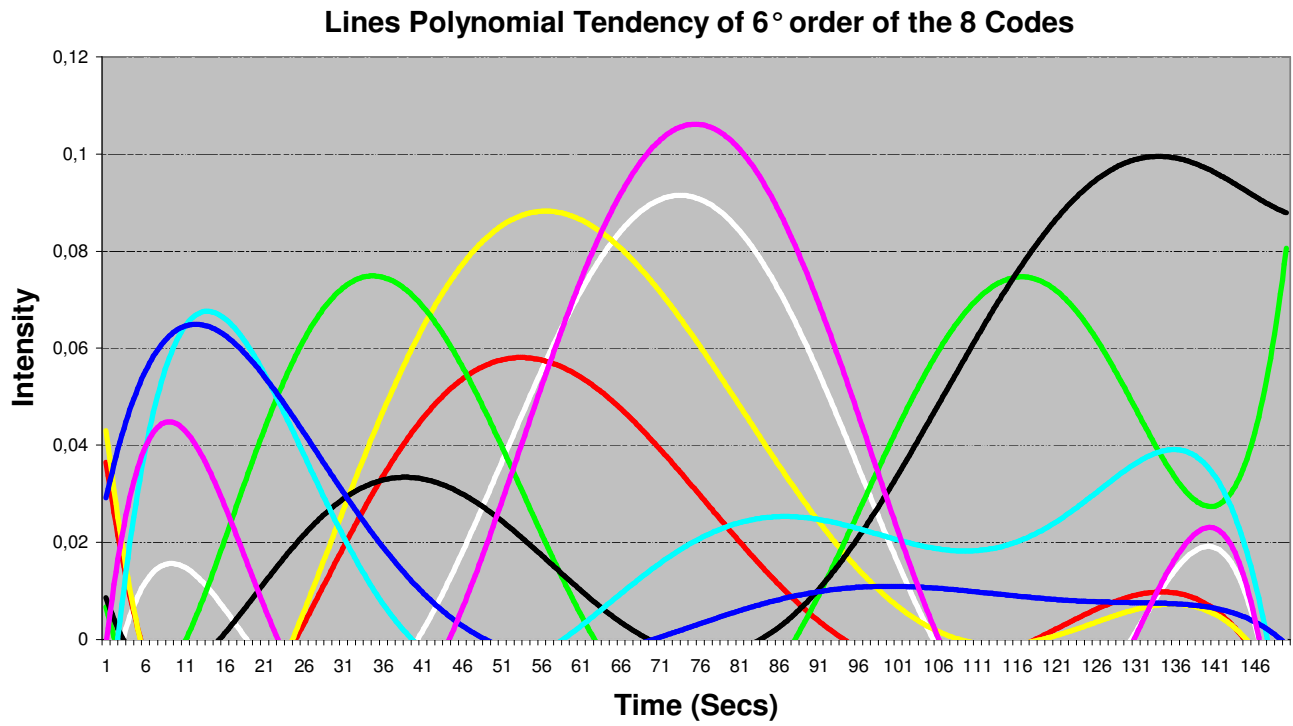
This profile has been recorded around halfway through the combined treatment with Systematic Desensitization and Cognitive Restructuring. The Systematic Desensitization had not been completed yet; nevertheless, for the finality of the search, it was requested to the patient to recall again the most dramatic moment lived during the sexual assault (Pict. No. 8, 9, 10,11,12).



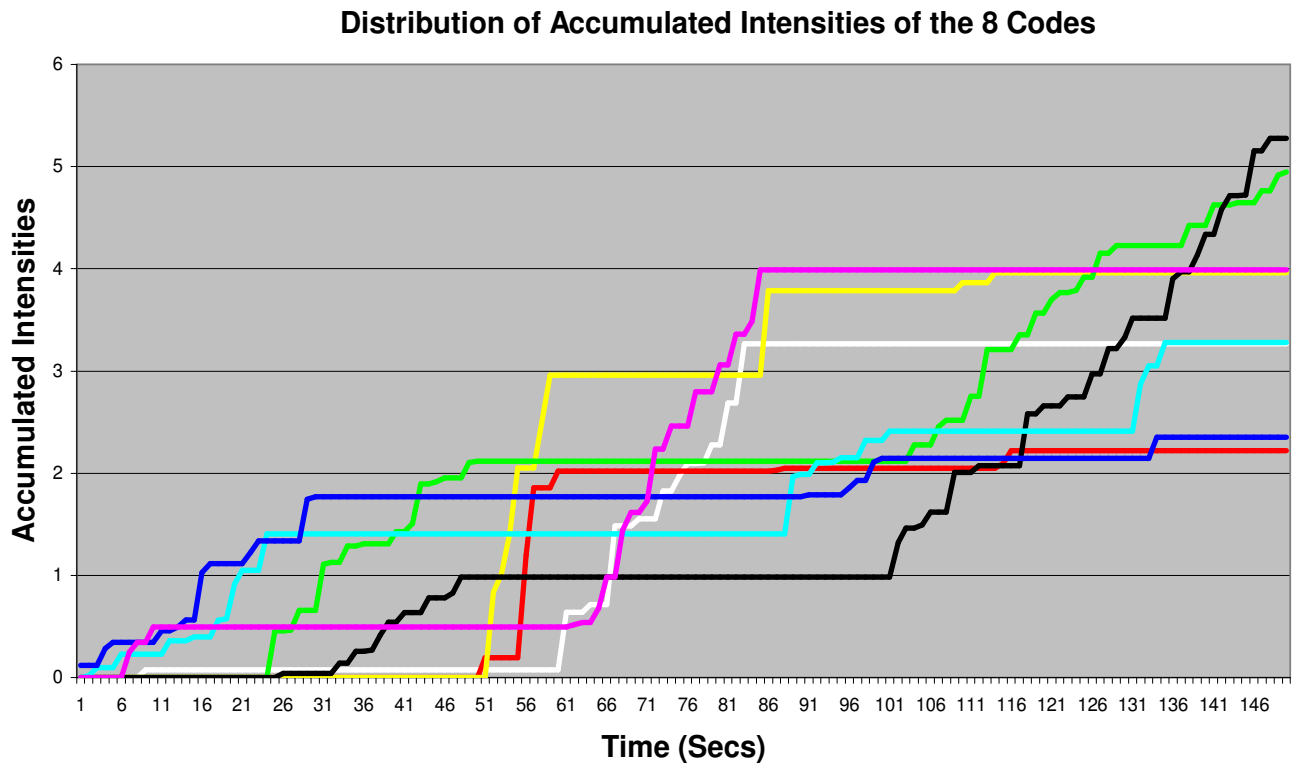
Pict. 8



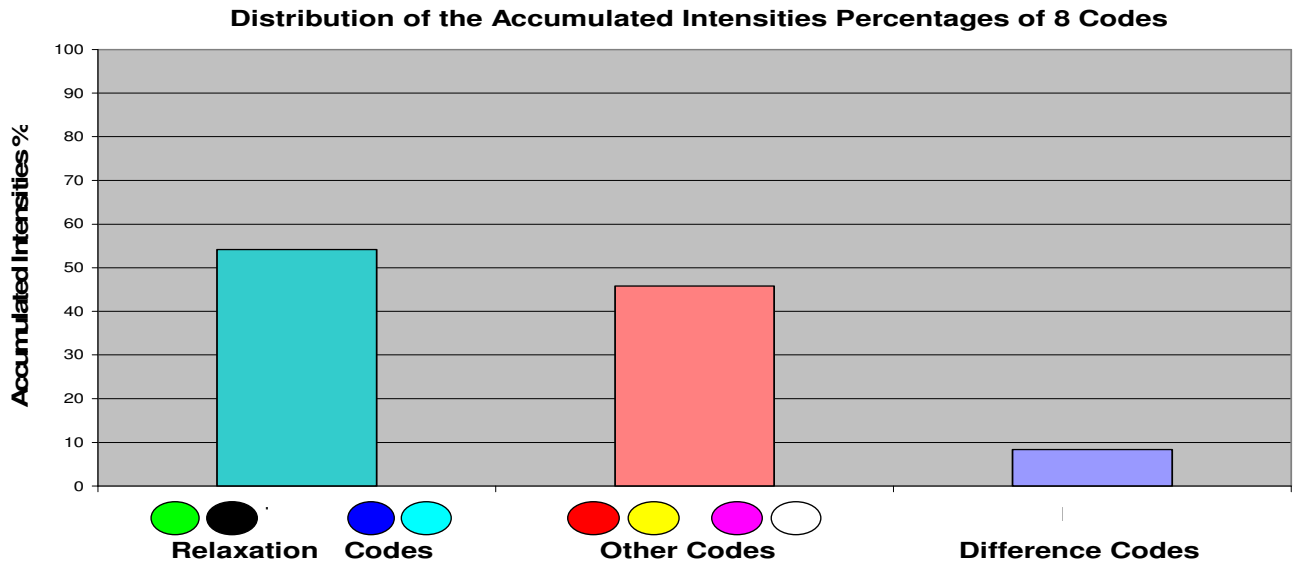
Pict. 9



Pict. 10



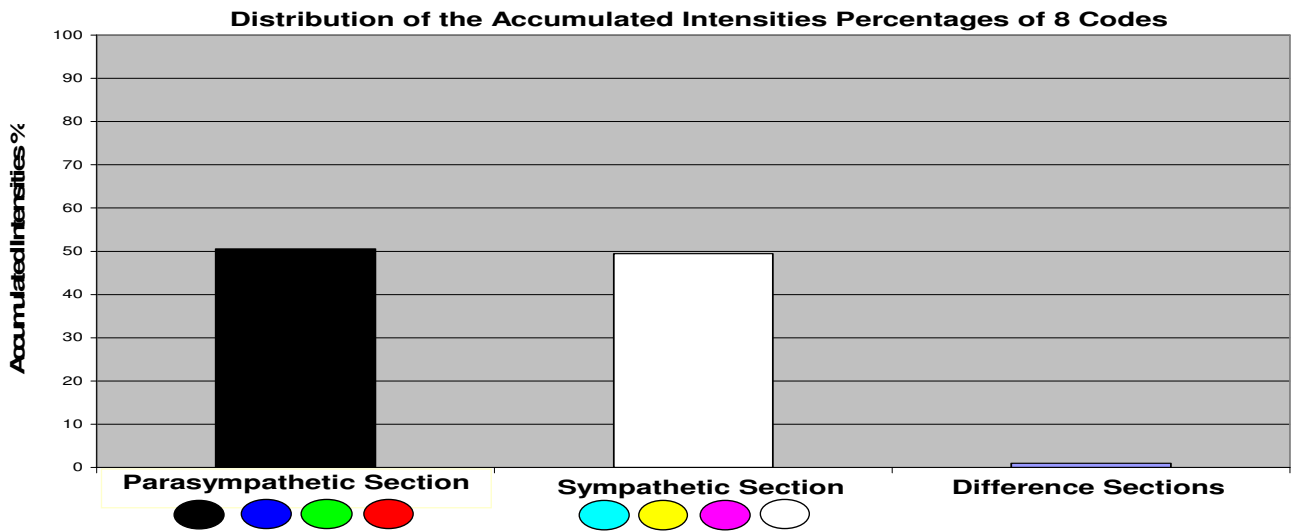
Pict. 11



Pict. 12

Initially the profile doesn't show any answer of defense.

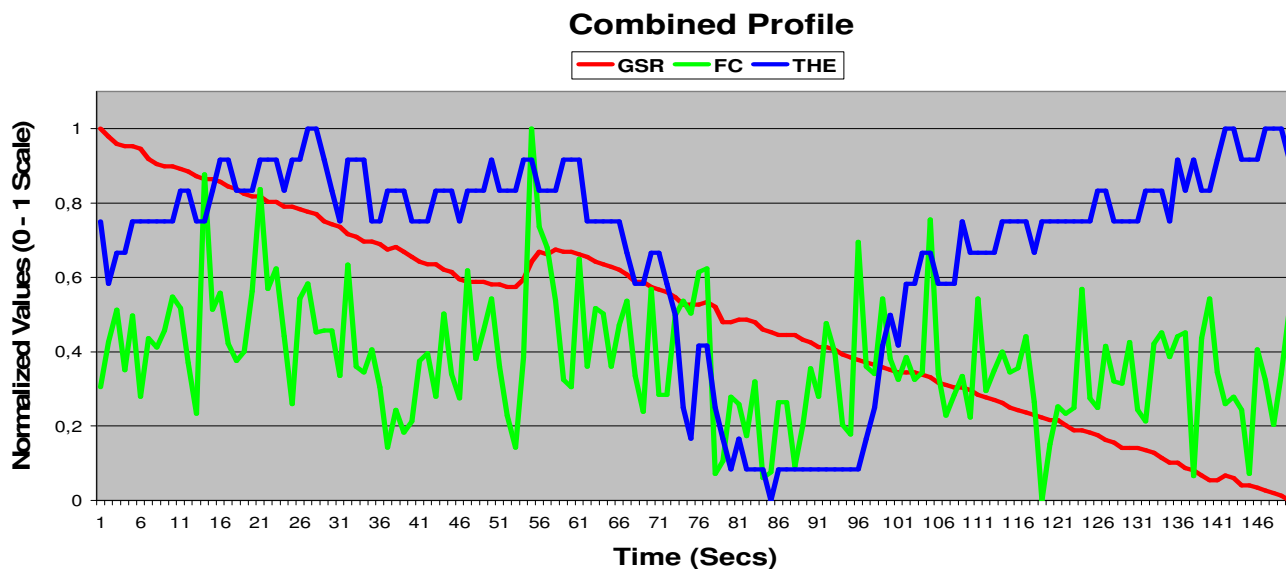
But after the 50th second the traumatic image is recovered and the first answer is characterized by coming out of **warm colors**. **Yellow** and **Red** are the most evident colors. **Yellow** characterizes the answers of *Hyperactivation, Excitement and Nervousness*. **Red** characterizes the *Anguish response to the effort for cognitive tasks or for the physiological control*. Shortly after the 60th second the profile becomes cold, with coming out mostly of some **Magenta** and then of **White**. Nevertheless, this answer of defense is time-limited and after the 90th second the profile continues with the **relaxation colors**: Green, Black, Blue and Cyan. In conclusion, in this profile the answer of defense has already much lower frequency, intensity and duration compared with the answer of defense recorded at the beginning of the treatment. Besides, now the activity of the *Anterior Hypothalamus* and the *Parasympathetic Section of the Vegetative Nervous System* (Black, Blue, Green, and Red) has increased in percentage (Pict. No. 13).



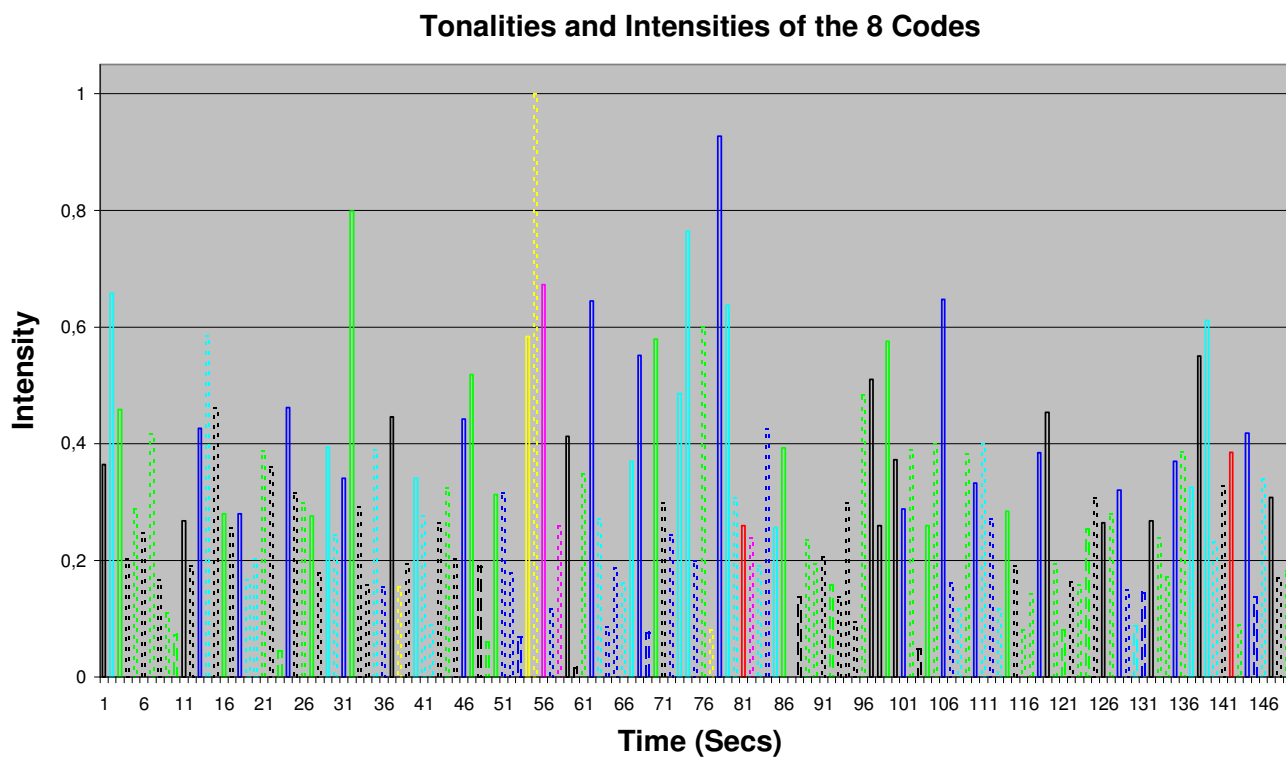
Pict. 13

Profile n°3

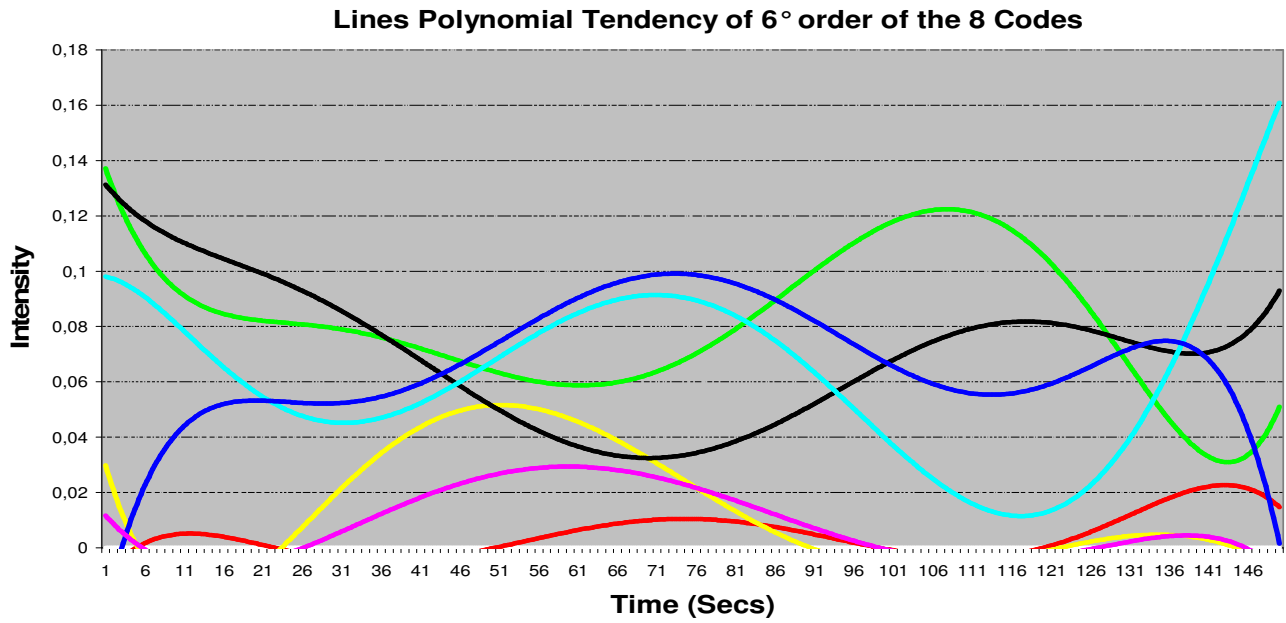
This profile has been recorded at the end of the combined treatment with Systematic Desensitization and Cognitive Restructuring . During the recording of this profile, it was requested to the patient to recall again the most dramatic moment lived during the sexual assault (Pict. No. 14, 15, 16, 17, 18).



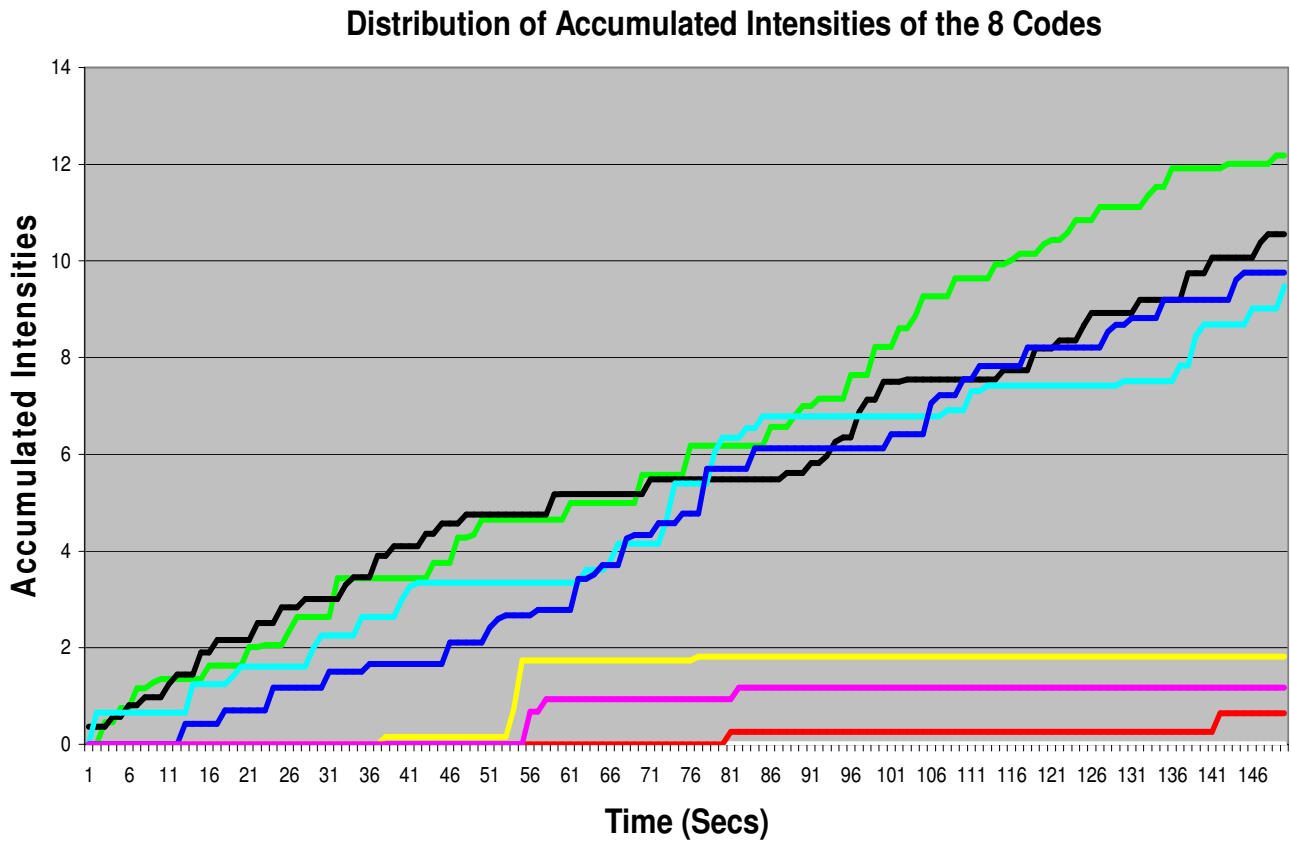
Pict. 14



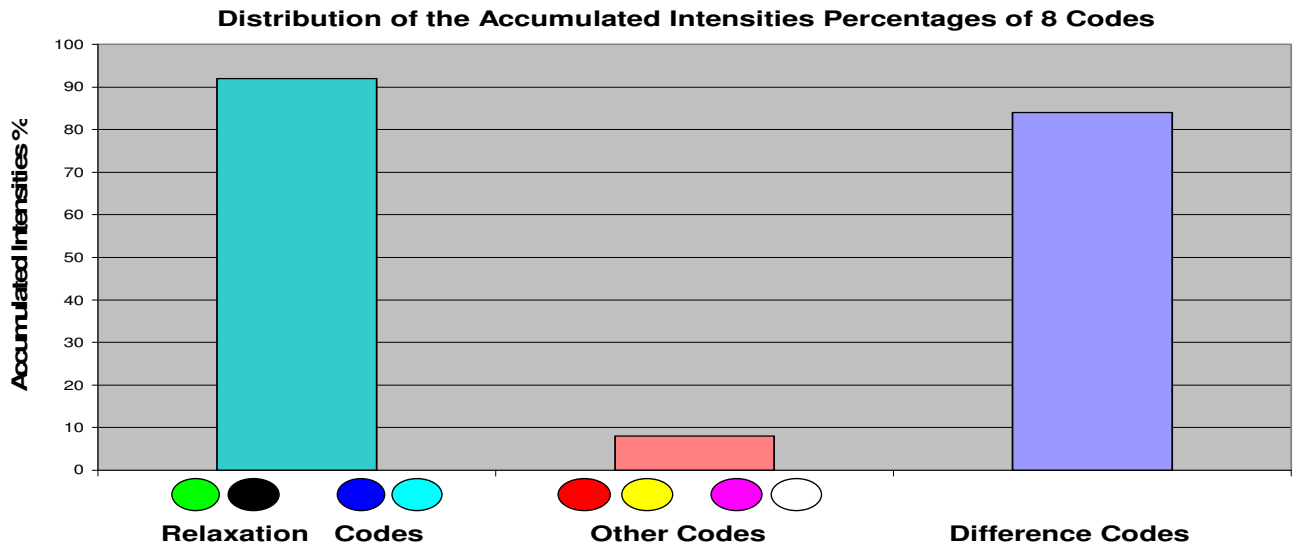
Pict. 15



Pict. 16

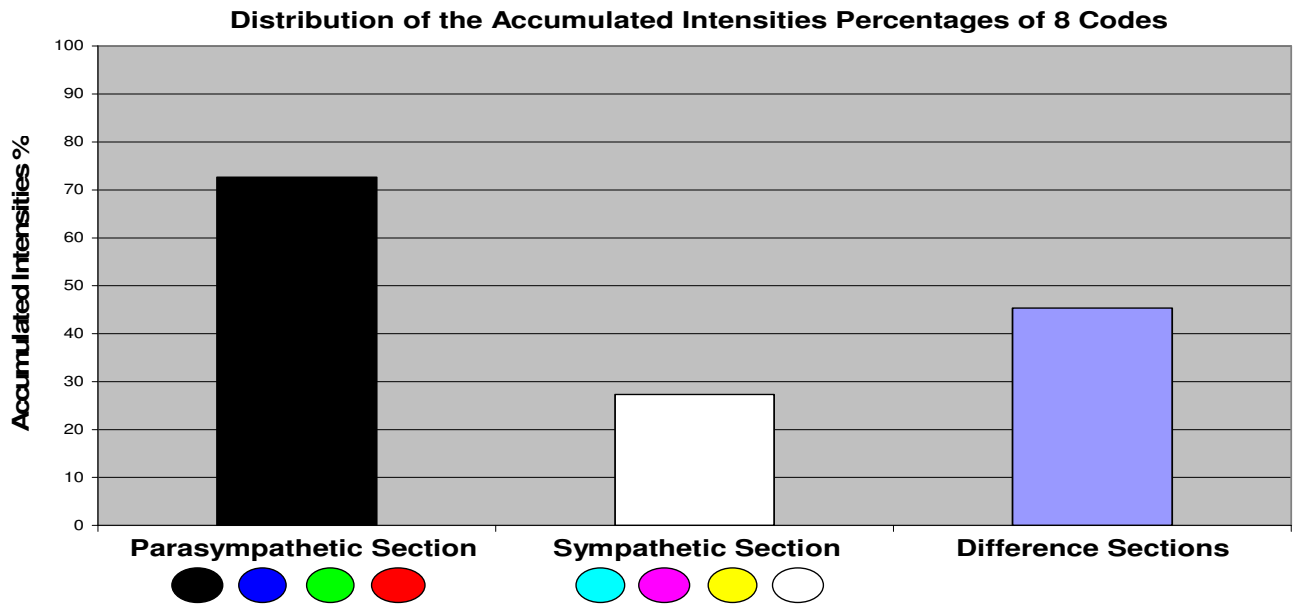


Pict. 17



Pict. 18

The profile begins with the typical colors of relaxation (Green, Black, Blue and Cyan). Only after the 50th second the traumatic image is recovered and the profile assumes for few seconds the **Yellow** and **Magenta** colors. Nevertheless, this answer of nervousness and then of anxious apprehension is totally inconsistent for frequency, intensity and duration. Already after the 60th second the profile continues with the typical colors of relaxation, the ones that have been found during the activation of the *Anterior Hypothalamus* and the *Parasympathetic Section of the Vegetative Nervous System* (Black, Blue, Green, and Red) (Pict. No.19).



Pict. 19

In conclusion, from this brief profile **no remarkable emotional and physiological defensive response come out anymore from the imaginative call of the most dramatic moment lived during the sexual assault**. This result is also confirmed by the low values reported by the patient in the Subjective Scale of Anxiety during the interview performed after the recording of this profile.

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