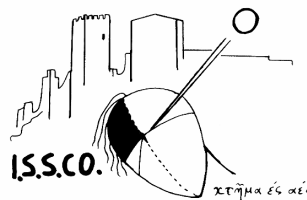
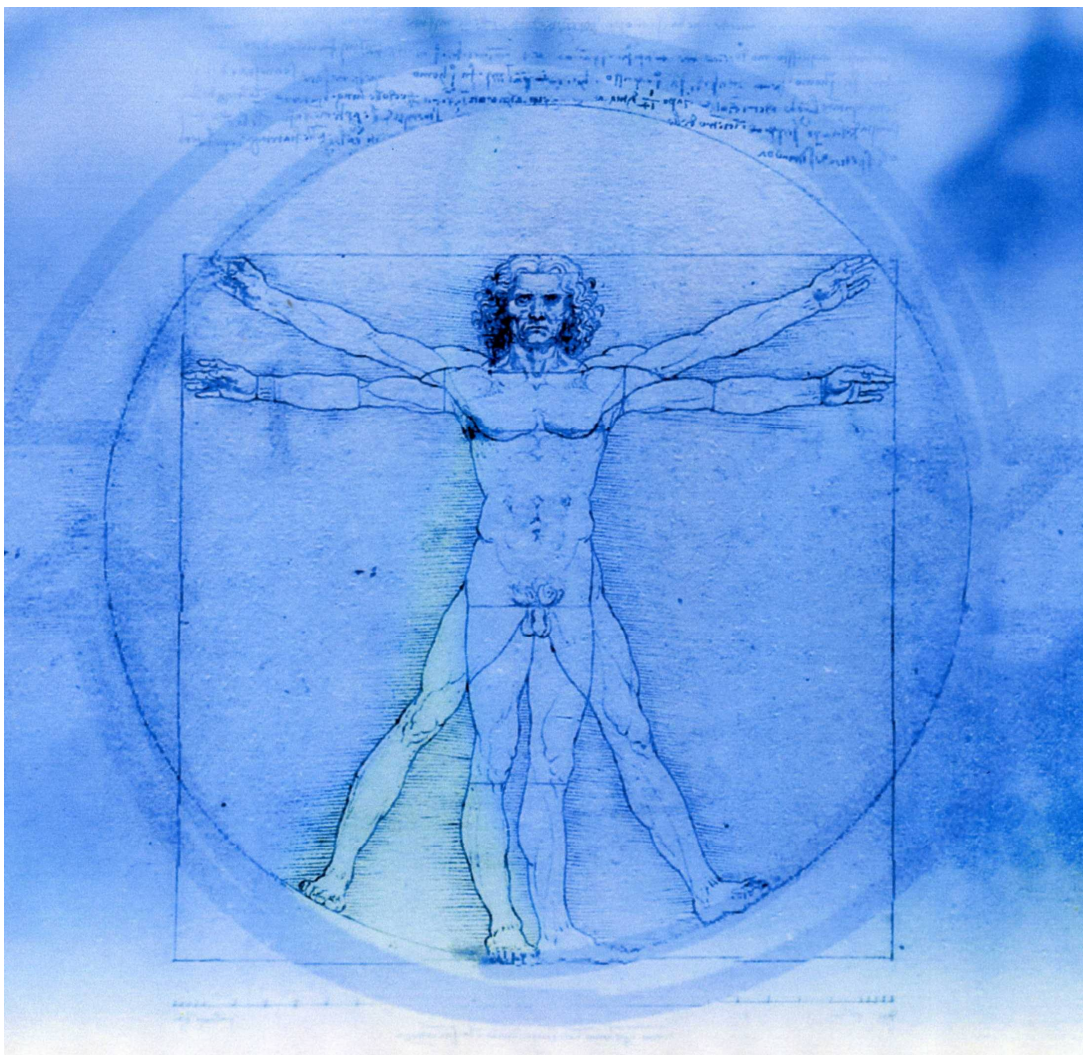


Tullio Scrimali

***NEUROSCIENCE AND
COGNITIVE THERAPY***
An introductory textbook



Istituto Superiore per le Scienze Cognitive Publishing

Copyright

**The copyrights of this booklet are property of Tullio Scrimali.
If you want to quote this booklet in a reference list, please write
the following:**

Scrimali, T. (2011) NEUROSCIENCE-BASED COGNITIVE THERAPY. An introductory booklet. Istituto Superiore per le Scienze Cognitive Publisher, Enna, Italy.

Index

The Author p. 06

Introduction p. 07

First part

Theoretical foundations

1. Theoretical and Clinical Context p. 09

2. The problem of the brain-mind relationship p. 11

3. Psychophysiology and Clinical Psychophysiology p. 17

4. Motor theories of mind and a biocybernetics model in neuroscience p. 19

5. Electroencephalography and Quantitative Electroencephalography p. 21

5. 1. Electroencephalography p. 21

5. 2. Quantitative Electroencephalography (QEEG) p. 21

6. Electrodermal Activity (EDA) and its monitoring p. 23

7. Psychoactive substances effects on the electrodermal parameter p. 28

8. Documentation of the dynamics of changing p. 31

Second Part

MindLAB Set: Hardware, Software and Methods

9. The MindLAB Set, an integrated system (hardware, software, database and know how) for Clinical psychophysiology p. 33

9.1. Introduction p. 33

9.2. Hardware p. 35

9.2.1. Psychodata Acquisition Unit (PAU) p. 35

9.2.2. Electrodes p. 36

9.3. Software p. 40

9.3.1. MindSCAN

9.3.2. Psychofeedback p. 40

Third part

MindLAB Set in action

10. The Katane Database	p. 43
11. Set and Setting with MindLAB Set	p. 46
12. Execution, reading and giving feedback the patient about a MindSCAN record	p. 48
13. Instrumental psycho diagnostic	p. 51
13.1. Generalized anxiety disorder	p. 52
13.2. Panic disorder	p. 52
13.3. Post-traumatic stress disorder	p. 52
13.4. Phobias	p. 52
13.5. Obsessions and compulsions	p. 52
13.6. Depression	p. 52
13.7. Eating disorders	p. 53
13.8. Addictions	p. 53
13.9 Schizophrenia	p. 53
13.9. Maniac episode	p. 53
13.10. Stuttering	p. 53
13.11. Hypertension	p. 53
13.12. Irritable bowel syndrome	p. 54
13.13. Premenstrual syndrome	p. 54
14. The use of recorded data for activating a <i>narrative of the self-regulation process</i>	p. 55
15. MindLAB Set and neurobiology of the relational processes: Attachment, reciprocity and the <i>Family Strange Situation Procedure</i>	p. 56
16. Biofeedback and Psychofeedback	p. 60
17. Mindfulness, MindLAB Set and <i>Synchronic Mind Training</i>	p. 69
18. Areas of use of MindLAB Set	p. 73
18.1. Mental disorders	p. 73
18.1.1. Panic disorder with or without agoraphobia	p. 74
18.1.2. Obsessive compulsive disorder	p. 74
18.1.3. Mood disorders	p. 74
18.1.4. Disorders related to substances abuse	p. 74
18.1.5. Eating disorders	p. 74
18.1.6. Personality disorders	p. 74
18.1.7. Schizophrenia	p. 75
18.1.8. Stuttering	p. 75
18.2. Psychosomatic area	p. 75

18.3. Meditation, mindfulness, music therapy	p. 75
18.4. Sport Psychology	p. 75
19. MindLAB Set and a training projects in educational field	p. 76
20. Making research with MindLAB Set and publishing results	p. 78
21. Training and information about clinical psychophysiology and biofeedback	p. 81
References	p. 82

The Author

Physician, Psychologist, Psychiatrist and Psychotherapist, Tullio Scrimali is currently Professor of Clinical Psychology at Medical School, University of Catania. as well as at the University of Kore Enna.

At the Department of Psychiatry, University of Catania, he established, during Eighties, the Laboratory of Cognitive Psychophysiology and The Cognitive Therapy and Rehabilitation Unit.

In Enna, he both founded and directs the ALETEIA School of Cognitive Psychotherapy (www.aleteia.it) and ALETEIA International, European School of Cognitive Therapy (www.aleteiainternational.it), a residential institute where specialized training courses for psychologists and psychiatrists worldwide are held.

Tullio Scrimali founded the scientific journal Complexity & Change and currently directs a scientific bulletin called ISSCo & ALETEIA News. Over the last 15 years, he has garnered major international attention presenting lectures, workshops and symposia on three continents in many Countries such as the United States, Canada, Mexico, England, Hungary, Germany, Denmark, Sweden, Finland, France, Spain, Poland, the Czech Republic, Serbia, Greece, Japan, Colombia Brazil, Argentina, Uruguay, Romania, and Lithuania.

In Poland, he set up and directed the first cognitive psychotherapy training program there, co-founding and co-developing the Polish Society of Cognitive and Behavioral Therapy.

Scrimali was Chair of an important international conference held in Catania in June 2000, entitled *Cognitive Psychotherapy toward a New Millennium*, welcoming the most highly qualified Authors in cognitive therapy as well as participating psychiatrists and psychologists coming from 49 countries and five continents.

He is a teacher of the Italian Society of Cognitive and Behavioral Therapy (SITCC), and founding fellow of Philadelphia's Academy of Cognitive Therapy. He established and currently directs two international scientific events that take place every year in Sicily, *Volcanic Mind in Catania*, and *The Mind in the Clouds in Enna*.

Tullio Scrimali has developed several scientific equipments for clinical psychophysiology (among them the MindLAB Set) that are currently the object of international spin-out.

Keynote speaker and workshops leader at the World Congress of Behavioral and Cognitive Therapy held in Vancouver (2001) and in Kobe (2004) as well as for the European EABCT in Prague (2003), Thessaloniki (2005), Helsinki (2008), Dubrovnik (2009) and Milan (2010).

During 2011, Tullio Scrimali started a program for teaching Cognitive Therapy in Armenia, (Colombia) and he has been invited speaker at the ICCP in Istanbul and at the third Asian CBT Congress.

Professor Tullio Scrimali is author of 150 scientific publications, including articles and monographs in various languages such as Italian, French, English, Czech, Polish, Portuguese, and Spanish.

One of his recent books, *Entropy of Mind and Negative Entropy*, published in Italy by Franco Angeli, and in England by Karnac Books of London, was presented during some special events in Rome in 2006 (Italian edition) and in New York in the spring of 2008 (English edition). This monograph represents a point of reference for the cognitive orientation to schizophrenia and its therapy in Italy and abroad (www.francoangeli.it, www.karnacbooks.com).

A new book in English: *Neuroscience-Based Cognitive Therapy. New Methods for Patients Assessment, Treatment and Self Regulation* will be printed soon by Wiley- Blackwell in Oxford (UK).

Introduction

Neuroscience constitutes one of the most important component among contemporary scientific background. This introductory textbook is focused in demonstrating and treating the important topics concerning how some recent developments of Neuroscience can be today used in order to better the intervention when carrying out a Cognitive Therapy with patients affected by many different mental disorders.

After reporting some theoretical aspects concerning the integration between Neuroscience and Cognitive Therapy, some new methods, coming from Laboratories, that can be easily applied to the clinic setting of Cognitive Therapy, are illustrated and fully explained. They are *Quantitative EEG* and *Electrodermal Activity (EDA)*.

Such parameters can be today monitorized in the clinical setting thanks to some new hardware and software which are inexpensive and that can be easily used, after a short training, by any Cognitive Therapist.

Since this textbook is proposed to Therapist who want to start their involvement in Neuroscience-Based Cognitive Therapy, electrodermal activity is mostly treated because it is the basic technique.

QEEG and Neurofeedback will be exposed in some other more advanced books of mine.

Basic information are reported concerning how to use EDA when assessing and treating patients, affected by many different Mental Disorders, with Cognitive Therapy. Many data are illustrated about mood, anxiety, eating, and schizophrenic disorders.

Detailed information are given about *Quantitative Monitoring of Electrodermal Activity*, a new methods that I developed and experimented for many years. This method is the simplest to be put into practice in Cognitive Therapy and it is also the less expensive.

Some new systems, including some hardware, able to monitorize Electrodermal Exosomatic Activity and which must be used together with a computer and by some specific software are fully illustrated.

These hardware and their relative software can be used both when assessing the patient and during his (or her) treatment. It allows the Cognitive Therapist to realize some new interesting methods for assessment such as the *MindSCAN* and some therapeutic intervention based on of self regulation such as biofeedback and *Biofeedback Based Mindfulness*.

Tullio Scrimali (www.tullioscrimali.it – tscrima@tin.it)
Catania, May 2011

First part

Theoretical foundations

1. Theoretical and Clinical Context

The MindLAB Set is an innovative system; it makes more efficient the clinical psychology, psychiatry, psychosomatic and psychotherapy setting. It has great potential even in scholastic and educational scopes. Before the explaining of the main topics of the monograph, I would like to clear up some points.

The screening of electrodermal activity and the Biofeedback are methodologies which yet have not found their exact framework. As we will find out, this psycho-physiological parameter has a history more than one century old, since the experimental psychology (Tarchanoff, 1890), it was used in the psychoanalytical ambit from Karl Gustav Jung (Jung, 1906) and recently it has approached the neuroscience field (Rossi, 2006). Even the Biofeedback electrodermal activity has a quite long history and, during recent decades, it has aroused interests but even disappointments and contradictions among the scientists (Fuller, 1978; Pancheri, 1979; Scrimali, Grimaldi, 1982).

Nowadays, searching on Internet about the electrodermal parameter and the Biofeedback, it is possible to find a wide and heterogeneous range of information.

Besides high tech equipment and methodologies for laboratory research, which are functional but pretty expensive, there are rudimentary instrumentations which provide data that are controversial and difficult to apply on the setting.

About the theoretical background, many studies have been made by the psychoanalytical and behavioral and cognitive approaches. Even the so-called “alternative medicine” has tried to use the electrodermal activity, but in a not scientific ambit, with approximate theories, using not professional equipment and so offering disorientating results.

Personally I believe that to improve the worth of the MindLAB set, it is necessary to make clear that we are talking about an accurate methodology, developed through long and depth researches; then is important to specify that the main epistemological frame to which we must report to is the cognitive-constructivist approach, especially to the logic of complex systems (Beck, 1979, Young, 1999; Guidano e Liotti, 1983, Guidano, 1988, Scrimali, 2003, 2006).

Therefore, the right MindLAB's context is the one which can be found on the recent neuroscience and psycho physiological studies (Andrassi, 1989, Scrimali, Grimaldi, 1991) and its applications have to be inserted in a framework of therapeutical, rehabilitational and psychoeducational programs used in a cognitivist orientation, and not just a reductionist approach, but the logic of complex systems.

Massimo Biondi has proposed, with a proper documentation, the conceptual frame of a psychotherapy biology. In this conceptual frame is even added the fascinating topic of a therapeutical relationship psychobiology. If the therapeutical relationship is considered a relational process, then it is affected by feelings and emotions, which can be studied from a psychophysiological point of view, not only in the patient but even in the therapist (Biondi, 2008).

Biondi's studies, supported by a substantial literature, show that the electrodermal parameter recording during a psychotherapy session carefully follows the emotional trend of the session. Biondi gives importance to the fact that the screening of the electrodermal activity, through

more sessions, records carefully the therapeutical process trend and in the end, the *successfully healing* of the patient.

My personal researches with the MindLAB, over many years, have moved in the direction of what Biondi has argued. The regular presence of a scientifically reliable equipment, which can be occasionally used, which can be comfortable for the therapist and the patient, can revolutionize the psychotherapist work providing useful information about the therapeutical complex processes that take place in the patient's brain during a therapeutical evolution.

On the following chapters I will provide you information about some changes occurred during many psychotherapies made by me with patients afflicted by various pathologies.

On this monograph, the main topic is to provide a propaedeutic path to the utilization of the MindLAB Set, and briefly are treated information about historical, scientific, methodological and clinical aspects, relevant for a correct use of the system.

2. *The problem of the brain-mind relationship*

The MindLAB Set is a methodology which works as *interface system* between brain, mind and relational context. For this reason, his use involves the topic of the relationship soma-psyche, one of the most complex arguments discussed by the contemporary epistemology and neuroscience. Therefore, I decided to spend some time, in this monograph, to this important topic, even if briefly.

My proposal of use of the MindLAB Set stands among the more recent studies that we can find in the psychotherapy area and contemporary neuroscience, like the Nobel prize Erik Kandel who believes that clinic, especially clinical psychology, psychiatry and psychotherapy are getting more linked to each other, or like Cozolino and Siegel who propose a *neurobiology of the psychotherapy and relational processes*, included the crucial aspect of attachment and reciprocity (Kandel, 1998; Cozolino, 2002; Siegel).

The problem of the relationship between brain and mind is a matter discussed through centuries; it was treated for the first time, in the modern age and in a complex way, by Cartesio, with the proposal of a *dualistic solution*. For the great French philosopher the mind was an extracorporeal unit (*res cogitans*), made from a *spiritual* reality and not material; the brain instead belonged to the physical dimension (*res extensa*). The two units interacted through the pineal gland's mediation function which was the crucial interface between mind immaterial world, and brain physical world (Garin, 1986).

The interactionist dualism was not a real new theory. Aristotele already had told that soul (psyche) interacts with the body (soma) forming a biunivocal relationship (Ackrill, 1993).

In Greece, during the V and IV century B.C., a deep philosophical reflection about the man and his mind (psyche) was argued and developed, it is the conceptual base of all the next developments of the theories concerning the problem of the relationship mind-brain. In the Greek philosophers reflection such Democrito, Platone and Aristotele is possible to find the three key positions for the conceptualization of the problem mind-brain which have traveled for two thousand and five hundred years and still nowadays are discussed in the same way. It is impressive how the modernity of Greek philosophy is still a solid base for the modern thought, in the occidental world.

Democrito is the founder of a substantialist materialist conception of the human psyche. He considers both soul and body as *units* made in the same way by atoms, even if those which form the psyche would be more dynamic and ethereal. Therefore, *matter* the body, *matter* the mind, but both are temporary since depending on the energy provided by respiration. For Democrito with the death, and with the stop of the breathing, body and psyche get disintegrated falling in a destiny of *increasing entropy*, as we would say today. For the great philosopher from Abdera, even the knowledge would born through material processes, through the interaction between the atoms created by material and sense organs (Diels, Kranz, 1976).

Ultimately, we could find in Democrito the real starter of the reductionist, physicalist and biologist movement, still existing today in the contemporary neuroscience.

Platone, several years later, strongly opposed Democrito's point of view, saying that the psyche, is made by a matter which is different from the soma. In fact, psyche would be, for the great Athenian philosopher, a totally different unit than soma, and it lives inside the soma

as a prisoner who would always transcend it. Moreover, for Platone the soul of man is immortal and it survives to the death of the body. In an unearthly life souls receive rewards or punishments according to their conduct during their earthly life, as is described in the Fedone (Reale, Antiseri, 1997).

Therefore, Platone can be considered the real precursor of the so-called *substantialist theories of mind* and soul which find their full realization in many religious doctrines, like the Christianity, Buddhism and Islamism. Besides this *substantialist vision*, that founded the modern religions, Platone proposes a description of the human psyche formed by *three different units*, well represented using the brilliant metaphor of the charioteer on a wagon pulled by two horses, one black, ugly and unreliable, the other horse is white, clever and meek. The charioteer, has to mediate the two very different animals in order to make the wagon drive, dominating the black horse which represents the carnal part of mind, emotional and pulsional, contrasted by the white horse which represents the intellectual part of the human mind.

A very important scientific revolution occurs few years later with Aristotele who is the first to introduce a *functionalist dualistic vision*, not substantialist, of the relationship mind-brain. The great philosopher from Stagira did not consider the human mind as an *ontological unit separated from the biological part of the brain*, but a function of the biological part. Aristotele proposed a *functionalist approach* to the study of mind, an approach which was deeply separated from his master Platone, who instead considered the human mind as a real *substance*, different from body and capable of an independent existence (Taylor, 1968).

Even Aristotele distinguishes in mind three components, but his thought is impressively modern referring to biological concepts. In facts, he talks about a *vegetative mind*, linked to biological base functions; a *sensitive mind*, linked to the perception of reality; and an *intellectual or rational mind* (Reale and Antiseri, 1983).

It seems incredible how this smart vision anticipates the current neurosciences acquisitions. *Vegetative mind* can be in fact identified in the hypothalamic and limbic system, the *sensitive mind* in the human information processing units and the *intellectual mind* in the frontal lobes, as we know from recent studies.

Platonic conception of mind, as an ontological reality which is autonomous from brain, has been obviously disagreed by philosophers, and then by materialist neuroscientists who have considered the mind not as an autonomous unit, but as a *process* which derives from brain.

In the modern age the English philosopher Hobbes has elaborated a *modern materialist conception of mind*, where psychic processes are only events of the mind activity which forms the brain. Hobbes tried to get over the Cartesian dualism, extending in the mind those features that Cartesio considered essential of the matter (Hobbes, 1994).

During the XIX century, the materialistic approach expressed in Hobbes' philosophy, find new motivations thanks to the studies of Thomas Henry Huxley, considered a pupil and a follower of Darwin, so following Darwin's biological researches, he proposed to restrict the interference of the spiritual and religious thought in the scientific field. For mind he created the word *epiphenomenon*, derived from Greek, and it means that *appears above*, as result of his biological activities (Huxley, 1874).

I would like to emphasize the modernity and the actuality of Huxley's theories, who anticipates the modern positions about complexity using the word *epiphenomenon*. In fact, in this context is considered very important the concept of *emergency*, following this concept the human mind is a product of the phylogenetic and ontogenetic evolution of brain as a consequence of his *progressive complexification* (Scrimali, 2003).

Freud, developing his psychodynamic and psychoanalytic theories, concerning the problem of mind, assumed a *partially functionalist conception* since he described the mind as a *function of the brain*, but he emphasizes the inaccessibility and the irreducibility of the unconscious, ending up describing it almost as a *substance* (Freud, 1989). His positions make him very close, in some authors' opinion, to Platone and the substantialism (Calciolari, 2006).

Freud, in agreement with his medical formation, used to emphasize that the knowledge about brain, available at that time, were not good enough to found the psychoanalysis with biological bases. Today this limitation has been largely overcome, thanks to the neuroscience developments, the psychophysiological and brain imaging techniques.

The Nobel Prize for medicine in 2000, Eric Kandel, has promoted studies and researches in fields like psychodynamic and neuroscience, and he confirmed many Freudian thoughts and insights (Kandel, 2001). Ironically, maybe Freud would have used the MindLAB Set, using a laptop computer on his legs while he was sitting near the small bed where his patient was, in his famous office in Vienna (Fig. I, Page 77). His student Jung partially realized it, during the period of great development of the psychodynamic movement, using the psychogalvanometer (Fig. V, Page 32) which can be considered the ancestor of the MindLAB Set (this topic will be discussed in the 5th chapter). For the use of computer in the setting is necessary to wait several years yet!

A new scientific approach, reductionist and materialist, that was very critical against the psychoanalysis, was developed between the end of the 800' and the first 900', the *behaviorist movement*, it proposed to delete from the scientific reflection in psychology the *concept of mind*, considering it unnecessary and harmful, the behaviorist considered important to study only what is observable, the *behavior* (Pavlov 1903). Pavlov also tried to use rudimentary psychophysiological techniques to obtain more objective information about mind, and this can be considered a starting for the modern reductionist psychophysiology.

The interactional dualism and his strong critic to the biological reductionism comes back in the second part of 900', Popper and Eccles established again the concept that mind and brain are *two different units*, since mind would belong to the World 2, and brain would belong to World 1 (Popper, Eccles, 1977).

In fact Popper described the existence of three realities: World 1, formed by the whole group of the material universes, inorganic and organic; World 2, which includes emotional, perceptive and creative experiences, linked to every individual Self; and World 3, formed by all the cultural reality produced by humanity during its development. Moreover Popper emphasizes that: - *Biological processes produce thoughts, intentions and a complete world of human mind product, for example, the language, which cannot be understood and explained only using neurophysiologic terms.* - (Popper, 1972).

The contribution of Popper and Eccles, who searched a new not reductionist approach concerning the problem of the relationship mind-brain, was a turning point in philosophy, in science and in neuroscience, at least for what regards the working methods, defining the need of an interdisciplinary comparison among studies coming from different fields (physics, science philosophy, neuroscience, psychology, psychotherapy, psychiatry). It is important to notice that nowadays there are many disagreements about the content, but not about the methods, against the dualistic-interactionist paradigm for what concerns the relationship mind-brain.

Edelman, for example, says that he has already overcome the problem of consciousness, developing a conception which is defined *Neural Darwinism* (Edelman, 1987).

Crick has stated categorically: - *Your joys, your pain, your memories, your ambitions, your sense of personal identity and of free will are just the behavior of a very large group of nerve cells and molecules which compose them.* – (Crick, 1995).

Roger Penrose, physical at the Oxford University, made a new conception of the integration of mind and brain, referring to the dynamics of quantum physics and criticizing the computational paradigm of mind (Penrose, 2000).

Eccles, in his last book called: *How the Self controls its brain*, showed how his last scope in his long scientific career and in his own life, in fact he died shortly after publishing the book, was to solve the fundamental problem of the interaction mind-brain, emphasizing that immaterial events, as mental events are, can modify material structures as physic and neural events and vice versa. The New Zealand Nobel Prize agrees with Penrose that is possible to overcome these problems thanks to the quantum physic. For Eccles, some fields like the probability fields of the quantum mechanics are not composed by either energy or matter. Thus Eccles says that mind can be considered *a not material field*, similar to a *probability field*. The anatomical location of the interaction between mind and brain would be in the presynaptic vesicular grids (Eccles, 1994).

But the controversy continues. John G. Taylor strongly disagrees, for example, the quantum approach to the study of the interaction between mind and brain, emphasizing some over simplifications in Penrose theories (Taylor, 1992).

Some other discouraged authors said that maybe the problem of the relationship mind-brain cannot be understood by man. Colin McGinn, into his book, *The Problem of Consciousness*, describes the gnoseological limits of the human brain, which can be attributed to the evolutionary dynamics. The American author argued: - *If mice and monkeys cannot even understand what quantum physic is, in the same way the Homo sapiens are not enough evolved to solve the problem of the interaction mind-brain* - (McGinn, 1991).

David J. Chalmers follows Colin McGinn, saying that any physic theory can only describes individual mental functions, but any actual theory can explain how the execution of the cognitive activities could generate the subjective experience of Self. However Chalmers thinks that is necessary to develop a scientific theory of the consciousness, so he tries to formulate a computational approach theory, sustaining that a powerful software which can work on a physical computer, would be able to create a phenomenon similar to a rudimentary mind. After saying that today is not possible to foresee the typology and the features of an Artificial Intelligence software which can simulate the consciousness, he concludes that this hypothesis cannot be discarded. In conclusion, Chalmers express himself in favor of a dualist hypothesis of the problem mind-brain, but linked to a *computational paradigm*. Brain would be a physical machine, mind a software formed by information (Chalmers, 1995). As we can understand, today we are far from a solution of the problem mind-brain. Generally seems that all the epistemological positions among different Authors who are into the neuroscience follow a common developing line. It shows that the human brain cannot be considered separated from the environmental context, history and cultural background. For this reason neuroscientists and clinical are moving to a conception of the problem mind-brain which will open promising prospective in application ambit rather than speculative. After this brief review regarding the problem of the relationship mind-brain, the moment to expose my actual opinion and their link with the MindLAB Set has come (I emphasize the word *actual* since I consider theories and thoughts as provisional processes agreeing with Popper's falsificacionism).

My reflection about this crucial topic has been developed since the early eighties (Scrimali, Grimaldi, 1982), becoming more clear in the nineties. The publication of the book *Sulle*

Tracce della Mente (On the Tracks of Mind) was an important step, with this work I disagree with the biological reductionism of neuroscience, and I propose a *constructivist and complex psychophysiology* which has been inserted in the Italian structuralist and systemic cognitivist movement. (Scrimali, Grimaldi, 1991; Guidano, 1988; Guidano e Liotti, 1983).

In agreement with Popper's epistemology of the scientific research and with the constructivism, I formulated the concept that the problem of the relationship mind-brain does not interest clinic field and neuroscientists, if not only *considering the success that the adopted theory can bring on the operational field*.

Then I give up establishing what mind *ontologically* is, and if it is a *unit or a substance which has an autonomous life*, even if I think that this is very unlikely! About brain, I have clear ideas and I consider it a complex system, not linear, far from equilibrium, able to self-organizing, and above all it evolves continuously from a condition to another according to a chronological and orthogenetic gradient which is irreversible.

So I tend to consider the mind not as a *material unit*, (religions are responsible to ensure the existence of a soul inside every human and his immortality) but as a process that born from the phylogenetic and ontogenetic evolution of human brain, or just brain. I mean *just brain* because I personally consider that even animals have a mind, different from ours, based mostly on analogical processes and obviously compatible with the less complexity of their brain and the less mass of the frontal lobes. I consider very negative the opposition between man and animals that many religions have created. As neuroscientist, theoretical and clinical of the human mind, I would like to express my opinion and say that between *sapiens* and the other creatures which live on our planet there is an evolutive continuum and then a *continuum of minds*.

I consider arrogant the conception that on this planet the man is the only thinking animal or the only one with a divine soul. In my opinion, this vision prevents us from loving animals in the way that they deserve. I have grown and loved many dogs and cats and I assure you that they have a great soul! They love, dream, play, care, cooperate, are sad, cry, despair. Primates even seem to have a sense of humor, and capable of having fun and making jokes to humans (De Wall, 2009).

If the human mind is an *emergent process* from the sapiens brain phylogenetic complexification, is necessary to consider that *many different minds* emerge from the process of complexification of every single brain, through the ontogenetic evolution of every single Homo sapiens, and it was established by Piaget (1954).

A mind is able of abstraction just after the adolescence with the reorganization of the frontal lobes during a crucial period of the life cycle evolution. A mysterious and unknown *paleognosic mind* emerges during the psychotic decompensation, taking the unlucky who lives this process in a paleologic bicameral state of mind (Scrimali, 2006a). A useful metaphor, which I do not consider exactly true because it is reductionist, but that I use with my patients, talks about informatics, *about computer and its software*. Therefore I explain them that their brain is the hardware and that the mind is a sort of software. Then I define myself their *Norton* (the name of one of the most famous antivirus software), able to identify viruses of the human mind, received from the social network and especially from parents, during a dysfunctional parenting (in this case not from internet). After identifying *viruses, bugs and trojans* in their mind (schemes, beliefs and dysfunctional internal models), I proceed to the reprogramming of mind for a positive and evolutive working.

During the clinical intervention with patients afflicted by a psychic disorder, and during clinical psychophysiological researches, which are the two fields where I have been active throughout my career, I believe that is needed to use the neuroscience new discoveries for

obtaining result in psychodiagnostics and in therapy, so I have proposed a *Instrumental psychodiagnostics* and techniques of *Emotional autoregulation*, based on the screening and the biological feedback of psychophysiological parameters, such as the *Psychofeedback* and the *Synchronic Mind Training* (Scrimali, 2000; Scrimali, 2006, 2006b, 2007).

In conclusion, I propose the MindLAB set as a methodology able to create an integration process between mind and brain. The data that it provides about the dynamics of brain structures, allow mind to acquire new information and, subsequently, to develop new skills. These skills imply the need of innovative attitudes and of more integrated balances, both intrapsychic, and relational and social.

3. Psychophysiology and Clinical Psychophysiology

The last ten years of the XX century are considered by an international agreement *the decade of the brain* (Valente, 1990). Basing on the job of many researchers and considering the substantial investments made, several very interesting results have been acquired, concerning a better understanding of the processes and functions of the brain, and also regarding the clinical field, the psychic disorder, and most of all the mechanisms for the care and healing (Scrimali, Grimaldi 1991).

At the beginning of the new millennium, for the first time, using structural and functional techniques of brain imaging, it was possible to demonstrate how proper cognitivist psychotherapy programs are able to create new brain networks, promoting the development of new synapses (Cozolino 2002; Scrimali 2006 a).

Today, thanks to the great progress of the digital microelectronics and informatics, some methodologies are simple and not expensive, so that they can be used in the clinical setting, and not only in the big research laboratories.

Personally I have contributed to these studies, formulating and developing a wide set of researches with the objective to identify new methodologies for detecting biological signals which can provide, on the clinical setting, useful information for the assessment and the therapy of the psychic and psychosomatic disorders (Scrimali, Grimaldi, 1982; Scrimali, Grimaldi, 1991; Scrimali 2006 a; Scrimali, Alaimo, Grasso, 2007).

The main idea which inspired and guided me during this work was the concept that refers to the electrocardiographs for cardiology and the electroencephalography for neurology. In fact it is hard to think about cardiologists and neurologists working without the instrumental support of techniques such electrocardiogram and electroencephalogram.

Studies and researches that I have made through the last years, have the target of creating and developing a proper *Instrumental psychodiagnostics*, which gives to every psychologist the possibility of using objective methods of valuation for the brain's state and mind's processes, that can be used during the setting (Scrimali, 2007).

The long path appears almost finished, and today the whole results can be summarized and schematized in this way:

Identification and development of the doctrine and scientific background.

Use of instrumental methodologies easy to apply.

Planning and experimentation of experimental methodologies with the following features:

- Simplicity of application
- Low-cost
- Possibility to propose it in large-scale

The problem of the relationship mind-brain is the most important field of study of the discipline called psychophysiology. Studies and researches in this field represent an important part of my scientific work.

At the Psychiatric Clinic of the University of Catania I founded in the eighties and have developed until today an experimental laboratory of instrumental and clinical

psychophysiology, where I have made many studies and researches. The results that I have acquired and the conceptualizations are the main topics of a monograph called *Sulle Tracce Della Mente* (On the Tracks of Mind) (Scrimali, Grimaldi 1991).

I defined as *Tracce Della Mente* the psychophysiological indices, physic signs related to emotive, cognitive and relational mental processes. My research work has developed through a not reductionist dimension, but systemic and marked by a constructivist epistemology.

The psychophysiology is the discipline that studies the relationship of dependency that is between psychic activities and biological parameters. In the last one hundred years it has developed very intensely, both in the methodological and in the doctrinaire and epistemological ambit, becoming today one of the most promising research areas in neuroscience.

During this rapid growth, helped even by the technological progress which has provided instrumentation and effective and reliable techniques, different epistemological backgrounds were born. In this area a different and new point of view has opposed to the biological reductionism and the associationism of the first authors (Pavlov, 1903), marked to the so-called *motor theories of mind* and to the new direction of the contemporary interactionist epistemology that, with Popper and Eccles, revised the thematic of the relationship mind-brain, basing on the studies made by the neuroscience and turning in a not biologist and reductionist dimension (Popper, Eccles, 1977).

The definition of psychophysiology has showed an evolutionary process. Mangina restated this discipline as: - *The science that studies the physiology of psychic functions, through the relations among brain, body and behavior, in the living subject that interacts with the environment.* - (Mangina, Furedy, 1983).

Subsequently, Andreassi proposed the following definition: - *The psychophysiology is the study of the relations between the manipulation of psychological variants and the resulting physiological responses, which can be measured in the living subject with the scope to clarify the relations between mental processes and somatic functions* - (Andreassi, 1989).

Therefore, it is clear that the psychophysiology represents the discipline that more directly involves the problem of the relationship brain-mind. Its developing has growth during the XX century starting from a reductionist point of view, until the reaching of a complex dimension, and the group of study created by me at the Psychiatric Clinic of the University of Catania has given an important contribution (Scrimali, 2000, 2003, 2007).

The proper psychophysiology could be also defined experimental psychophysiology, and with the physiopathology, that consists in the biological modification of the processes and the various psychic and psychosomatic disorders study, founds an interdisciplinary dimension, giving rise to the clinical psychophysiology that involves the study of the psychophysiological parameters, and not in a laboratory with healthy subjects but in clinical ambit with patients who suffer psychic and psychosomatic disorders (Stegagno, 1988, 1991; Palomba, Stegagno, 2004). The clinical psychophysiology interacts and provides many contributions to different contexts such as the clinical psychology, psychiatry, psychotherapy, social psychology, health psychology, behavioral medicine, psychosomatic medicine (Palomba, Stegagno, 2006).

The developing of the clinical psychophysiology has involved the resolution of complicated technical and methodological problems, connected even to the economical aspect, giving the opportunity to acquire a low-cost registration system, to make possible the use during the clinical and psychoeducational setting.

The MindLAB Set is one of the solutions made for the implementation of psychophysiology techniques in the clinical setting, making concrete the use of a proper *clinical psychophysiology*.

4. *Motor theories of mind and a biocybernetic model in neuroscience*

As already written, the reference ambits for a correct contextualization of the MindLAB Set are, the cognitivist constructivist and systemic psychotherapy, and the psychophysiology. In this chapter I would like to point that the psychophysiology which I refer to is not the classic one, reductionist and associationist.

Starting from the late Eighties, I have worked to the developing of a *constructivist psychophysiology* that can be inserted in the Italian cognitivist clinical background. With Guidano, Liotti and Perris, it has turned to a constructivist and systemic concept, creating a frame of reference which can be summarized in the following points (Guidano and Liotti, 1983; Guidano, 1988; Perris, 1989):

- Human beings are pro-active and not re-active in relation to the environment;
- There is a wide range of processes of mind that work at the tacit level and therefore are not aware, even though they are a powerful form of knowledge;
- The personal human experience and his growth are *self-organizing processes*, strictly individual and unique, and the self-organizing patterns show a strong tendency to self-maintaining;
- Even if self-referential, the organization patterns of the Self, their history and their active operation patterns, are influenced by relational and social systems.

A crucial turning point of the *cognitivist psychology* was in the second part of the Sixties, with the contribution of Miller, Galanter and Pribram which are collected in the historical book *Plans and the Structure of Behavior* (Miller, Galanter, Pribram, 1960).

These three Authors clearly assumed that, between the stimulus and the behavioral or psychophysiological response, there is much more than a simple mechanism of association could explain. For this definition, every nervous input is *controlled* by a central origin process.

In fact, the sensory receptors are active regardless of any excitation coming from the environment, and these activities are continuously modulated by efferent nerve fibers. The most paradigmatic example is the one of the stretch receptors, which are on muscles. These receptors, called neuromuscular spindles, are controlled by efferent fibers (gamma fibers), that depart from the motoneurons. The afferent informative pattern depends on the muscle relaxation degree, but even on the control activities that central nervous structures exert on the receptor.

In conclusion, to establish the real relaxation degree of the spindle, the nervous system has to consider the level of control activity exerted by the central nervous system to the neuromuscular spindles. Therefore, the brain is not passively subjected to inputs, but, the

incoming information directed to the neuronal structures of mind is always the result of a comparison between external data and patterns of spontaneous activity inside the organism. Miller, Galanter and Pribram replaced the concept of *reflex arc* with the T.O.T.E. unit, formed by a verification element and an operative element, introducing in psychophysiology the *cybernetic hypotheses* which assume the position that one of the fundamental mechanisms of the nervous system is the feedback.

The acronym T.O.T.E., which is formed by the initial letters of the words Test, Operate, Test, Exit, defines an operative unit for which every nervous systems mechanism, no matter if it transfers energy, information or if it exercises control, can be activated through two processors: one that is able to make a *test*, and the other which is prepared to perform operative activities.

So, the operative activity is indissolubly connected to the elaboration activity of the information. The mechanism starts in presence of *incongruity*. All the information coming from outside of the nervous system, does not act for his energetic content or for its peculiarity, but for the meaning that the nervous system itself attaches to it.

Following this line of thought the *motor theories of mind* have been created, they assume that the nervous system does not work as a passive receptor and associator of sensorial data, but as an active organizer and selector of reality data.

Motor theories of mind are the specific elaboration of the constructivist epistemology, in neurophysiology ambit. They allow to create a new framework that studies the human brain, no more in a sensorial and reflexological orientation, but biocybernetic, systemic and processual. If the human mind is *motor* and *proactive*, rather than *sensorial* and *reactive*, is clear that the reality is not registered passively, but it is built through the use of complex heuristics that are founded on the programs of the mind, which can be innate, or structured during the growth and learning processes.

These programs that in the cognitivist ambit are defined as *operative internal schemes and models* are responsible of the final interpretation of the reality data. The use of the MindLAB Set allows to access to the tacit and automatic components of these programs, contributing with their gradual modification and evolution, in an overall process of the mind developing.

5. Electroencephalography and Quantitative Electroencephalography

5. 1. Electroencephalography

The surface of the brain produces a series of spontaneous electrical potentials that change according to mental state. The first observation of electrical signals originating from the nervous system dates to 1848 when Duboi-Reymond detected the presence of such action potentials as activity markers on the part of a peripheral nerve. Later in 1875, Caton made a similar discovery of electrical activity in the brain through studies with monkeys and rabbits (Caton, 1875).

The breakthrough discovery that electrical brain activity recorded on the scalp could correspond to cognitive functions, or emotional activation, is due to German psychiatrist, Hans Berger who published an article in 1929 describing an oscillatory-type electrical activity model recorded from a human brain (the subject was his own son, Klaus). Berger was the first to hypothesize that the electroencephalogram (EEG) identifying that technique might be utilized as a biological marker for mental disorders and that, therefore, could have potential for clinical implementation and use, both from the diagnostic and therapeutic standpoints (Berger, 1929).

The enormity of initial enthusiasm the new technique inspired in the psychiatric community that was flattered for having found a new marker for mental disorders from recording electrodermal activity is quite understandable. Nevertheless, this enthusiasm soon waned, as the study of simple spontaneous electroencephalographic activity could not make use of complex statistical analysis that would allow identification of any significant mental disorder data until the consequent advent of computers that could analyze data to make the activity understandable.

Electroencephalography still provided important data about the basic conditional functionality of the central nervous system. It then became a very useful tool in neurology, with particular application to the study of epilepsy.

5. 2. Quantitative Electroencephalography (QEEG)

The study of quantitative electroencephalography constitutes a recent development in psychophysiological research that presents interesting prospects for the complex diagnosis of various mental disorders. The QEEG does not differ substantially from traditional electroencephalography. Computerized quantitative analysis, however, permits us to calculate some statistical variables that can then be compared with one of the various databases developed over the years, allowing the comparison of the same variables from clinical subjects and data collected in studies on healthy control subjects. The areas of research that have been opened with the advent of quantitative electroencephalography are represented by the work of Duffy, Hughes, Miranda, Bernad & Cook, 1994 described here.

- objectification of a biological vulnerability: evaluate the extent to which certain functional bases exist for a specific disorder that you are studying
- therapeutic planning: identify the weak and strong points in the organization and electrophysiological state of a subject's brain, in such a way as to select and plan the optimal type of therapy
- therapeutic evaluation: objectively document effective treatment, comparing the EEG data before and after treatment.

Quantitative EEG could be second level device to be introduced in the clinical setting. In fact in comparison with the monitoring of Electrodermal Activity it require more sophisticate and expensive devices and higher technical competencies.

6. *Electrodermal activity and its monitoring*

The monitoring of the electrodermal activity is the psychophysiological technique which has the longest history and the widest literature. It is a parameter connected to the skin tissue features in some parts of the body, especially the fingers of the hands. At first glance may seem strange that information provided by the fingers can refer to what happens in the brain (Prokasy, Raskin, 1973).

Observing some aspects related to the functions of the skin of the hands, and in particular of the fingers, is possible to understand the relationship that link them to emotive, cognitive, behavioral and relational activities of the brain. In fact the epidermis of the fingers is the structure which the humans use to get in touch with the external world, and thanks to it handle it properly. For the *Homo sapiens* *touching* and *manipulating* means *knowing* and *acting*. To make sure that the skin of the hands and the fingers carry out their function at their best is necessary that the skin flexibility and resistance features are settled properly. It can be obtained with a continuous and well determined hydration of the epidermal stratum corneum of the sweat glands .

Specific experiments have showed that blocking the micro sweating through injections of anticholinergic substances, the skin of the hands becomes less sensitive, less capable of handling and less resistant to abrasions. Is commonly known that when the hands are dry and dehydrated (for example in winter and if aggressive detergents are often used), is easy that the skin opens and even that small wounds appear.

Another common observation is that when the skin of the fingertips is dehydrated the sensitivity and the capacity of handling decrease. Let try to recognize a small item or to put a thread in the eye of a needle with dehydrated hands!

The continuous modulation of the hands' *micro sweating* activities is a crucial process to recognize, handle, act and relate. *Shaking the hand* when you meet somebody is a relational action which transmits much information to the brain. I am sure that shaking a hand which is warm, dry, soft and smooth you would receive a different feeling that shaking the hand of someone whose hand is cold, sweat, rough and chapped. So, even social relations are conditioned by the skin sweating activity of the hand!

Since the production and the use of the sweat is a very expensive process, in fact it requests a great expense of energy and important salts, it is natural that it is closely and accurately regulated by the nervous system. Therefore, the cognitive and executive brain (frontal cortical system) and the emotional brain (limbic and hypothalamic system) jointly contribute to regulate the sweating activity of the hands.

It appears very clear that the sweating of the fingertips is an excellent *track of mind*, using the metaphor created by me several years ago to define the different psychophysiological parameters (Scrimali, Grimaldi, 1991). But how is it possible to record the electrodermal parameter from the hands sweating activity? The answer can be given considering that, as many other biological systems, the hands skin behaves similarly to a resistor which conductance is continuously modified according to the functional state of the skin tissue and of the nervous system that controls it.

If we apply a small potential difference on the skin of the hands, the electricity will find a high resistance to the circulation, due to the high insulating property of the *dead cells of the stratum corneum*. The epidermis though, is not a compact structure, but it is crossed by tear ducts of many sweat glands.

The sweat is a solute rich of salts, particularly of *sodium chloride*, it is therefore an electrolytic solution which is able to decrease considerably the electrical conductivity of the skin, which in every moment depends from the activity level of the sweat glands. More is the quantity of sweat made by the sweat glands and slowly deposited in the stratum corneum, the higher will be the *skin conductance*.

Thus, sudden noises, a deep sigh, an answer asked to the subject, or a movement, are followed after two seconds, from a decreasing of the electric resistance in some skin areas. This transient response, which in the past was called *psychogalvanic reflex*, and that today more correctly is called *phasic electrodermal response*, has a characteristic form of wave, with an increasing time within 1 and 2 seconds and a decreasing time considerably longer (Edelberg, 1970).

The decreasing side of the wave form can take different aspects: from a wave that gently degrades to a rapid descent. The average latency time for a palmar response registered in a comfortable temperature (20°), roughly is of 1,8 seconds (Edelberg, 1972).

We must clarify that, since the *electrodermal resistance* varies in inverse proportion to the emotional level, is preferred to use the *conductance* as electrodermal physical parameter, which activates in a direct relation with the *emotional activation*. Basically, more is the value of the *conductance*, which is registered in *microsiemens*, higher will be the *level of emotional activation* of the subject or patient.

In 1966 Johnson and Lubin (1966) proposed the term *electrodermal activity* to describe the different electrical phenomena connected to the skin sweating activity, distinguishing two different kinds of electrodermal processes, *phasic* and *tonic* (Lacey, 1947). The terms *psychogalvanic activity* and *psychogalvanic reflex* were definitively abandoned in the scientific literature of the Sixties (Venables, Martin, 1967) but unfortunately they are still used in dissemination ambit and on Internet.

Phasic responses are indicative of rapid and transient activation movement, consequent to an anxiety response, an emotional situation, a conflictual situation, mental activities that cause *worry* or preparation to the action. The phasic responses seem to be activated by the quick contraction of the *myoepithelial cells* that surround the duct of the sweat glands and which action causes a rapid emission of sweat from the glandular duct. According to the international nomenclature, these phasic responses are defined *Skin Conductance Responses* (SCRs), by Edelberg (1967). The production of the above-cited responses, caused by the contraction of the *ducts myoepithelial cells*, seems to be connected to the action of the adrenalin (Fowles, 1973). It seems that the myoepithelial cells are sensitive even to catecholamines (adrenalin and noradrenalin) present in the bloodstream (Goodall, 1970).

The screening of these responses can be made in different circumstances, both clinical and experimental. In the clinical point of view, is particularly interesting the registration of the anxiety responses, to objectively assess the real emotive consequences of disturbing situations (Davis, 1929). Between all the electrodermal phasic responses, the parameter that has been more accurately analyzed and studied are the so-called *orientation responses*, which are phasic responses evoked through the random administration of patterns of tonal acoustic stimuli, consecutive and equal between them (Sokolov, 1963).

This researching method allows to screen the trend of the *habituation*, which is the process whereby phasic responses *tend to extinguish* with the repetition of the stimulus. If the type of

administered stimulus does not change, gradually the interest of the subject decreases to the total extinction of the phasic electrodermal response. The speed wherewith the process of habituation occurs can change depending on the subject, and in the subject itself, depending on his emotional and cognitive condition.

The study of the *electrodermal phasic responses* evoked through monotonous sensorial input (stimuli) or cognitive and more complex input (events), is an important methodology for the study of the human information processing (Berlyne, 1961; Scrimali and Grimaldi, 1991).

A considerable importance has the study of an electrodermal activity similar to the *phasic evoked responses* which occurs without any external stimulus; these *spontaneous phasic responses* are defined, in the Anglo-Saxon literature, *NS-SCR, Non Specific - Skin Conductance Responses*. The phasic spontaneous responses are caused by mental activities which occur during apprehensive and intense situations, as the one that is registered in obsessive patients, or who suffer a generalized anxiety disorder; these mental activities are called *worry* (Davey, Wells, 2006).

Now it's time to describe the tonic electrodermal activity, which is the *Electrodermal Conductance Base Level (Skin Conductance Level, SCL)*, and it is an index of the general state of *activation and vigilance* (Malmö, Shagass, 1949). A decreasing of the *Skin Conductance Level* indicates a progressive psychophysiological relaxation, a process of general distension (Mathews, Gelder, 1969).

The screening of the electrodermal conductance base level seems to be particularly useful if you want to objectify the psychophysical relaxation level achieved through the learning and practice of various techniques of self control (Scrimali, Cardillo, Caruso, Caniglia, Macaudo, Rapisarda, 1977).

Paul showed that the psychophysical distension, produced by a brief training of relaxation techniques, is strictly connected with the modification of the Skin Conductance Level (Paul, 1969). The daily screening of this parameter is able to provide reliable information about the stress level of the subject.

To conclude the description of the electrodermal parameter, we must consider that everything that has been written until now refers to the *exosomatic electrodermal activity*. This term indicates that the electrodermal parameter which is analyzed is generated by an external application on the skin of a potential difference that makes possible to register the conductance on the skin and its variations. There is another type of electrodermal activity; to register it potential differences applied are not needed, the registration occurs positioning two electrodes, one in an area poor of sweat glands as for example the back of the hand, and the other in an area rich of sweat glands, such the palm (Wilcot, 1959).

With this method is possible to register a potential difference of about 50 millivolts using an operational amplifier. The modification of the emotional state causes variations of the potential and it can even change its polarity. The endosomatic measurements are more accurate and rich of information, for example they can distinguish the orientation reflex from the defensive reflex. They need quite complex instrumentations and methodologies to provide useful data in researching and clinical setting ambit.

The regulation of the electrodermal activity is complex and it involves structures of the central and peripheral nervous system. In the central nervous system is possible to find three different systems which are able to regulate the electrodermal activity. 1. The cortical system, situated in the *premotor cortex of the frontal lobe* (Area 6 of Broadman, Schwarz, 1937); 2. A system that is in the *front limbic structures* (Isamat, 1961); 3. The system of the *amygdala, the hippocampus and the thalamus*.

As we can see the electrodermal activity involves many processes. Those connected to the *planning and execution* in the frontal lobes, therefore one of the more evolved and sophisticated structure of the whole nervous system; the *emotional processes* connected to the limbic system; the *memory* through the hippocampus; the *regulation of the sensitive input* due to the thalamus. Moreover, the study of the electrodermal activity made contemporary on both hands can provide interesting information about the processes of *hemispheric specialization* both structural and functional. Some researches have shown that the functional asymmetry between the right hand and the left hand can increase or decrease due to the emotive state, and also in relation to pathological states such schizophrenia or depression.

A recent research of Bob, Susta, Glaslova, Pavlat and Raboch (2006) showed that in the schizophrenic condition and in the depression, the patterns of hemispherical coherence, studied with the bilateral registration of the electrodermal activity, can provide indications which are consistent with the clinical situation. These authors particularly dwelled on the fact that while in the right-handed controls there is a slight prevalence of the Skin Conductance Level Values, the same condition is inverted in the depressed people and exasperated in the schizophrenics.

From a biochemical point of view the substances that influence the electrodermal activity are the catecholamines, as the adrenalin can activate the myoepithelial cells that are contained in the sweat glands' duct, activating phasic responses.

The final mediator of the nervous terminations that innervate the sweat gland is the acetylcholine. This explains why substances with anticholinergic properties tend to decrease the electrodermal conductance.

The screening of the electrodermal parameters is simple and it provides a considerable quantity of valid and reliable data about the psychic, cognitive and emotive activities, this is the reason for the substantial bulk of studies and researches which have been made in this field.

The first comments about the electrodermal activity start in the late 19th century with Tarchanoff who was the first to scientifically register and study this psychophysiological parameter of the human being (Tarchanoff, 1880).

The instrumentation was very simple and it basically was a bridge of Wheatstone, which was fully implemented and described for the first time by the author itself in 1843, in order to generically measure the resistance of the materials, and it is still used in the industry.

It is a system formed by a source of electrical energy, so a battery, a series of electrical resistances and a galvanometer. The electricity that flows in the circuit is measured by the galvanometer and it depends on the value of the resistance which has to be measured. Every variation of the resistance is reported by the needle movement of the galvanometer (Wheatstone, 1879).

Tarchanoff was the first who used a device for the screening of the electrodermal activity based on the bridge of Wheatstone. Essentially, the *variable resistance* of the bridge of Wheatstone was formed just by the skin of the patients' hands Tarchanoff's instrumentation was the first device in history which could screen a psychophysiological parameter, giving birth to the history of neuroscience.

Today the developing of the microelectronics have made the measurements more reliable and especially easier to be registered and to be tested via the use of specific powerful software installed on microcomputers which are equipped with the instrumentations.

In psychotherapy the study of the electrodermal activity makes his entry with the researches of Karl Gustav Jung who based on the notion of Freud that the therapy has to identify the unconscious process which cause the suffering of the patient. Jung applied the registration of the electrodermal activity at the analytical technique. He created a list of words that he used to read to the patients while registering the electrodermal activity. If a word was connected with topics that were critical for the psyche of the patient Jung could find obvious electrodermal phasic response. His experiences with the electrodermal activity were published in 1906 in the article *Studies in World Analysis* (Jung, 1906). This important contribution of the great Swiss psychiatrist can be considered the first important demonstration of the integration of the electrodermal activity screening in the psychotherapeutic setting.

As I have already written, during recent years the growth of the electronics and informatics has allowed a new developing of the electrodermal activity screening. Today the main components for an efficient screening are substantially three: an instrumentation for the measuring, a software for the registration of information and a computer for the elaboration of the collected data.

The purpose of my researching work have been to develop, thanks to the MindLAB Set, an economic methodology, easy to use, which can be disseminated in a strictly scientific field and able to provide clinical and scientific results that are reliable and then usable in replicable experimental studies.

The MindLAB Set is formed by an *integrated system* which includes a unity for the acquisition of the electrodermal parameter, the *Psychodata Acquisition Unit*, a complex software called *MindSCAN & Psychofeedback* and a reference database called *Katane* which provides a clear orientation for the examination of the data collected from the patients.

The introduction of an instrumental methodology in the clinical setting involves yet the resolution of many difficulties, and for this reason great care have been dedicated to the study and the resolution of critical technical problems like the choice of the electrodes, the mode of application, the use of a *conductive paste isotonic to the human sweat*, and also to the complex issues related to the setting debated after the recent studies of the cognitive Ergonomics. Special care has been dedicated to the study of the interfaces for the sharing of information between instrumentation and operator, instrumentation and patient, and between operator and patient.

The realization of the MindLAB Set tends to accomplish today the dream of Jung of being able to access to the unconscious processes (cognitivists would say *tacit*) using instrumentations which can provide clear information about them.

7. Psychoactive substances effect on the electrodermal parameter

Very often the patients whom electrodermal parameter is measured with the MindLAB Set use to take medicines, so is necessary to know the effect that the substances make on the electrodermal parameter in order to correctly interpret the registered data. The electrodermal parameter, as any other physiological system, can be directly or indirectly influenced by active substances which can be introduced in the human body. This problem is well known to the electroencephalography specialists who advise the wash out of all the psychotropics some days before making a tracing, since several drugs can produce a marked effect to the morphology of the recording.

For what concerns the electrodermal activity it must be specified that the effect of the administered substances can influence this parameter in a different way, acting at a *peripheral level*, so on the skin, on the control centers, therefore on the central nervous system level.

Each substance which is able to produce anticholinergic effects decreases the electrodermal conductance, since the final chemical mediator of the sweating activity is the acetylcholine.

Substances those are able to make an anticholinergic action can decrease the electrodermal conductance with a *peripheral* mechanism besides their effect on the central nervous system.

Some of these substances are:

- Antispastic
- Antiparkinsonian
- Neuroleptics
- Tricyclic antidepressants

Other psychoactive substances, including some of those above cited, affect the electrodermal activity as they modify some psychic processes such anxiety and the arousal, mood and thymic activation, or the human information processing. In this case, the fact that the electrodermal activity is modified depends on the symptomatic therapeutical action of the drug.

Among the substances which are taken unnecessarily we can find coffee, tea, tobacco smoking and alcohol. The first three substances excite the nervous system causing an increasing of the electrodermal conductance. The alcohol instead causes a biphasic effect, an increasing effect at low doses, and a decreasing effect of the electrodermal activity at higher doses besides the sedative effect.

Now I am going to briefly describe the effect of some common drugs which can affect the electrodermal parameter.

Beta-blockers

Thanks to their adrenergic action, they are able to decrease the perception of the anxiety physical symptoms and can contribute to reduce the electrodermal activity both tonic and phasic. This can be considered during the therapeutical activity and can be used for the screening of the anxiety condition (Gruzelier, Connolly, 1979).

In hypertensive patients there is a correlation between the decreasing of the pressure parameters obtained with beta-blockers, and the electrodermal conductance values reduction.

Benzodiazepines

The benzodiazepines are psychotropics which can counteract the anxiety and today are the most prescribed and used medicines in the planet. Their effect on the therapeutical action has been widely documented, for what concerns the SCL, it is reduced, and it also reduces the number of phasic responses (NS-SCR). A clear relation of the benzodiazepines therapeutical effect has been documented; it works both in a short-term (even few minutes if are used benzodiazepines at rapid action such lorazepam) and average-term (several days) period if a systematic therapy is applied (Frith, Stevens, Johnstone, Owens, 1984). This can be helpful to document its pharmacodynamic and therapeutical effect.

Neuroleptics

Unlike the chlorpromazine which exercises an anticholinergic peripheral effect that can decrease the electrodermal conductance besides a therapeutical result, the haloperidol acts on the electrodermal conductance only as consequence of its symptomatic therapeutical effect on the psychosis (Gruzelier, Hammond, 1978). Therefore the screening of the phasic and tonic electrodermal activity can be a screening index of the pharmacodynamic and symptomatic activity of the haloperidol. This can be observed in the schizophrenic, and even in the maniacal and hypo-maniacal condition. In this case the administration of haloperidol gradually decreases (during several days) the *Skin Conductance Level* and the *Spontaneous Phasic Responses*' number (NS-SCRs).

Antidepressants

The tricyclic antidepressants affect the skin electrodermal activity through their anticholinergic action, and it has been demonstrated by a study that I conducted in the early Eighties (Scrimali, Grimaldi, Rapisarda, Lombardo, Alberghina, 1982), this phenomenon does not happen with the *serotonin specific reuptake inhibitors* – SSRI which influences the electrodermal parameter just due to the timo-analeptic effect (Thorell, Kjellman, d'Elia, 1987).

The effect of the SSRI drugs on the electrodermal conductance can be used as valuation parameter of their *therapeutical action*. In a depressed patient the administration of fluoxetine gradually increases the conductance in correspondence with the mood improving. I would like to specify that when I write about therapeutical action of a serotonin reuptake inhibitors I do not mean a real antidepressant effect, since the real therapeutical result can be obtained with the modification of automatic dysfunctional schemes and thoughts, the relational patterns (internal operative models), processes that not one so-called *antidepressant* can promote and that can be obtained only through the psychotherapy. Actually the so-called antidepressants should be called timoanaleptics since the only effect that they can make is the improving of the asthenia, apathy, anhedonia and the somatic symptoms of the depression.

Several treatments made with these drugs have registered a consistent number of suicides (Teicher, Glod, Cole, 1990). This fact is not so surprising, this phenomenon can be explained

referring to the fact that the patient, while is suffering much, creates suicides projects that cannot be executed due to the lack of executive capacity, the suicide can occur while the timo-analeptics activating effect has revealed. In this case is possible to say that the patient is dead *improved!*

Antiepileptic drugs, also defined *mood stabilizers*

The valproic acid, the sodium valproate and the carbamazepin can decrease the tonic and phasic electrodermal activity while they act on the mood in the maniacal and hypo-maniacal condition (Keck, McElroy, 2009).

8. Documentation of the dynamics of changing

As I have written, the electrodermal parameter seems able to reveal and screen (it has already well documented by a wide literature) the therapeutical changes that occur in anxiety disorders, depression, in maniacal episodes, in bipolar disorders and in the schizophrenia.

Even the psychotherapy, the emotional self-regulation techniques and the mindfulness can improve the functional conditions of the nervous system and cause significant changes of the electrodermal parameter. So, if the patient improves his symptomatic condition, consequently the electrodermal parameter changes. The clinical use of the MindLAB Set allows to realizing ordinarily a psychobiology of the therapeutical process, Biondi recommends it as a possible option of research (Biondi 2008).

Since several years I have introduced the MindLAB as a constant presence in my setting of psychiatrist, clinical psychologist and psychotherapist. The results are very interesting. Often the patient and his family do not appreciate the first changes which occur with the therapeutical process. A proper elaboration of a MindSCAN, and the comparison of the tracks made at the beginning of the therapy with a new track, can show the positive trend of the therapy demonstrating that the changes have occurred but they still do not see them.

The valuation of the electrodermal parameter changing can be implemented following a simple mathematical formula proposed by Blanchard and Andrasik; the percentage of improvement (%) can be obtained subtracting the baseline *Skin Conductance Level* (SCL) with the *Skin Conductance Level* registered after the treatment and multiplying the total value by 100 (Blanchard, Andrasik, 1987).

The SCL values that must be used for the calculation, in accord with the Blanchard's and Andrasik's formula, are the average minutes of registration, and it also emerges from the statistical analysis made with the MindSCAN software, therefore it will be the average value of the assessment period.

Second Part

MindLAB Set: Hardware, Software and Methods

9. The MindLAB Set, Integrated system (hardware, software, database and know how) for clinical psychophysiology

9.1. Introduction

The MindLAB Set is an integrated system for clinical psychophysiology; its tasks are the monitoring of the *exosomatic electrodermal activity*, the registration, the storage and the post-elaboration. It is formed by three *hardware* units, and two types of *software*: the *MindSCAN* and the *Psychofeedback*, a related database which is the Katane.

The hardware component is formed by the *Psychodata Acquisition Unit (PAU)*, together with a couple of electrodes and an USB cable for the computer connection.

The MindSCAN and Psychofeedback software are specific programs, developed to work on Windows 98, Windows ME, Windows NT, Windows XP and Windows Vista.

The set is completed by this monograph that contains the Katane database which is the archive with all the referring normative data built on a wide sample of healthy subjects (chapter n.9).

The MindLAB Set can operate even on old-generation computers; this choice has been taken to allow the reuse of elaborators which are no longer used but which can be useful in some clinical psychophysiology works if combined with the MindLAB Set. The use of a laptop makes the system autonomous and operative in every context.

To actuate the biofeedback procedures related to the Psychofeedback program is necessary that the computer has speakers so that the patient can benefit the acoustic feedbacks. Is possible to use a headphone which allow the patient a custom listening; this situation fits during a work group with more MindLAB Sets used by different people.

The realization of the MindLAB Set system concretizes a long work of experimental and clinical researching, developed at the Laboratories of the Superior Institute for the Cognitive Science, and of didactical experimentation at the School of Psychotherapy Specialization ALETEIA with cognitive orientation. Moreover, the MindLAB Set is the arriving point of a project that includes the design, the engineering and the testing aiming to the realization of an integrated system formed by three main units *hardware*, *software* and *database*, which is able to put together important and innovative scientific concepts, with a low-cost, and with the aim of make possible the use of it by every clinical psychiatrist, psychotherapist, psychologist, and even in the clinical rehabilitation, in the psychoeducation, in school ambit and in the sport medicine.

The optimal use of the whole set can be supported by the continuous possibility of trainings and updatings offered to the operators who wish to study in deep the theoretical and methodological bases of use of this new methodology. In fact I have developed several courses about all that regards the MindLAB Set, the Neuroscience and the Clinical Psychophysiology, these courses are even residential for who lives outside Sicily, and can be attended at the ALETEIA School (www.aleteia.it; www.aleteiainternational.it; www.psychotech.it). The plan is reported at page

One of the main barriers to the diffusion of the clinical psychophysiology methods have been, until now, the lack of valid instrumentation that can be easily acquired at a reasonable cost, and which functioning can be learned in a short time.

The MindLAB Set is a professional system absolutely integrable with the clinical setting. Its small size, portability, and the accurate cognitive studying make it ideal for psychotherapeutic and psychoeducational activities in every kind of operative context. The features of the set have been studied even according to the teaching activity. Using a video projector and an audio amplification system both connected to a computer, the MindLAB Set is suitable for the teaching and the training in classrooms with many students.

The MindLAB Set has been widely experimented even in this ambit; in the Medicine Course of the University of Catania, in the Courses of Psychological Sciences and Magistral Degree at the Kore University of Enna, at the Degree Course in psychiatric and psychosocial Rehabilitation at the University of Catania, at the ALETEIA School and in a large amount of university courses. The system has been used overseas in occasion of international workshops. MindLAB Set meets all European rules for safety and every FDA guidelines (USA) for GSR monitoring.

**Monitoring of the exosomatic electrodermal activity,
both tonic and phasic (MindSCAN);**

**Continuous biological Feedback to the patient
of the related electrodermal activity (Psychofeedback).**

The provided Feedbacks are: acoustic (three different types of sound) and visual. The visual types are three: two are analogical (colored vertical bar and a graph based on the Cartesian axes system) and one is digital which can indicate in every moment the value of the skin conductance in microsiemens.

The visual information, benefited by the patient, is *synchronic* and hence relative to what is happening in a specific moment and *diachronic* so it can gather information about previous phases of the actual registration or biofeedback training:

**Data printing related to the electrodermal conductance screening, made
by the operator in order to compile a detailed protocol of the session;**

**Recording of the psychophysiological data which can be reused
afterwards;**

Making of some post-elaborations on already registered records.

A very important feature of the electrodermal activity registration and feedback system included in the MindLAB Set is the removal of the problems related to the processes of *sensitivity* and *balancing*.

Since in every subject the electrodermal conductance values vary much and so do the values of the modifications which are registered, in most of the equipments used for the screening and the biological feedback of the electrodermal parameter is necessary in each utilization to set the instrumentation sensitivity and the balancing to keep active the acoustic and visual

feedbacks which often are interrupted because the values registered in an exact moment go out from the set range.

During the biofeedback training, the balancing procedures and the re-setting of the sensitivity compromise the quality of the information provided to the patient, in fact after the regulation is necessary to explain him that the feedback is quantitatively different from the one occurred before the balancing activity.

The measure system of the MindLAB Set allows to operate with a sensitivity and a range suitable for every person. Therefore the acoustic and visual feedbacks result always proportional to the occurred change.

The only operation that sometime the operator has to do is the expansion or the reduction of the scale. This operation is intuitive and does not change the referring scale of the digital values so the patient can read them easily.

For the regulation about the medical devices, it should be noted that the MindLAB Set must not be understood as a biomedical instrumentation or set.

9.2 Hardware

9.2.1. Psychodata Acquisition Unit

The Data Acquisition Unit (*Psychodata Acquisition Unit – PAU*) it is an electronic device which acquires the electrodermal parameter, elaborates it and transfers it to the computer. It has been designed and built bearing in mind the more advanced achievements in ergonomic and cognitive ergonomic, in order to make discreet and natural its presence in the setting and its physiological application more intuitive.

The Unit must be connected to the computer through the supplied USB cable. The alimentation is provided by the computer. An opto-electric decoupling device, contained in the motherboard, makes the Unit secure for the patient!

Devices in the Psychodata Acquisition Unit:

Switch

The switch is used to turn on and off the unit. It can be useful when the computer where the PAU is connected is working for long work sessions for other scopes than the use of the MindLAB Set. Thus is possible to reduce the effort of the electronic device and no energy is subtracted to the computer battery if it is a laptop.

Bright Led

When is turned on indicates that the Unit is working.

Jack connector for the electrodes

The electrodes jack has to be gently inserted with a slight rotary motion in a clockwise direction.

Usb connector for the computer cable connection

Insert the cable on the Psychodata Acquisition Unit gently and without force. The connector is shaped and can be inserted only in one position. Before trying the connection make sure that the plug and the connector match!

9.2.2. Electrodes

The problem related to the typology and modality of fixing of the electrodes, and the eventual use of conductive paste, appear to be very relevant to obtain reliable and replicable data about the electrodermal parameter.

The operative choices which are taken in every system of measurement are the result of some compromises. In the specific case of the MindLAB Set the main purpose has been to obtain electrodes of easy application, cheap and of easy maintenance.

After a long developing and experimentation work, *stainless steel* electrodes with a Velcro band have been chosen for an easy application and no use of the conductive paste. The electrodes have a circular form with a diameter of 10mm. The choice of the stainless steel which is not covered by a proper salt, such the silver electrodes that is covered by silver chloride and is much expensive since is made by specialized laboratories and especially used for researches, was taken for an economical reason. Moreover the silver chloride patina gradually tends to abrade with the use, and so the durability and efficiency of these electrodes are limited.

After the choice of the typology of electrodes, supplied with the MindLAB Set, the decision and its efficiency have been valued through many experimental experiences, which are described below.

The temperature problem

Literature data suggest that the ambient temperature affects the electrodermal conductance, so the measurements should be made in an acclimatized ambient (Boucsein, 1992). In the specific case of the MindLAB Set electrodes, I have proposed to establish if the electrodes temperature was important and if the fact that they had an *ambient temperature* before the application to the skin could generate a bias on the reading of the conductance.

The polarization problem

The use of steel electrodes can lead to the activation of the *polarization phenomenon*. In fact, the electrodermal conductance depends on the presence of sweat on the epidermis, which is rich of negatively charged chlorine ions, while the sodium ions are positively-charged.

The ions must be able to move freely on the skin area where the electrodes are applied generating a small potential difference.

After several minutes of screening, if the chlorine ions fix on the positive electrode while the sodium ions cover the negative electrode, the *polarization phenomenon* can be activated. This involves an apparent decreasing of the conductance which can be a possible bias since it can be interpreted as an arousal decreasing. In the related literature (Boucsein, 1992), is written that the polarization effect of the electrodes should be more expressed in the phasic responses ambit rather than what concerns the Skin Conductance Level.

The strength of this phenomenon depends on the intensity of the electricity that is provided by the instrumentation which measures the electrodermal conductance. Even the surface of the

electrodes is important in order to determine this phenomenon. In fact, the dimension of the electrodes surface is negatively correlated to the polarization effect.

For what concerns the MindLAB Set electrodes, we have tried to ascertain, if and in what measure, they suffer the polarization phenomenon especially in relation to the Argent/AgCl Electrodes.

The conductive paste problem

We made researches to analyze if the use of a conductive paste could modify the values of the Skin Conductance Level and the evoked phasic responses.

Subjects, Materials and Method

10 subjects were involved in the research, 5 men and 5 women, with an average age of 32.10 +/- 12.36. All the subjects were volunteers and they were aware to be involved in a scientific experiment. The sample was composed by some young and adult people in order to include subjects where the electrodermal activity was considerable and active, since it tends to decline in relation to the age.

The sequent electrodes were used:

1. Standard MindLAB Set steel electrodes made by PsychoTech-Tools for Mind (www.psychotech.it), applied with Velcro bands.
2. Experimental MindLAB Set electrodes, fitted with a plastic cup, filled with saline conductive paste type GEL 100 made by BIOPAC Systems, Inc., fixed with Velcro strips.
3. Ag/AgCl cup electrodes, made by BIOPAC Systems, Inc. (www.biopac.com) type EL258, filled with the same saline conductive paste used with the typology of electrodes previously described.

These electrodes were fixed to the fingertips through double-sided tape discs model ADD208 made by BIOPAC system, Inc.. The research was made at the Laboratory of Clinical Psychology of the Superior Institute for the Cognitive Science, thermally conditioned at 21° Celsius with 60% humidity. The subjects were sitting on a comfortable armchair. All the subjects were right-handed so the electrodes were always applied to the index fingertips of the right hand.

Thermal effect related to the electrodes

The first part of the research target was to assess the **thermal effect** on the electrodes. For this purpose we proceeded as follows. A **MindLAB Set Duo** prototype had been used; it is able to contemporary screen the electrodermal activity of both hands. A couple of electrodes was applied for 10 minutes in order to let the metal achieve a thermal equilibrium with the skin of the subject. After 10 minutes a couple of electrodes already at ambient temperature was applied to the other hand, and immediately started the bilateral screening of the electrodermal activity. At the end the average values of the electrodermal conductance were recorded, but most of all if the trend of electrodermal variation in the first minutes of screening was different.

Results

In all the 10 analyzed subjects the recorded average values of the SCL did not show any significant difference, and the trend of the electrodermal activity was not different. So applying to the ten observations and results the **sign test**, the hypothesis that there is no differences between electrodes which are applied while are already at skin temperature and electrodes applied while are at ambient temperature is confirmed with an high level of significance ($p < 0.01$).

The polarization effect

Three trials were made using in succession three different kinds of screening.

Each trial lasted 4 minutes and was composed by 2 minutes of baseline physical and mental relaxation with open eyes, followed by half a minute of hyperventilation and successively by half a minute of recovery. Between a trial and the other there were about three minutes to remove the used electrodes and apply the successive type of electrodes which had to be tested.

Results

The results of this tranche are summarized in the following tables:

Table I
Medium values of four minutes SCL recording

	4' medium values	D.S.
1. MindLAB Set standard steel electrodes:	4.25	0.64
2. Experimental MindLAB Set steel electrodes with plastic cup and use of conductive paste:	9.5	0.26
3. Ag/AgCl BIOPAC Systems EL258 electrodes:	17.12	2.43

Table II
Values of the phasic response stimulated by the hyperventilation
Expressed in % of the pre-activation level

1. MindLAB Set standard steel electrodes:	45.00	07.00
2. Experimental MindLAB Set steel electrodes with plastic cup and use of conductive paste:	69.00	43.88
3. Ag/AgCl BIOPAC Systems EL258 electrodes:	46.00	34.65

Comparisons on the results grouped in the tables I and II, had been made using the T test of Student, as is reported in the following tables III and IV

Table III

Skin Conductance Level

Comparison: Electrodes 1 versus Electrodes 2 $p < 0.05$ Significant
Comparison: Electrodes 1 versus Electrodes 3 $p < 0.05$ Significant
Comparison: Electrodes 2 versus Electrodes 3 $p < 0.05$ Significant

Table IV

Phasic response activated by hyperventilation

Comparison: Electrodes 1 versus Electrodes 2 $p > 0.05$ Not significant
Comparison: Electrodes 1 versus Electrodes 3 $p > 0.05$ Not significant
Comparison: Electrodes 2 versus Electrodes 3 $p > 0.05$ Not significant

Discussion

No thermal effect was observed on the MindLAB Set electrodes, therefore they can be applied and the recording of the electrodermal parameter can be made immediately. On the MindLAB Set electrodes no significant polarization effect which could affect the reading of the Skin Conductance Level (SCL) or the phasic responses was shown. The use of the conductive paste considerably modifies the reading of the Skin Conductance Level, so its application makes the data which are obtained without the paste not comparable with the data obtained where the paste was used.

The use of the conductive paste applied through cup electrodes covered by silver chloride, can significantly modify the Skin Conductance Level parameter compared with the values which would be obtained using steel electrodes. The typology of electrodes and the use of a conductive paste do not affect the phasic responses (SCRs). The use of the conductive paste involves serious methodological problems because it dirties the patient's hands and it results problematic during the clinical setting. Once covered by the conductive paste the electrodes must be accurately cleaned after each use, carefully and with a considerable waste of time.

Conclusions

The Skin Conductance Level values are considerably influenced by the use of the conductive paste, in fact they increase. The phasic electrodermal activity is neither conditioned by the features of the electrodes nor by the use of an eventual conductive paste. So it is possible to affirm that the electrodes realized for the MindLAB Set have ideal features for the clinical setting.

The readings of the electrodermal parameter are free of very evident bias and the qualitative and quantitative variations can be attributed to the variation of the psychic parameters. The Skin Conductance Level data obtained using the standard MindLAB Set has to refer to the Katane database. If you want to obtain data which are quantitatively comparable with the data

present in literature is necessary to use special electrodes in Ag / AgCl and use a conductive paste.

In this case we recommend using the BIOPAC Systems electrodes with double-sided discs and conductive paste which is very often cited in the scientific literature. The researches related with the phasic variations of the electrodermal conductance can be made measuring the responses in percentage terms and in comparison to the pre-stimulus value and the data obtained by the standard MindLAB Set electrodes, in this case the value are comparable with the information recorded by the MindLAB Set system.

9.3. Software

9.3.1. MindSCAN

The MindSCAN software purpose is the recording, the memorization and the comparison analysis of the electrodermal data recorded through the Psychodata Acquisition Unit (PAU). Its use allows to visualize and memorize the parameters acquired by the PAU during every session and also to make different kinds of comparison analysis on the data collected in the archive.

9.3.2. Psychofeedback

The second included software allows making complex biofeedback procedures with the *MindLAB Set*, it is the *Psychofeedback*.

Visual displays

Observing the monitor, the patient will be able to acquire three different kind of visual feedbacks

Synchronous Digital

The numeric indication of the conductance;

Synchronous Analogical

Red vertical bar proportioned to the conductance level;

Diachronic Analogical

The graph which is shown and that provides indications about the conductance level recorded in the previous phases;

I think it should be noted that the solution used for the analogical visual display, and the possibility of modify the scale width in every moment, allows to visualize accurately the trend

of the electrodermal parameter both in patients with low values and in patients who show higher level of electrodermal conductance values.

The wide range of the scale, which can arrive to 40 microsiemens, makes possible to visualize the trend of a session without having to use a balance command as you must do instead when the display is formed by a led bar hardware which necessarily has a limited range.

The solution adopted by the MindLAB Set and in the *Psychofeedback* software eliminates the need of regulate the sensitivity of the instrumentation and to balance the position of the display on the led bar, when such hardware is used.

This solution makes the training more natural as is less influenced by setting operations.

Choosing a scale from 0 to 20, the operator can work with the vast majority of the patients, showing to the user a linear recording of the emotive level trend, which is easy to understand and free of the bias that the operations of sensitivity resetting and balance involve when an instrumentation with a led bar display is used.

Acoustic displays

There are three kind of acoustic feedback. One indicates that the values are stationary, another that the values are increased, the third that the values are decreasing.

Third part

MindLAB Set in action

10. The Katane Database

Once that the MindLAB Set was realized and experimented, it had been necessary to gather a series of normative data which constitute a referring database for the comparison of the records obtained by patients who suffer different kinds of pathologies.

This procedure is similar to the one followed for the realization of the various already existing database, concerning the screening of the electroencephalographic activity analyzed through programs managed by computer.

The first reference database that has been created by me and it is reported in this monograph is the Katane, so called in honor of the city where I was born.

Katane is the name of Catania in Greek and it means *grater*. This name was chosen by the first Greek settlers who were impressed by the lava rocks that formed the ground of the new city, making it seem just like a grater.

In order to build the reference database called Katane, I proceeded asking collaboration to healthy patients who were not afflicted by any psychic pathology and who were willing to collaborate. The used instrumentation was a MindLAB Set connected with a laptop.

This allowed us to create a mobile setting which had been used in different contexts such as:

University (Faculty of Science and Psychological Techniques; Political Science; Legal Science; Communication Science; Medicine and Surgery);

Private Housing of experimenter's acquaintances and friends;

Office of an elderly protection Syndicate (obviously it had been useful to create the older age group).

In order to exclude not evident psychopathological conditions, every component of the control group was subjected to the *Middlesex Hospital Questionnaire* (Crown, 1966).

The total number of the tested people was 536. Using the MindLAB Set, the method of recording was the following. The subjects were comfortably seated for 10 minutes. After that they were acclimatized and tranquilized a 4 minutes recording was made. The sampling rating was a data every 0.25 seconds, so obtaining a screening of 4 minutes. The instructions given to the patients were the following: - *Now we are going to measure a parameter related to your emotive situation. The only thing you have to do is to still remain seated and calm for 2 minutes doing nothing.* –

The first assessment was concerned to the Middlesex Hospital Questionnaire resulting data. The subjects who showed high levels in the four reference scales which are referable to the electrodermal parameter, thus *emotive activation*, were identified. The four scales are: anxiety, phobias, obsessions and somatizations. Successively the parameter *depression* was studied too.

24 subjects of the group showed dysfunctional values in these specific scales and so they were excluded from the database.

On the data obtained from the subjects without any dysfunctional psychological parameter we made a preliminary assessment.

We wanted to establish if the Skin Conductance Level measured with the MindLAB Set was affected by the age, since this topic is treated in some researches of the related literature.

For this purpose the control subjects were divided in 4 groups: 11-15, 16-25, 26-60 and over 60. For each group was calculated the average and the standard deviance of the three considered parameters, as is reported in the following tables.

Age group	11/25
Overall	8.0 ± 5.6
Males	8.0 ± 5.0
Females	8.0 ± 6.4

Age group	16/25
Overall	6.8 ± 4.9
Males	7.2 ± 4.8
Females	6.4 ± 4.9

Age group	26/60
Overall	3.8 ± 3.3
Males	3.9 ± 3.8
Females	3.6 ± 2.5
Age group	Over 60
Overall	2.0 ± 1.1
Males	1.9 ± 1.1
Females	2.2 ± 1.2

The averages and the standard deviations were compared with the Student's *T* method of analysis for the values in different samples.

The first analysis concerned the variable *sex*. The comparison of the data related to both sexes, obtained in the age groups, did not show any significant difference ($p > 0.05$). Successively we calculated the averages and standard deviations for each age group without considering the variable *sex* (*Overall* values in the tables).

On this data further comparisons were made. In statistical term, the first and the second age group did not result different, so I decided to insert the data in a new age group which consider the age from 11 to 25 and which average value and standard deviation are:

Age between 11 and 25: average mS 5.4; Standard deviation +/- 4.4

These values were compared with the data obtained with the age group 25/60. The comparison showed a difference between the averages and the standard deviations that can be considered statistically significant ($p < 0.01$).

Finally we compared the data related to the II and III age group. The result showed a difference which is highly significant in statistics ambit ($p < 0.001$).

In conclusion is possible to affirm that the electrodermal conductance, measured through a MindLAB Set, does not differ in the two different sexes but it reduces with the age. This seems to be attributable to the physical characteristics of the skin that tends to dehydrates because of the brain activation which reduce during the senescence.

Ultimately, the Skin Conductance Level reference data, referred to the Katane database, with which compare the patients' data are the sequent:

Age 11-25	average: 5.4 values between 1 and 10
Age 26-60	average: 3.8 values between 0.5 and 7.1
Age Over 60	average: 2.0 values between 0.9 and 3.1

Since the minimum values of the three groups are not too much different, simplifying and rounding the results is possible to affirm that in the young people the normal values are included within 10 microsiemens, in the adults within 7 microsiemens and in the elders (over 60) within 3 microsiemens.

11. Set and Setting with MindLAB Set

Set and Setting have been crucial topics in the medicine ambit but especially in the psychotherapy. The term *Set* refers to the material aspects of the context where the relation between the therapist and the patient takes place. Therefore the physical environment like the session room, and in general, all the rooms where the clinical activity is made, all the used items, the microclimatic condition, the furnishings, the background sounds, the proxemics.

The setting regards the relational aspects, so the interaction between therapist and patient. Is evident that Set and Setting influence each other. For example the white coat is part of the Set but strongly influences the Setting. Plastic gloves and masks influence it even more.

During the long time while I worked at the Psychiatric Clinic of the University of Catania, I had always avoided using the coat since it immediately gives the idea of a *biological and medical* setting, instead I used to relate with the patient with normal and sport clothes.

When happened that tramps and alcoholics arrived directly from the street, in pitiful hygienic conditions, I had always refused to use mask and rubber gloves as instead use to do many colleagues.

Do you think that is possible to establish a care relationship presenting yourself masked and with rubber gloves? Imagine a good mother who before changing the nappy of his child puts a mask, a sterile green coat and rubber gloves. However the colleagues who use to do so believe to be *good psychiatrists*, and in fact maybe they are, but only for a *biological psychiatry*, the orientation that gave us asylums, electroshock, lobotomy, indiscriminate neuroleptic therapies and the conceptualization of the so-called *chronicity*. No, Thanks!

In the psychotherapy ambit, Freud worked very accurately with the Set and the Setting. For the great master from Vienna, who probably was a bit obsessive and who acted in an exasperated deterministic conception, everything had importance. Visiting his office in Vienna I was struck by the attention for the details.

Now, after about two centuries of modern psychiatry history, and more than one century of psychotherapy, we live an era of revolutions. For example, the *asylum set* and the institutionalization setting have been eliminated (at least in Italy) thanks to bold and brilliant psychiatrists like Basaglia (Basaglia, 1968).

But is the time matures enough for the systematic use of instrumentations in the psychotherapy and clinical psychology set? Is today possible to join neuroscience and psychotherapy during the daily clinical work?

Undoubtedly the problem exists and I have tried to study it accurately for several years. For example, if the clinical psychophysiology set is formed by a laboratory, and if during the session we must ask the patient to come with us in the laboratory to make a record, it can create in the patient emotional dynamics (even in the present relatives, that usually in Sicily are numerous and apprehensive!) and noticeable resistance by the therapist who is constrained to move, during his work, in different environment and use complex and complicated instrumentation. So I have understood that the ideal solution was to insert in a discreet and ergonomic way the MindLAB Set in the usual setting of the clinical interview and of the psychotherapy.

In this way, after having done part of the interview, we can propose to the patient to measure the electrodermal parameter, but we can do it while neither the patient nor the therapist have to move from their armchairs, and even better maintaining the same exact posture used during the interview.

Instrumentation and computer discreetly come into play, while the application of the electrodes without specific preparations or conductive pastes makes the whole situation much easier and less dramatic. Talking with the patient it is recommended to call them *sensors*, since the term electrode is alarming because it evokes shock treatments and in general the risk of receiving electrical shocks!

The MindSCAN software is so intuitive and the graphic interface so clear that the therapist will not be distracted by it and so he can apply all his attention to the patient maintaining the eye contact during the assessment procedure.

As we can see, the setting which is possible to create using the MindLAB Set, has been accurately studied and experimented by me considering advanced conceptualizations, obtained by the recent cognitive ergonomics developments.

The most effective setting considering what has just been explained, and that allows to stably integrating the MindLAB Set in the daily clinical work, and also considering the assessment phase (*MindSCAN*) and the therapy (*Psychofeedback*), is the one called *face to face*.

Such setting can be created during the normal condition of the interviews and the consultations in Medicine, Psychology, Psychiatry and Psychotherapy. The operator is sitting at his desk while the patient and the eventual relatives are sitting in front of him. To realize this kind of setting is necessary the use of a monitor with the screen that face the patient.

If the operator together with the MindLAB Set uses a laptop, nothing else is needed to realize the *face to face* setting. Where the operator prefers to use a desktop computer, he has to provide a *vga splitter*, which can be bought at every electronic shop. Is necessary to easily switch on and off the second monitor, this operation can be made on the laptop using the command F8.

In the case where a desktop computer and the face to face setting are used, the monitor for the patient can be switched off through a remote switch (gettable in electronic shops).

During the normal clinical interview the monitor used for the patient is turned off, and even during a base valuation of the electrodermal activity made with the MindSCAN methodology. The second monitor will be turned on by the operator when the registered record will be showed to the patient.

If the operator does not have a second monitor, is possible to proceed in a different way. Is possible to work at the desk during the assessment phase, while the data will be showed to the patient through a printed record. When biofeedback procedures have to be made, and the second monitor is not available, is necessary to create a *side by side* setting where both the operator and the patient are able to observe the monitor. This second option can be accepted in the biofeedback phase because such technique in any way needs a redefinition of the setting.

12. Execution, reading and returning of a MindSCAN record

The MindSCAN consists in a recording of the spontaneous tonic and phasic electrodermal activity, made with the MindLAB Set, and for a total lapse of time of *four minutes*. The registration is composed by three phases:

- Two baseline minutes
- One minute of cognitive activation (serial subtraction of the number 7)
- One minute of recovery

The MindSCAN is very easy to use and it provides precious indications for the psychodiagnosis and the integrated treatment planning. It can be routinely used with all the patients during the first interview. It requires about ten minutes, including the restitution of the result and the printing of the record. Now I am going to briefly describe the MindSCAN procedures.

Setting

After having done the preliminary interview using a face to face setting, it is possible to proceed. Initiate the MindSCAN and Psychofeedback software without activating the acoustic feedback. The monitor that faces the patient has to be turned off in this phase.

Spoken introduction for the patient

Now I would like to do a simple measurement of a parameter which is related to your emotive condition. Thanks to the neuroscience development today is possible to measure and quantify the emotive condition using this instrumentation.

It is like the electroencephalography in neurology or the electrocardiography in cardiology.

We try to obtain an objective documentation of the physiologic processes operating status.

In our specific case we will obtain a documentation of your emotive condition.

The acquisition of this parameter is very simple and free of every kind of negative effect. The instrumentation is secure since it is alimented by a battery and isolated from the computer. Moreover you will feel nothing. Think about the temperature measuring to somebody who is supposed to be feverish.

Instead of the thermometer, I will apply two small sensors on two finger of the right hand. The recording is composed by three phases and it lasts four minutes. During the first phase you just have to try to stay calm. Then I will tell you a number and you will have to perform some calculations for one minute, after that you should try to relax and clear your mind of any thought.

Test

Wipe gently with a dry tissue the *index* and *medium* fingers of the *dominant hand* and fix the electrodes on the fingertips without pressing too much but assure that the electrodes do not move. After having applied the electrodes, turn on the instrumentation and start the recording (button PLAY). Wait for one minute in order to allow that the instrumentation can calibrate on the conductance value of the patient, set the data acquisition value at 0.25 seconds. So the graph will show a 4 minutes abscissa. When the graph reaches the second minute point, activate the mark-event and say to the patient:

-The number you have to think about is 250! Now aloud and telling me the result, subtract the number 7 going back until I do not tell you to stop.-

After one minute of serial subtractions of the number 7, we can tell the patient to stop and activate again the mark-event, and ask him gently to relax his mind trying to do not think about the cognitive test just done.

Registration of the record

At this point leave and save the obtained data. Do not forget to register in the special window that it is a first *MindSCAN* record.

Restitution to the patient

Now the operator can print the record and show it to the patient or switch on the second monitor, and comment the result. You can point with the mouse the important aspect of the record. Show to the patient the registered values (minimum, maximum and average) and comment them. If the values are higher referring to what is indicated in the *Katane* database, considering the age, let the patient notice that effectively his emotive condition results altered. Observe and show to the patient the record morphology, if in the first two minutes there are more than three spontaneous phasic responses and if their width creates the form of a sawtooth, explain that it shows a mental activity which is considerable and excessive. Comment also what happened during the serial subtraction of the number 7 and the recovery period.

In normal condition during the cognitive task a slight increase of the conductance and a fast recovery of the previous value should have been recorded. Instead a sharp increase of the values during the *subtractions of the number 7* not followed by a value recovery indicates a high anxiety and preoccupation level.

Treatment planning

Now tell to the patient that this instrumentation is not only designed for the psychodiagnosis but it is useful even for the integrated therapy. Propose some *Psychofeedback* sessions with the purpose of learning new strategies of emotional autoregulation. Explain that a positive outcome of the integrated treatment (pharmacological and psychotherapy) will modify the recording result, so during the therapy more measurements will be made to gather information about the progressive clinical improvement.

As is possible to understand, the described procedure is highly innovative and it can impress positively the patient who will be happy to end the session with a record and an objective valuation of his condition. The just described methodology has been extensively tested by me with hundreds of patient, always obtaining positive clinical results and high satisfaction levels by the patients.

13. Instrumental psycho diagnostic

The *Instrumental Psychodiagnostic* is a new clinical psychology orientation that I have developed through recent years. It consists in the attempt to use psychophysiological techniques during the assessment process, in order to acquire biological information which complete and can be integrated with the psychological and relational information. The concept of *Instrumental Psychodiagnostic* is into the ambit of the complex biopsychosocial model, for what concerns the psychic disorder, and it proposes to consider the human condition, the psychic disorder and the therapy, from a psychological point of view that consider the *mind* and the human relationships, since etiologically the man is a social animal (Scrimali, 2007).

The *Instrumental Psychodiagnostic* purpose is to make possible, in the clinical setting, assessment procedures able to show the operating processes of mind. The screening of the electrodermal activity that can be made using the MindLAB Set can be perfectly inserted in the *Instrumental Psychodiagnostic* field, which also includes the study of the electroencephalographic, electromyographic, cardiac, thermal and in future even biochemical activities.

During the long experimentation work at the ALETEIA Clinical Center of the Superior Institute for the Cognitive Science, I have collected useful information to create the Katane database, which refers to the normative values gained by a suitable sample formed by many control subjects, I have already spoken about it in the previous chapters. Successively I had tested wide patients groups afflicted by the following clinical disorders:

- Generalized anxiety disorder
- Panic disorder
- Post-traumatic stress disorder
- Phobias
- Obsessions and compulsions
- Depression
- Eating disorder
- Addiction
- Schizophrenia
- Maniacal episode
- Stuttering
- Arterial Hypertension
- Irritable bowel syndrome
- Premenstrual syndrome
- Psychogenic impotence

The results which has been collected and elaborated, considering the current literature, will be reported below in an extremely summary form. For a deepening of this topic look at the

bibliographic indications and at a new monograph that I am working on (Scrimali, 2009, in preparation).

Data related to the different clinical disorders

13.1. Generalized anxiety disorder

In this pathology there are high levels of *Skin Conductance Level* which oscillations appear to be in tune with the anxious symptomatology trend (Birket - Smith, Hasle, Jensen, 1993).

13.2. Panic disorder

Recent and accurate experimental researches have documented high levels of the *Skin Conductance Level* in the patients who suffer a panic disorder, it considerably increases implementing different strategies to activate the panic attack. Some researches consider that this information is related with the high plasma noradrenalin levels which are usually found in these patients (Braune, Albus, Frohler, Hohn, Scheibe, 1994).

13.3. Post-traumatic stress disorder

In the Post-traumatic stress disorder has been demonstrated a specific activation response, which is characterized by an electrodermal activity increase that occurs showing to the patient some drawings of the dramatic event, while the increase does not occur showing imagines of stressful events which are not linked to the specific trauma experienced by the patient. Another interesting data regarding the electrodermal activity in the post-traumatic stress disorder is that the recorded arousal electrodermal response decreases in relation to the therapeutic improvement obtained with pharmacological treatments and cognitive therapy (Tarrier, Sommerfield, Connel, Deakin, Pilgrim, Reynolds, 2002).

13.4. Phobias

High values of the *Skin Conductance Level*. A further increase occurs if the patient imagines the feared situation or showing to him related movies (Lader, Wing, 1964).

13.5. Obsessions and Compulsions

Is characteristic the presence of many and wide spontaneous phasic responses linked to the *worry* phenomenon (Zahn, Insel, Murphy, 1984; Hofmann, Moscovitch, Litz, Kim, Davis, Pizzagalli, 2005).

13.6. Depression

The depression is characterized by low conductance values and the presence of spontaneous phasic responses, especially if in the clinical picture even the anxious phenomenology is present and most of all the *brooding* (Lader, Wing, 1969).

13.7. Eating disorder

Anorexia

An increase of the Skin Conductance Level occurs showing food to the patient, this explains that the food activates a conditioned stress response with the consequent difficulties to digest (Scrimali, 2003).

Anorexia and Bulimia

Using a camera and filming the patient imagine there is an increase of the *Skin Conductance Level*. For the *cognitive restructuring* it is useful to explain to the patient (during the self-observation phase) how the vision of her/his body generates an increase of the arousal, with the consequent *avoidance* which promote the vicious circles that are at the base of the dysfunctional body schema maintenance (Scrimali, 2003).

13.8. Addictions

During the craving the records show high level of the *Skin Conductance Level* (Taylor, 2004; Taylor, Carlson, Iacono, Lykken, McGue, 1999).

13.9. Schizophrenia

In presence of positive symptoms is possible to observe many spontaneous phasic responses and high arousal levels (often the conductance values reach levels higher than 30 microsiemens). When negative symptoms prevail, there is a low spontaneous phasic activity. The increase of the *Skin Conductance Level* can be considered as a possible relapse *warning sign*, rather I defined it *new crisis* (Zahn, Frith, Steinhauer 1991; Scrimali, 2006).

13.10. Maniac Episode

During the hypo-maniacal or maniacal episode the electrodermal conductance considerably increases. The systematic screening of such parameter can be used as a turning *warning sign* of the thymic condition. (Iacono, Lykken, Pelouin, Lumry, Valentine, Tuason, 1983).

13.11. Stuttering

The stuttering is a clinical condition that afflicts millions of people around the world. A research shows that in the occidental world there are from 40 to 50 million of children afflicted by stuttering (Coleman, 1976). Several studies demonstrate that the anxiety and the phobic social attitude play a crucial role in the maintaining of the disorder (Weber, Smith, 1990; Craig, 1990). The arousal is high and it is higher while the patient starts to stutter.

13.12. Hypertension

Several researches focused on the analysis of the biological response patterns to different kind of stressors (for example intense and unpleasant sounds) have demonstrated that, in hypertensive patients more than in healthy control subjects, several physical parameters are altered, and the difference with the normotensive subjects is very significant.

In particular is possible to find high levels in the arterial pressure of the cardiac rate, in the plasma noradrenalin of the cortisolemia and in the free fatty acids (Bauman, Ziprian, Godicke, Hartrodt, Nauman, Lauter, 1973).

The screening of the electrodermal activity allows, in an experimental situation, to observe higher values of the Skin Conductance Level and the increasing response is higher than in the control subjects. Even the recovery of the values previous to the stressor administration appears to be delayed (Fredrikson, Dimberg, Frisk-Holmberg, 1980).

This data is very interesting if we consider using the MindSCAN for the study of the emotional components linked to an eventual slight and recent hypertension.

Later in this monograph is explained that the Psychofeedback can be considered a good resource in the integrated treatments for the hypertension. Several researches made by our work group, using the MindLAB Set, allowed us to identify high level of the SCL in the hypertensive subjects, and even its reduction during pharmacological and integrated treatments, this reduction is in tune with the decreasing of the arterial pressure.

13.13. Irritable bowel syndrome

The irritable bowel syndrome is a widespread problem, pretty disabling considering the disorders that it involves (colic, diarrhea, constipation) and which is hard to cure since it is a strictly functional problem connected to emotional dynamics.

Experimental researches have demonstrated that in the patients who suffer the Irritable bowel syndrome is possible to observe high values of the base electrodermal conductance level and they significantly increase in stressful situations (Walter, 2006).

13.14. Premenstrual syndrome

The premenstrual syndrome is a dysfunctional condition that can appear in female subjects in the period after the menstrual flow. It is characterized by a somatic and psychic discomfort. For what concerns the psychic aspect appear to be relevant the emotive tension, the irritability, the impulsiveness and the aggressiveness. In this syndrome the electrodermal activity shows high values of the Skin Conductance Level (Van Den Akker, Steptoe, 1980).

14. Use of recorded data for the activation of a narrative of the autoregulation process

The possibility of recalling from the archive the saved records is a very important function for the therapeutical process. In fact, in therapy is necessary that the patient can develop a *positive narrative* related to his continuous clinical condition evolution.

Often the patients tend to negate the progresses due to their pessimistic vision, which is related to their dysfunctional schemes. Using the software functions that allow to visualize all the records made during the different phases of the treatment, the patient is facilitated to develop a new and more positive and adaptive narrative, this process is strictly linked to the developing process since is clearly documented by the records.

Later on the monograph there are important aspects of this topic when I will describe the *Family Strange Situation*. Showing to the patient and the relatives the records, allows to highlight in an objective way that the high expressed emotion behavior of the relatives causes stress to the patient and it is clearly demonstrated with the MindLAB Set.

This information can be the premise to create a *narrative* based on the fact that the interaction patient-family is objectively negative. Another aspect related to this topic is the possibility to instantly test during the session the effect of a benzodiazepine like the lorazepam.

In this way the patient can observe, thanks to the registered records, the situation before and after the administration of the substance, understanding the rapid and effective effect

15. MindLAB Set and neurobiology of the relational processes: Attachment, reciprocity and Family Strange Situation Procedure

The Attachment Theory studies the patterns which are related to the parenting and the attachment processes (1958, Ainsworth, 1988, 1989).

The dynamics of the attachment is a crucial component for the developing of the relational human mind (Guidano, 1988, Liotti, 2003, Siegel, 1999). In recent years a new science based on the social psychology and the neuroscience has been developed, it is called *neuroscience of the human relationship* (Cozolino, 2006).

Inside the *neuroscience of the human relationship* field an important place is taken by the social psychophysiology, which is a specialized branch of the psychophysiology (Andreassi, 1989). In this ambit the screening of the electrodermal activity has been used as monitor of the attachment processes, showing high levels of SCL both in the caregiver and in the child who has an anxious-resistant attachment style (Lemche, Giampietro, Surguladze, Amaro, Abdrew, Williams, Brammer, Lawrence, Maier, Russel, Simmons, Ecker, Joraschky, Phillips, 2005).

At the Institute of the Psychiatric Clinic of the University of Catania, I have developed a line of research in the *social psychophysiology* ambit, which tends to study the related psychophysiological family emotional climate considering the level of the electrodermal activity (Scrimali, Grimaldi, 1991).

Such line of research has been developed referring to a series of studies which provided encouraging results (Gruzelier, Venables, 1975). Ohman in 1981, after having done a complete review of the related literature, concluded that the electrodermal parameter appear to be strictly correlated to the clinical condition of the schizophrenic patients, with particular attention to the relapses and to the episodes of clinical decompensation (Ohman, 1981).

Vaughn and Leff demonstrated that the stress caused by the environment, like the life-events or the partnership with high expressed emotionalism relatives, can increase the arousal of the schizophrenic patients, and they confirmed this data through a classic experimental research (Vaughn, Leff, 1976).

The relationship between the arousal highlighted via the electrodermal activity screening, and the exposure of the schizophrenic patients, was later confirmed by a subsequent research made by Tarrier, Vaughn, Lader and Leff (Tarrier, Vaugh, Lader, Leff, 1979).

Another potential interesting aspect of the psychophysiological techniques application, in the ambit of the multimodal study of the familiar emotive climate, can be linked to the objective valuation of the emotionalism of the schizophrenic patients' relatives. In fact it appears to be true the hypothesis that the schizophrenic patients' relatives with high expressed emotionalism have high levels of arousal which are possible to be demonstrated through the electrodermal activity screening.

Regarding this topic, several trials made at the psychophysiology laboratory of the Psychiatric Clinic of the University of Catania gave us important results (Scrimali, Grimaldi, 1991). Starting from this preliminary information I had successively developed a new multimodal assessment of the familiar relational pattern which is called *Family Strange Situation*.

Basically this procedure consists in valuating not only the patient's electrodermal activity, in presence and absence of the relatives, but even his performance for what is concerned the possibility of control of the electrodermal parameter in a biofeedback condition. More details about the *Strange Family Situation* will be explained below.

After having done the Five Minute Speech Sample in order to value the Expressed Emotionalism with all the living relatives, the patient is subjected to a procedure which can be summarized as follows:

Trial:

The patient receives a brief description of the biofeedback dynamics

The patient tries to decrease the acoustic feedback of the instrumentation (10')

The electrodermal record is registered via the computer.

II Trial:

Repeat the First Trial in presence of the relatives.

In this phase the following task is given:

To the patient:

- *Repeat what you did before trying to obtain the best possible result-*

To the relatives:

Explain briefly what the patient is going to do (*-He has to decrease the acoustic feedback and modify the analogical visual display. It is possible if he is able to relax- .*) Specific task: - *Observe his performance trying to collaborate for the best result -.*

The relatives' attitude (physical proximity, behavior, verbal and not verbal communication) is filmed with a video recorder. For what concerns the more specific aspect of the methodology, needs to specify what follows.

In the ambit of the *Family Strange Situation* the MindLAB Set and the *Psychofeedback* software are used. The software allows, as we already know, not only the memorization of the two trials, but mostly the analytic and synthetic comparison between them. In fact, once that the valuation process is done, the operator is able to show to the patient and his relatives the achieved results. In particular, the baseline record is highlighted in green, while the record obtained in presence of the relatives is in red. Moreover, the software creates a bar graph which reports the average values of both records using the same colors, green and red. In order to validate the *Family Strange Situation* an experimental research had been made.

In the research were involved 17 families where no member was afflicted by a psychic disorder. To verify the real condition of the chosen and contacted families, all the members were tested with the Middlesex Hospital Questionnaire Test. Each family was composed by the parents and one or more sons. 17 sons were chosen to perform the control group that had to be compared with the psychiatric subjects. The group was formed as follows:

Males: 7 males

Females: 10 females

Age 25, 82 +/- 5.75

Social class: middle

To activate the Family Strange Situation procedure the families were convened at the Psychiatric Clinic of the University of Catania. Only the parents participated to the session, in

the case that in the family there were brothers or sisters of the tested subject, they were not be involved in the assessment procedure. The subjects who emulated the patient's role filled the Relative Bonding Instrument.

In the table are reported the average values, the standard deviation and the conductance variance of the second trial comparing them with the first trial results of every subject. From a first analysis of the electrodermal parameter trend variation, during the second Trial, it was possible to note what follows. During the second Trial, no decreasing of the electrodermal conductance was recorded in all of the tested subjects. No modification was observed only in one tested subject.

In 16 subjects the average electrodermal conductance, during the second Trial, had increased. The average variation value observed in the whole group, during the second Trial and in comparison with the first Trial values, was 1.32 with a standard deviation of ± 1.11 .

Successively we wanted to understand if the electrodermal conductance increase in the healthy subjects was correlated with the control attitude of the parents referring to the variable *control*, investigated with the RBI. With this purpose we filled the table II, where are reported the values of the conductance variation in each subject with the average of the control values registered by both parents. We tried to find out the presence of an eventual correlation using the non-parametric Wilcoxon signed-rank test. The p resulted less than 0.05, so highlighting a statistically significant correlation.

Table I

Subject:	I Trial	II Trial	Difference
G.V.	6.68 \pm 1.58	6.82 \pm 2.35	0.14
O.P.	4.15 \pm 0.42	5.58 \pm 0.46	1.43
N.C.	3.83 \pm 1.13	4.59 \pm 1.84	0.76
G.B.	2.31 \pm 0.23	5.75 \pm 0.62	3.44
C.B.	3.08 \pm 0.66	3.52 \pm 0.34	0.44
L.D.	3.90 \pm 0.44	6.85 \pm 2.06	2.95
G.C.	2.26 \pm 0.24	4.31 \pm 0.62	2.05
A.P.	7.88 \pm 1.38	10.24 \pm 1.70	2.36
R.S.	2.27 \pm 0.90	4.71 \pm 0.92	2.44
M.C.	6.16 \pm 1.15	6.11 \pm 2.08	0
E.R.	2.92 \pm 0.29	3.25 \pm 0.43	0.33
P.S.	4.47 \pm 0.67	5.46 \pm 0.73	0.99
S.S.	5.92 \pm 0.53	6.05 \pm 0.72	0.13
L.D.	8.65 \pm 1.76	8.96 \pm 0.68	0.31
L.B.	1.90 \pm 0.29	2.40 \pm 0.25	0.50
G.C.	6.32 \pm 0.88	8.62 \pm 1.58	2.3
C.M.	5.12 \pm 0.39	7.02 \pm 1.25	1.90

Table II

Patient:	Conductance variation (microsiemens)	<i>Control</i> values in the parents
G.V.	0.14	27.0
O.P.	1.43	25.5
N.C.	0.76	25.5
G.B.	3.44	29.5
C.B.	0.44	16.0
L.D.	2.95	20.0
G.C.	2.05	8.5
A.P.	2.36	19.5
R.S.	2.44	23.0
M.C.	0.0	28.0
E.R.	0.33	17.5
P.S.	0.99	17.5
S.S.	0.13	27.0
L.D.	0.31	16.0
L.B.	0.50	22.5
G.C.	2.3	27.5
C.M.	1.90	22.5

The data resulting from the research can be summarized as follows. Firstly, the *Strange Family Situation* was found easy to manage, reliable and economic. The MindLAB Set perfectly worked and it can be used for the systematic actuation of the *Strange Family Situation*. Thanks to the experimentation that we made, we gained some base values to use as reference data for the next researches when using the *Strange Family Situation* to test systematically patients afflicted by psychic disorder.

An ulterior significant result that the research allowed to identify, is the one related to the idiosyncrasy of the *control* parameter for the determinism of the arousal emotional reaction during the familial interaction. In fact, the more is the control that the tested subject perceives from the relatives, the more appear to be the arousal reaction and so the self-control competence results lower.

The research allowed to obtain two relevant results.

The first was the individuation of the reference pattern in healthy subjects with which is possible to compare the pattern of the psychiatric patients who will be submitted to the *Family Strange Situation*. The second reached goal was the identification in the *control* process, made by the parents against the tested subject, of an important variable in order to determine the relational stress. Such observation involves considerable implications for the psychoeducation and rehabilitation treatments of the families and the patients who suffer psychic disorders.

16. Biofeedback and Psychofeedback

In my opinion, the biofeedback is one of the most interesting and stimulant innovations in the therapeutical ambit of the recent years. The innovative charge that this technique brings, both in neuroscience and in psychotherapy, has not yet exhausted on theoretical field, while on the application ambit, its accurate use can represent a *tactical instrument* of change, effective and manageable. In cognitivist ambit, the biofeedback has involved a huge number of studies, reflections and applications (Pancheri, 1979, Scrimali and Grimaldi, 1982, Scrimali and Grimaldi, 1991, Baumeister, Vohs, 2006).

The conceptual researches and elaborations developed by me over more than 30 years, have passed through the behavioral and cognitive psychotherapy evolution which have a *personal history* where is possible to identify four different phases, *behaviorist* (late Seventies), *cognitivist standard* (Eighties), *constructivist* (Nineties) and *oriented to the logic of complex systems* (two thousand years).

During this brief monograph, is not possible to completely describe the biofeedback topic (for this purpose the reader can consult the specialized monographs; Scrimali, Grimaldi, 1982, 1991; Scrimali 2003; Baumeister, Vohs, 2006), so rather it will be analyzed the topic of the *biofeedback* and *self-control* from a psychophysiological, cognitivist constructivist and oriented to the logic of complex system point of view.

The biofeedback, whose name derives from the combination of the English terms *biology* and *feedback*, is an experimental and clinical procedure, which basically consists in the proposal of presenting, with the help of suitable instrumentation, information relatives to the dynamic trend of biological functions which are obtained directly from the subject (Fuller, 1977). The main objective is to teach, to the patient, the possibility to regulate and control biological functions which usually do not depend from the voluntary control or that are not more voluntary due to a diseased condition. In the first case, a new form of biological regulation is established, in the second case it is improved, in the third it is resumed.

Examples of such different dynamics, respectively, can be the three which follow.

Generally the subject is not aware of such kind of information, but through optical displays or acoustic feedbacks is possible to let the patient identify, through a trials and errors process, the tactics that cognitively and emotionally are effective or not to take the control, so is possible to stabilize the mechanisms that lead to the specific parameter.

In this case, the purpose was to establish a voluntary control on the parameters which usually are automatically regulated, at the subcortical level. Instead, in the case of the electromyographic biofeedback, where the main purpose is to obtain a state of deep relaxation, it is important to notice that a certain awareness of the muscular tension or distention is present, thanks to the proprioceptive feedbacks mechanisms of the neuromuscular spindle.

In this circumstance the instrumental feedback does not introduce information, but rather makes it more detailed and therefore more effective for control purposes. Finally, in case of a loss of the physiologic informative feedback caused by a diseased process, the biofeedback technique performs a *vicarious function* of the physiological damaged channel. This usually happen in rehabilitative medicine, using feedback mechanisms on parameter such the position

of an art, which is not more properly communicated to the central mechanism control due to the loss of a proprioceptive feedback.

The biofeedback developing started in the United States, in the end of the Sixties, when Miller demonstrated, in the Animal, the possibility to learn the control of biological functions regulated by the neurovegetative nervous system, such the heart rate and the peripheral cutaneous vasomotor activity (Miller, 1969). In the same period, always in the United States, another group of researcher demonstrated that even in the human being was possible to reach the self-control of parameter like the heart rate, the cutaneous vasoconstriction, the electroencephalographic rhythms (Snyder, Noble, 1968).

In the Seventies the biofeedback techniques spread in America and in Europe. The microelectronic has, without any doubt, contributed to its rapid diffusion and allowed the creation of compact, easy to handle and economic instrumentation. In Italy the biofeedback developing started in the late Sixties, especially at the Psychiatric Clinic of the University of Rome where Pancheri and his group formed the Italian Biofeedback Society (Pancheri, 1979). Successively, in only ten years, the biofeedback paradigm was considerably changed, passing from reductionist conceptions to more articulated theories, basing on the *human information processing* and influenced by the cognitive epistemology (Scrimali, Grimaldi, 1991).

The first phase of the biofeedback developing both in experimental and therapeutical ambit had been strongly influenced by the behaviorist principles of the *operating conditioning* learning. For this conception the feedback plays the role of reinforcement, stabilizing the physiological responses tending to the reaching of the training objective, making less probable responses which are discrepant respect the prefixed control target.

The biofeedback setting was formed following this principles, this was the reason because the reductionist researcher tended to create devices able to grant feedback such rewards (food, or even encephalic centers of pleasure stimulations) or punishments (electrical shocks), using it on the animals.

Although if in a traditional paradigm, even in this case the biofeedback brought to light new data that put in crisis an old axiom of the behaviorist and reflexological psychology, which was the belief that the psychophysiological parameters under the control of the autonomous nervous system could not be subjected to operating or instrumental conditioning, but only to pavlovian conditioning.

This solid belief, formulated by Miller and Konorski in 1928, and that was accepted and supported by Skinner, was a sort of scientific dogma until the late Sixties (Miller, Konorski, 1928; Skinner, 1976).

In 1967, Neal Miller and his workgroup started a series of experiments which unequivocally demonstrated that a parameter under the control of the neurovegetative system such the heart rate, in the animal, could be conditioned through operating conditioning (Miller, 1969).

Once that the paradigm which brought the belief that the automatic physiological responses could not be conditioned, always in the late Sixties, some researchers began to demonstrate the possibility to acquire the control of many parameters, even in the Man, using techniques of biological feedback.

Today the conception of the biofeedback as *application of the learning principles*, through *operating conditioning*, still is accepted by many Authors. During the Eighties a new modality of interpretation based on the systems theory and on the cybernetic and informatics of the *human information processing* had developed. In the last decades the systems theory has had a rapid and intense developing in an interdisciplinary sense. For this theory, an important role is played by the study of the possibilities and modalities of integration between

control and systems, no matter if they are of physic nature, or chemical or biological (Wiener, 1966; Varela, 1986).

The regulation of the dynamic processes that take place in the human body, as in the animal, is possible especially through feedback mechanisms. The regulation via feedback of dynamic activities can be defined as a situation where the final conditions of the process can act to regulate the course of the process itself. In this context great importance assume the informative element.

It is indispensable that some kind of device is present and works as analyzer of the dynamic course of the process, which *communicates* information to the effectors mechanisms, so that they act on the process in the wanted sense. So, the cortical control system, cannot work on the muscular activities if it is not continuously *informed* of the interested skeletal segments position, of the pressure exerted on the skin and of the tension or distention grade of the different muscular groups involved in the related movements.

The cortical nervous system is not able to properly control activities such heart rate, arterial pressure or cutaneous vasoconstriction, not due to the lack of effectors mechanisms and circuit, but for the lack of informative channels. In fact, the data which are related to the trend of the cited biological functions are channeled at the diencephalon level and they do not reach, if not in a very small measure, the level of the cerebral cortex

The biofeedback techniques form, using a set which is composed by electrodes or a transducer, instrumentations able to analyze and elaborate the signs related to the monitored parameter. The displays are important, both acoustic and visual, and execute the crucial function of enabling the sensorial channels (usually the acoustic and visual channel) to receive information about the trend of the monitored biological functions.

The acoustic feedbacks can only be analogical and synchronic, while among the visual feedbacks there are three different typologies: diachronic analogical (Record), synchronic analogical (Led bar) and synchronic digital (Numerical display).

Now we have to establish what really happen when the dynamics of autoregulation, made possible by the set of instrumentation which forms the biofeedback setting, are enabled. In accord with the *cognitive biocybernetic logic*, the control exerted on functions which usually are involuntary, would be expressed through a conscious and voluntary process. So, the feedback is not a *reinforcement*, but rather a *message*. Such interpretation of the biofeedback dynamics is at the base of the Brener theory, who creates an informative model of the self-control through biological feedback (Brener, 1974).

For the model of Brener, the possibility of control on a specific biological function is correlated to the amount of available information, at conscious level, about that function. Therefore, the biofeedback would be a technological modality to activate or increase the control of biological functions, establishing or improving the informative feedbacks that bring to the consciousness the dynamic trends of the controlled parameter.

Basing on my personal interpretation of the biofeedback dynamics, since the beginning of my researches and clinical experiences, I have agreed to the *biocybernetic model*. The cognitivist constructivist epistemology which I have referred to, since the first Eighties considered totally inadequate the reductionist model about the learning through conditioning. Only in the first years of work with the biofeedback, while I was a medicine student yet (Seventies), I referred to the behavioral orientation of the *operating conditioning*.

When I approached the cognitivist ideals, it appears to me that a paradigm of biological functions learning where the human body is seen as a sort of *passive receptor of reinforcements* cannot be proposed. Instead I have considered a model where the subject has to acquire new autoregulation skills, is considered active, determined by a feedforward to

execute a continuous series of control experiment through the elaboration of different mechanisms, tried and successively adopted or discarded depending on the feedback result, if the feedback is positive or if it gives back a falsification message which nullify the used tactic.

Until now I have described the biofeedback as a simple self-control dynamics of biological parameters. But since it has considered a potential therapeutical instrument many other questions and problematics have been pointed out, and so the biofeedback therapeutical dynamics has not a univocal model.

About this topic I would like to highlight that even in this context a process similar to the one described above had been repeated. In fact, the dynamics of this new and revolutionary therapeutical process was early put into a reductionist orientation, referring to the epistemological background of a medicine discipline like the pharmacology.

A dichotomous model was proposed for the biofeedback, considering only the *specific effects* and the *aspecific effects* or placebo of whatever pharmacological therapeutical instrument. Consequentially, many researches had been made, with the tendency to isolate the variables to emphasize on an unequivocal specific effect (motor function control) which significantly operates in the therapeutical process, while for the aspecific factors like the expectations or the modifications of theories, a slight and not determinant influence should had been shown.

In few words, the biofeedback should had been work like a technological pill and demonstrates an unequivocal specific control effect on the biological variables, exactly like a medicine which has to do a clear and documentable pharmacodynamic action on a definite biological substrate. A conception of this kind is clearly influenced by the reductionist background of the contemporary medicine.

I must admit that at the begin of my biofeedback research work I was very slightly affected by these theories, in fact I made some *biofeedback training – placebo* experiments which purpose was to find a specific therapeutical effect (psychophysiological) of an electrodermal biofeedback technique. Successively, I felt unsatisfied by this type of interpretation of the biofeedback therapeutical dynamics, so I developed a more complex theory with Chiari (Chiari, Scrimali, 1984).

For this new conception, the dichotomy between *specific affects* (specific biological parameter control) and *aspecific affects* is unrealistic, because the cognitive factors are already involved during the dynamics of the control, as I have duly stressed, showing the *biocybernetic model* of the biofeedback.

Therefore, if there cannot be control without the intervention of the cognitive factors, all the more so there cannot be a therapeutical effect without any modification of the skills system of the patient both at tacit and explicit level. So I believe that the control of the monitored parameters proceeds together with the building of new modality of interpretation of the external reality and of the self, meant in biological and psychic sense, and even to the developing of new abilities. The different modality of interpretation of the external reality and the building of new skills lead to an evolution of the personal identity, which will be more adaptive, and this would be the most important result of the therapeutical change obtained by the biofeedback training.

Until now I have talked about the biofeedback techniques describing how it is possible to establish and take a therapeutical advantage from the biological feedback of different parameters. At this point it occurs to notice that the biofeedback main topics are different among them, distinguishing if we talk about screening of *physiological parameters* or *psychophysiological parameters*.

For this distinction I need to refer to the biofeedback definition: - *an experimental and clinical procedure which consists in the presenting to the subject information related to biological functions of his organism, with the help of suitable equipment.* - I want you to notice how the biological functions of the organism which usually we refer to, can be of different kind.

In particular, is possible to distinguish some *biological parameters* which execute somatic activities, and *psychophysiological parameters* which instead regard psychic functions. A biofeedback technique that starts from the screening of a biological parameter such the muscle tone aims to the somatic control, while other kinds of biofeedback such the ones of the electroencephalograph rhythms and of the electrodermal activity aim to the emotive and cognitive self-control. In this regard, Pancheri and Chiari operated in 1979, establishing the distinction between the *direct feedback* and the *indirect feedback* (Pancheri, Chiari, 1979).

In 1980, in occasion of the II Congress of the Italian Biofeedback Society I proposed to define *physiofeedback* or physiological feedback the direct feedback and *psychofeedback* or psychophysiological feedback the indirect feedback.

More immediate is the *physiofeedback* topic, which involves the control acquisition of a specific function, and therefore involves only physical problems, already well studied and solved (for example the EMG-feedback, the muscular activity dynamics); more complex and ticklish is the *psychofeedback* topic, which refers to the psychophysiological thematic.

Is not superfluous notice that some biofeedback techniques can assume either *physiofeedback* or *psychofeedback* connotation depending on the utilization. Is typical the example of the EMG-feedback, which is a *physiofeedback* when is used for the bruxism therapy (data acquisition of the chewing muscles and tone control of the same muscles), while it becomes a *psychofeedback* in other cases (data acquisition from the frontal muscle and control of the emotive level).

The concept of *psychofeedback* presupposes the possibility of screening of a biological parameter as index of psychic phenomena at cognitive and emotive level. At the present studies and researches state, the two biofeedback techniques which satisfy the definition of psychophysiological feedback are the biofeedback for the electrodermal activity and the biofeedback of the electroencephalographic activity, in particular the alpha-training. The EMG-biofeedback made screening the frontal muscle tone, even if it has been widely used for the purpose of modify the emotive situation of the patient, it appears to me, after several experimental and clinical data, not suitable to be used in a psychophysiological ambit in the context of a cognitivist psychotherapy. The reasons are the following.

Firstly, it has not been demonstrated that the relaxation of the frontal muscle corresponds, in every patient, in a generalized muscular relaxation. Moreover, has been documented by Crebelli, Delle Chiaie and Valletta that the *tension* of the frontal muscle does not correlate significantly with the treatment result (Crebelli, Delle Chiaie, 1984).

The EMG-training, made to obtain a muscular relaxation, can be considered into the relaxation techniques, this does not allow using the biofeedback setting as a situation where is clearly possible to analyze the emotive reactions, get a sense of the dysfunctional schemes and to analyze and falsify wrong belief systems.

As I will explain later, the interpretation of the biofeedback therapeutical dynamics in cognitive psychotherapy is linked just to these factors which are particularly present in the biofeedback of the electrodermal activity and of the electroencephalograph rhythms. In fact, these parameters are well correlated to the emotive variations and to the cognitive activities, they allow to set up a psychotherapeutic treatment plan where the most important target is not the self-control meant in a reductionist way considering the decrease of the functioning level

of the monitored parameters, but rather the analysis and the modification of the disadaptive awareness systems at tacit and explicit level.

Most of my clinical and research work, has taken place in the psychophysiological biofeedback context, where I have deeply studied the electrodermal and the electroencephalographic feedback. For this topic it occurs to notice that if in literature does not exist a disagreement on the validity of the electrodermal parameter, such the screening of the patient's emotive and cognitive conditions for the electroencephalographic feedback of the alpha rhythm, it does not mean that the literature data are free of ambiguity and unequivocal (Boucsein, 1992).

The very first phase of the biofeedback developing in psychotherapy sense, took place in the so-called *relaxation techniques* ambit. In fact, since many years there was developed various methods with the purpose to let achieve a psychophysical relaxation to those who practiced them. The most noteworthy were the autogenic training of Schultz and the muscular relaxation training of Jacobson (Schultz, 1960; Jacobson, 1929). Such techniques were used autonomously, to allow the neurotic patients to reacquire a certain emotive control, and in more complex treatments such for example the progressive relaxation of Jacobson, in the *systematic desensitization* (Bertolotti, 2005).

The last cited technique which is fully described and interpreted by Wolpe, according to a reductionist and behavioral epistemology which identified the therapeutical rational in the principles of *reciprocal inhibition*, was already well spread in the Sixties (Wolpe, 1958).

So, when the relaxation techniques through biofeedback started to be affirmed (EMG-feedback, electrodermal-feedback), some Authors thought to use the new therapeutical instrument into a method which accord to the epistemological setting of the systematic desensitization. The first data about the biofeedback utilization in the *systematic desensitization* ambit was written in the early Seventies (Rappaport, 1972).

In Italy, the first experiences of integration of the biofeedback in the ambit of the *systematic desensitization* treatment, was made and published by my work group and successively by Chiari and Mosticoni (Scrimali, Grimaldi, Aguglia, 1978; Chiari, Mosticoni, 1979).

Is necessary to emphasize how during the first phase of the biofeedback utilization into the psychotherapy context, was not used a new paradigm, the operators just observed that the use of biological feedback techniques, in the *systematic desensitization* ambit, allowed making the treatment more effective. This higher efficiency was attributed at the larger depth of relaxation and to a faster learning of the self-control. The cognitive factors that the biofeedback introduction brought to the *systematic desensitization* paradigm was quite put into the background.

The first two Authors who properly analyzed the biofeedback topic from a cognitive point of view were Lazarus and Meichenbaum (Lazarus, 1975, Meichenbaum, 1976). Lazarus interpreted the biofeedback technique, in psychotherapy ambit, as an instrument able to increase the *coping* skills of the patient against the feared situation. For this Author, the quantity of anxiety felt by a subject in any problematic situation is inversely proportional to the awareness to have behavioral and cognitive suitable instruments to effectively manage and solve it.

The consciousness of the possibility of controlling the emotive reactions, developed during the biofeedback training, would cause an increase of the coping skills against the feared situation. The Lazarus formulation is very interesting, in fact in 1981 I planned an experiment to study the coping attitudes against the acoustic and unpleasant stimuli, in normal patients and in anxious patients, but the main purpose was to see if a training based on the

Electrodermal Biofeedback could modify over time the coping skills of the anxious patients and at the same time the representative style (Scrimali, Grimaldi, Rapisarda, 1983).

The results of the research were positive, this made me definitively abandon the paradigm of the reciprocal inhibition in favor of an epistemological conception of the biofeedback, marked by a cognitivist formulation, in psychotherapy. I was even inspired by the theories of the cognitive factors in therapies with biofeedback, formulated by Meichenbaum. For this Author a biofeedback training is composed by three phases: the first, initial conceptualization; the second, acquiring skills and making experiments; the last, transfer to the real situation what just learned during the treatment.

At these three phases can be overlapped the three stages described by the cognitivist self-control theory, proposed by Meichenbaum. In the first the patient starts to self-observe his behavior and his physiological responses; in the second new cognitive processes and behavioral skills start to develop; in the third and last stage the belief system of the patient undergo a restructuring.

The conception of Meichenbaum shows, finally in a clear way, that the learning of a self-control skill is therapeutic in the same measure as it can modify the knowledge system of the patient. Such conception is the reference point of my biofeedback dynamics conceptualization in psychotherapy, conceptualization which I formulated and systematized with Chiari. For this formulation, in the biofeedback training there would be three phases, a *self-observation* phase, a *modification of the instructions* phase, and the *restructuration of the belief systems* phase. The self-observation phase consists in the explaining and clarifying to the patient the dynamics of the anxious pathology, in relation with the feared situation, focusing the attention on the behavior, on the internal dialogue and on the emotive reactions which he shows during the problematic situation.

Such work is completed by a series of psychophysiological and cognitive-behavioral trials which purpose is to show the arousal reaction of the patient against simple sensorial stimuli, his capacity to manage the stressful situations and his attitude to try to solve the problems in a constructive way and without the use of avoider tactics.

The results of this assessment phase are shown to the patient. Usually from this data emerge the difficulties of the patient to live well the arousal conditions and the deep belief, referring to present, past and future, that there is no possibility of emotive control. This is associated with a general inability to positively face and manage the situation characterized by negative emotions (reduction of the *coping skills*) and an almost constant present low confidence in the own efficiency to manage the problematic situation.

The second phase, *modification of the instructions*, has as purpose to *train* the patient and so let him learn the emotive control, successively to improve his *coping skills* and his *self-efficacy*. These targets are obtained through the biofeedback training.

The training of the patient with the instrumentation gradually falsifies his belief about the impossibility of arousal control, increases his *resilience* skills through the coping practice made against experimental stressors, and the result would be an improvement of the confidence in himself (*self efficacy*).

The new situation results to be incongruous with the previous dysfunctional beliefs, and such incongruity which is a proper *cognitive dissonance*, can lead the patient to a general review of the self-image, through a modification of the *internal dialogue* and the *representative style*, which is originated by a progressive loss of the escape behaviors and a gradual establishing of active behaviors which tend to front the feared situation.

So a proper *cognitive restructuration* occurs. Ultimately, the therapeutic dynamics of the biofeedback can be attributable, for the just described conceptualization, to the following factors:

- Control of the psychophysiological anxiety factors;
- Restructuration of the beliefs regarding the anxiety problem;
- Increase of the *coping* and *resilience* skills
- Increase of the *self-efficacy*.

From my constructivist point of view, I highlight the fact that the new acquired emotional autoregulation skills modify the construction of reality by the patient. Now the lived life-events (the panic attack, for example) have lost their *threat* and *strangeness*, becoming auto-referred processes, which can be fronted and explored. A *progressive sliding* into the *personal identity* area starts to appear. The patient's old memories linked to experiences of loss of control, escapes and avoidances, therefore failures, do not affect the present as they used to do, and instead the representation of himself as able to regulate the emotional process, front the problems and explore the own world tend to consolidate.

The last and more recent conceptual elaboration on the biofeedback topic, that I have developed, is the one referred to the logic of the *complex systems* (Skarda, Freeman, 1990; Scrimali, 2001). In accord to this conception the biofeedback would not essentially be a *self-control* process, but rather a *self-regulation* process. In the ambit of the so-called techniques of self-relaxation, which includes the *Autogenic Training* of Schultz (1960) and the *Progressive Muscular Relaxation* of Jacobson (1929), the main target is to reduce *the complex activation level of the organism*.

This target is achieved with methods which purpose is to reduce the *ergotropic* attitude of the organism, the one which is present when the subject has to front demanding activities to promote the so-called *trofotropic* attitude, which decreases the energy expense and favors the restore of optimal levels of functioning of the organism. To practice such techniques is requested a setting which can favor the reduction of sensorial input, therefore suffused light and eyes may closed, pleasing sounds and perhaps relaxing music. Even the assumption of postures tending to favor the relaxation is prescribed, as the ones represented in the

For the processual systemic point of view which I have just described, minor importance is attributed to the concept of *relaxation* and more emphasis is attributed to the *autoregulation*. Basically, is proposed to the patient to acquire the skill of self-observe and manage the emotions in vigilance state and in a setting similar to the reality of every day.

Most of the patient whose I propose the *Psychofeedback*, made through the MindLAB Set and the relative software, systematically tend to close their eyes and often they complain about the acoustic feedback because them would be *stressful*. In this case is needed to explain to the patient that is not a *relaxation technique* but an *autoregulation process*, which has to be implemented in a situation similar to the real life. If the patient is seized by a panic attack while he is driving the car, surely è cannot close his eyes and *relax*, instead he should try to *regulate*, modifying the *internal dialogue* and reducing the emotional activation, exactly what he learns in a sessions with the MindLAB Set.

Therefore, is easy to understand that the self-control is a new skill that involves new balances between the cortical frontal systems and the limbic and hypothalamic structures. The new balance is not characterized by the recent conception of the complex dynamics and not linear

systems logic, so by a simple top-down control where the frontal system (top) takes the control of the limbic system (down), but it is a new dynamics where the process of cortical regulation produces a new balance condition distributed among the different systems through recursive mechanisms of feedback.

In fact, the regulations of the complex processes in a dynamic system which is not linear and far from the balance, do not occur according to a *top-down* logic, from the more evolutes to the more archaic, but according to a *recursive dynamics* where new patterns of balance emerge. Essentially, talking about the biofeedback is too simplistic think that the cortical frontal structures *take the control* of the limbic structures which are more archaic. In fact, we find a new dynamic balance which is more adaptive in the communication between cortical frontal centers of the neopallium and limbic emotional structures of the archipallium. The whole system evolves and it is reset in new dynamics, moving towards more evolved balances of a new different *chaotic attractor*.

17. Mindfulness, MindLAB Set and Synchronic Mind Training

The *mindfulness* thematic, which is strictly linked with the meditation topic, implies the possibility that each subject is able to reach, through a process of studying and learning, the systematic production of *specific states of mind*, which have a therapeutical value in a wide range of fields. Literary, the *mindfulness* term describes a positive state of mind that is possible to obtain thanks to a gradual learning. It is a condition where the attention is focused on the *here and now*, it keeps away from the future problems or from what happened in the past and it includes, in a positive and benevolent awareness, all the body information which are often neglected (Giommi, 2005).

The mindfulness techniques are inspired by ancient oriental practices of meditation, like the Vipassana, but they have been developed in a specific logic for being easier to apply even in the western world. One of the most important conceptualization in the mindfulness ambit tells that the life of every man is very often turned in a condition which is defined *automatic pilot*, a life based on stereotyped mental processes, repetitive and that impoverish the rich human being creativity and the freedom of the subject. The target of the mindfulness practise is to come out from the automatisms and from the external negative conditionings, in order to improve the awareness of the mental processes and use them harmonically and positively.

The author who has created a mindfulness standard method is John Kabat-Zinn at the University of Massachussets in Boston (Kabat-Zinn, 2005). The great development of the applications of mindfulness techniques in many ambits, from the improvement of the quality of life (health psychology) to the medicine and the clinical psychology, has promoted the development of researches which purpose is to document the mindfulness effect on the central nervous system, using functional and morphologic cerebral screening methods.

These studies tend to demonstrate that the right hemisphere appears to be more involved especially at the right prefrontal cortex level. Daniel Siegel deepened, on his book *The Mindful Brain*, a series of studies and researches that link the mindfulness thematic to the functional and morphologic study of the central nervous system, using a scientific approach based on the neuroscience (Siegel, 2007). The American Author particularly focuses his attention on the processes of neuronal integration and emotional autoregulation, processes that seem to be activated by the mindfulness.

The cerebral areas identified as involved in the processes of development of new neuronal network seem to be localized in the middle prefrontal cortical region. Siegel highlights how these areas and the relative neuronal network are responsible of crucial psychic processes such the regulation of the physical activities (trofotropic versus ergotrophic), the inter human functional communication, the emotional regulation, the possibility to plan and implement flexible and weighted responses to the environment demands, the empathy, the meta-cognitive self-control capacity, the fear modulation, the intuition and the moral sense. The importance and the large number of the involved processes explain the great therapeutic potential of the mindfulness and of the regulation of such neuronal circuits.

The mindfulness was integrated in the cognitive orientation treatment of the depression by Segal, Williams and Teasdale with the specific purpose of reduce the relapse ratio and

seriousness teaching to the patient how to inhibit the painful symptomatology of the brooding about the past which would be one of the relapses causes (Segal, Williams, Teasdale, 2006). My recent researches have turned on the mindfulness topic combining it with the possibility of screen and receive feedback from the electrodermal activity and therefore in a *psychofeedback* condition. So I have developed an original approach to the mindfulness based on the neuroscience, and supported by the experimental acquisition achieved at the experimental and clinical psychophysiology laboratory of the Psychiatric Clinic of the University of Catania and at the Superior Institute for the Cognitive Science (Scrimali, 2006 b).

In the context of this ambit of studies and researches, I have developed an innovative form of training which I defined Synchronic Mind Training (Scrimali, 2006 b). The denomination of this therapeutic technique is referred to the concept of *diachronic mind* and *synchronic mind* (Scrimali, 2006 a).

A peculiarity of the Homo Sapiens is the cognitive and digital mind, typically diachronic, able to remember the past and to look at the future in a proactive way. In a healthy state, the two mind systems should work in a dialectical but harmonic way. In pathologic situations instead, the diachronic mind digital activities produce a continuous brooding about the past and an incessant pessimistic vision of the future. Such attitude is very evident in the depression but even in the obsessive-compulsive disorder. In the first case is especially present the phenomenon of the *rumination*, in the second the phenomenon of the *worry* (Davey, Wells, 2006).

In such circumstances the *Synchronic Mind Training* can play a positive therapeutical action, however integrating in a change project strategically oriented to the progressive restructuration of the dysfunctional mental processes.

The *Synchronic Mind Training* can be defined as the trial to actively achieve a mind condition similar to the one described in the mindfulness and based on positive attitudes of the frontal circuits both limbic and hippocampal, with the help of psychophysiological instrumentations able to grant a feedback.

As I have pointed out when I described the cerebral base of the electrodermal activity, this parameter provides information just on the condition of the frontal areas, the limbic system and the hippocampus. Consequently the screening and the biological feedback of the electrodermal activity seem to be methods additional to the classical mindfulness techniques.

The mental condition, produced during the Synchronic Mind Training, is characterized for the following aspects and relative processes:

Non-conceptual

Arrest of thoughts flow (cognitive activity of the left hemisphere) and activation of the analogical mind (right hemisphere) with the images search;

Focused on the present

The diachronic mind, linked to the past and proactive about the future, has to be *off*;

Non-judgmental

Every content or state or mind, which can arise, has to be temporarily accepted and not discussed;

Intentional concentration of the attention

Is needed to pay much attention to the acoustic and visual feedback provided by the instrumentation;

Synthetic

Must take into account at the same time (synchronically) of the body and of the mind;

Tending to the exploration

Is necessary to discover new mind conditions through the research and the positive feedback provided by the instrumentation.

Liberating

The training experience has to create a sense of release from the constraints of the diachronic mind (past and future) and from the disturbing mental activities. The Synchronic Mind Training has to teach to the patient to reach a linear state of mind able to stop this brooding process. The training last six sessions, made with the MindLAB Set. Once that the patient learned the condition of *synchronic mind*, he has to practice it daily for at least 15 minutes and even during the daily routine as if it was a base attitude of his mind.

In the obsessive disorder the methodical allows the patient to observe the automatic mental processes related to the obsessions with detachment and without judging, as if he observes them from the outside, in this way he can avoid the activities of mental neutralization and rituals actuation at behavioral level.

Actually at our laboratories are ongoing a series of controlled researches concerning the application of the *Synchronic Mind Training* in the pain therapy, in the obsessive disorder, in the gastroenterology, for the asthma therapy, in cardiology and in the parturition preparation.

In order to allow the readers the accomplishment of the *Synchronic Mind Training*, I briefly report some practical indications. The first step is to provide to the patient the instructions related to the Psychofeedback which have to be implemented with the MindLAB Set. Once activated the MindLAB with the Psychofeedback software, we will provide to the patient the following preliminary instruction:

- The instrumentation performs a screening of the emotive activation. The acoustical and visual displays provide information. The information serves to regulate the mental condition. During the training you have to focus the attention on your condition moment by moment and on the here and now avoiding to project in the future and to linger on the past. -

After being sure that the patient has understood the dynamics of the emotional self-control through Psychofeedback, provide the following instructions:

- The training serves to learn how to produce and maintain a state of mind that is characterized by the following aspects and relative processes. –

Now show and explain the *Synchronic Mind Training* features, which are described in the previous pages, explaining them in a simple and chatty way.

If the patient is able to produce a *synchronic mind* condition and reduce the emotive activation, it will be possible to observe in the record a progressive rarefaction of the spontaneous phasic responses linked to the cognitive mental activities and at the same time the *Skin Conductance Level* values will decrease. Once obtained this result, it is important to encourage the patient to *photograph* the new state of mind that he was able to create so he can recreate it at home without the instrumentation practicing this typology of mindfulness for at least 15 minutes a day. The new acquired ability will be used as competent management process against the dysfunctional processes of the *rumination* and *worry*.

18. Areas of use of MindLAB Set

The MindLAB Set as well as the *Psychofeedback* and *Synchronic Mind Training* techniques, appears to be particularly useful in the context of *complex therapeutical protocols* (Scrimali, 2003). The consideration that a crucial component of every psychic disorder is the incapacity of the patient in the regulation of his own emotions, is one of the most discussed reflection among the psychiatrists, clinical psychologists and psychotherapists since the 18th century, with the theorization of Pinel about the incapacity of the alienated to regulate their emotions and so on the need of create treatments (then predominantly custodialistic) which can manage better such problem (Pinel, 1987).

In this monograph is not possible to retrace properly the development of the conception of emotional autoregulation and the entire complex development of the psychoanalytic, behaviorist and cognitivist movements. I would like to point out that, in the ambit of the systemic and complex cognitivist orientation, the emotional autoregulation techniques can be inserted as tactics of complex and well-structured strategies of change.

Moreover note that is not only a matter of *control* the emotions, but rather of learning to *recognize* and *self-report* them, instead of considering them as *external and pathological symptoms* which have to be modulated. Therefore, the critique that comes from many gestalt or psychodynamic orientated psychotherapists who think that the *Psychofeedback* techniques serve only to hide the problems is inadequate and inaccurate.

In the therapeutical work that I propose, in the ambit of the protocols that I have developed, the self-observation is a crucial component of the psychofeedback *techniques*, and therefore I do not define them of *self-control*, but rather of *emotional autoregulation*.

Psychofeedback and Synchronic Mind training have been experimented in different areas of use such:

18.1. Mental disorders

In this field I have made the major part of research and clinical experiences inserting the use of the MindLAB into the different protocols with a cognitivist and complex orientation developed by me for the treatment in the following disorders (Scrimali, 2003, 2006).

- Panic disorder with or without agoraphobia (*Dedalo* protocol)
- Obsessive compulsive disorder (*Sisifo* protocol)
- Mood disorders (*Galatea* and *Eolo* protocols)
- Disorders related to substances addiction (*Dionisio* protocols – a set of various therapeutical programs for each substance that leads to the addiction)
- Eating disorders (*Fineo* and *Tantalo* protocols)
- Personality disorders (*Polifemo* protocols – a whole family of different protocols for the different personality disorders)
- Schizophrenia (*Negative Entropy* protocol)

18.1.1. Panic disorder with or without agoraphobia (Dedalo protocol)

The new emotional autoregulation skills, acquired through the *Psychofeedback*, make the patient more able to manage the critical situation in a qualified way, increasing his coping skills. Even the *Self-efficacy* and *mastery* increase.

18.1.2. Obsessive compulsive disorder (Sisifo protocol)

Acquiring the skill to reduce the anxiety can make superfluous the behavioral or cognitive ritual that the patient habitually uses as dysfunctional mechanism of coping. The *Synchronic Mind Training* practice promotes the development of the right hemisphere, which is lacking in the obsessive patient, and a better integration between emotion and cognition.

18.1.3. Mood disorders (Galatea and Eolo protocols)

In the depression the acquisition of the *Synchronic Mind Training* skills makes possible in the patient to effectively contrast the *brooding* phenomenon, which is one of the dysfunctional process present in the pathology. For the maniacal patient the reduction of the arousal allows to reduce his excessive activation level and to better regulate dysphoria and impulsiveness.

18.1.4. Disorders related to substances abuse (Protocols Baccheia)

The emotional regulation, in the addiction treatment, works in the trial of not take the substance, which often is used as self-medication or to improperly manage negative emotions like anxiety, frustration and sadness. Moreover, the self-control skill, acquired through the *Psychofeedback*, can be used to manage the craving.

18.1.5. Eating disorders (Fineo and Tantalo protocols)

In the bulimia (Fineo protocol) and in the anorexia (Tantalo protocol) the emotional autoregulation skills that can be promoted by the *Psychofeedback* and *Synchronic Mind Training* practice, can be very useful to manage the binge eating impulse, the vomiting impulse and to control the rumination and the worry that follow the fact that the patient ate more than he/she wanted to.

18.1.6. Personality disorders (Polifemo protocols)

The personality disorders are characterized by a strong difficulty to manage the relational dynamics. This dysfunction is imputable to a gap of the emotions regulation processes which activate during a relational dynamics, and even to the difficulty that the frontal lobe structure has to correctly plan the operative sequences that instead activate in an incoherent and chaotic way. The *Psychofeedback* and *Synchronic Mind Training* practice can improve the integration between the cognition and the strategic planning skills of the frontal structures with the limbic system structures.

18.1.7. Schizophrenia (Negative Entropy)

In the schizophrenia, the possibility to learn how to regulate the arousal, through the *Psychofeedback* practice, is a precious instrument of coping against the hallucinations and in general against the psychotic decompensation.

18.1.8. Stuttering

The biofeedback techniques are indicated in literature as an useful methodology for stuttering treatment, to reduce the arousal and give to the patient the emotive self-control skills (Craig, Cleary, 1982).

Some research and clinical experiences, made at our laboratories of the Superior Institute for the Cognitive Science using the MindLAB, have provided encouraging results. In fact, the MindSCAN documents high arousal levels while the *Psychofeedback* allows the patient to acquire new skills of emotional self-regulation, useful to reduce anxiety which activates and maintains stuttering.

18. 2. Psychosomatic area

Even the psychosomatic area has been deeply studied by me, the results have been positive and they confirm the already existent and encouraging literature data, especially referring to three fields, the *arterial hypertension* treatment, the *irritable bowel syndrome* and the *premenstrual syndrome* treatments. (Baumann, Ziprian, Godicke, Hartrodt, Naumann, Lauter, 1973; Walter, 2006; Peper, Gibney, 2003).

18.3. Meditation, Mindfulness and Music therapy areas

In this context I have made several researches with the MindLAB Set, they confirm the effectiveness of such methodology which clearly documents the modification of the *state of mind* that is possible to achieve with meditation, mindfulness and music therapy (passive listening) techniques.

18.4. Sport Psychology

This field, even if actually is the one less explored in my researches made with the MindLAB Set, has already started to show encouraging results in the management of the preagonistic and agonistic anxiety in sports where the emotive variables are crucial, as for example the skeet shooting.

19. MindLAB Set and a training projects in the educational field

In the educational field, the curricular activities can be integrated by a didactic work based on *projects* able to introduce and implement innovative didactic processes even with the help of resources which are external to the scholastic ambit (Scrimali, Grimaldi, Rapisarda, 1983).

In this context the MindLAB Set has been used in an experimental work realized in collaboration with a secondary school of Enna where we proposed a *project of health education* based on the theoretical-practical study of the relationship mind-brain problematic made in class (Scrimali, Tomasello, 2009).

Moreover, we pointed out the importance of the health meaning, not as the simple *absence of disease*, but rather as promotion to a *full welfare* that can be achieved mostly with the understanding of the specific emotive, cognitive and relational dynamics that are part of each person. An ulterior aspect, which was deeply treated with the students, was the possibility to acquire an emotional autoregulation attitude that turn in a better management of the different emotive problems.

The development of such kind of *project* took place after the realization that the actual scholastic programs are especially finalized at the knowledge of the *external reality* and very little time is spent for the understanding of the crucial fact that a positive and harmonic development of the human life requires also the capability of self-observing and of regulating own emotions, both in the psychic personal life and in the relational field.

In fact, recent researches demonstrate that the practice of the self-observation and of the mindfulness promotes the development of better relational skills, enhancing the activity of the *social brain*. This aspect seems to be crucial if we consider the actual relational difficulties of the adolescents and their growing closure in a selfish, competitive and basically inclined to the alienation world (Siegel, 2007).

So I have developed, successively proposed and then implemented a didactic program that is formed by a preliminary theoretical part, aimed at explaining to the students the history and the dynamics of the mind-brain interaction. Successively it was introduced and then discussed the usefulness of promoting in the evolutive age, not only the knowledge related to the external world reality, but even and most of all to the processes of mind. A brief hint about the mindfulness topic completed the theoretical part.

After having treated in class the just outlined topics, the learning and experiential experimentation phase started, explaining to the students how the MindLAB Set, through the application of modern neuroscience principles, can make possible the visualization of emotive and cognitive mental processes.

We created an enlarged setting where we used a video projector that allowed the whole class to observe the trend of the electrodermal activity during the screening trials.

Every student was subjected to a four minutes recording of the electrodermal activity using the MindSCAN software. Successively each member of the class could try to acquire the base emotional autoregulation elements through the implementation of biofeedback and mindfulness techniques, allowed by the utilization of the *Psychofeedback* program.

The values of the electrodermal activity, observed and recorder (to each student was delivered the own MindSCAN record print), and the trend of the autoregulation trials were discussed in group.

The project, which was developed by me, had been realized in class by a Psychologist, Dr. Damiana Tomasello in collaboration with the teachers.

The experimentation achieved very positive results. All the students participated with enthusiasm and emotive involvement to the study of the new possibility of understanding the relationship mind-brain, made possible by the recent developments of the neuroscience and the use of the MindLAB Set. Many students showed high electrodermal conductance levels and they demonstrated to be very interested in a possible attainment of emotional autoregulation skills that could be eventually developed outside the class context, in a specific *psychological counseling* setting. In conclusion, the experience implemented and described in this chapter, provided positive feedbacks to the hypothesis of spreading the MindLAB Set in a scholastic and educational context in order to promote the knowledge of the own emotional dynamics.

This has prompted me to develop a MindLAB Set specially designed for the application in the scholastic ambit. In this case the kit is fulfilled with printed material which has to be provided to the students for the deepening of the proposed topics and with multimedia material for the presentation in class of the issues that are at the base of the MindLAB Set and Health Education project.

The interested people can get ulterior and more detailed information about this topic visiting the website www.psychotech.it.

20. Making researches with MindLAB Set and publishing results

In this part of the monograph, I would like to briefly provide some indications to the MindLAB Set users who would make research works and spread the results of their studies publishing them.

The experimental design could consist in the documentation and in the comparison of sequential processes that are performed in the same group of subjects or patients. This design is defined *repeated measures in the same sample*.

An ulterior kind of research can be aimed to the comparison of the data obtained with the MindLAB Set in different conditions and in different samples. In this case we talk about an *experimental design relative the comparison of two samples*.

Naturally, in this circumstance the two samples have to be homogeneous in all the variables which not interest the result of the study such age, sex, culture and the only difference has to be the variable that you want to study. For example, an anxiety condition presence.

A prototype of the first type of research could be the documentation, in the same healthy sample, of the possible effects of different music track. For example, some *relaxing* tracks and some characterized by *peppy* rhythm and sonority. In this case, the MindLAB Set can be used to record in an objective way the effect of the passive music listening on the emotive variables.

An ulterior example of such kind of research could be the one where you want to document the effect of meditation techniques on the arousal. Even in this case the correct procedure would be to measure the condition of a certain number of subjects in a normal condition of relaxation and then during the meditation activity.

From a technical point of view, some important indications for making researches with the MindLAB and share them, for example, through a scientific publication, are the following.

Control group

When you create control groups you have to be sure that all the included subjects do not unconsciously have any clinical symptoms or some psychopathology elements that can affect the research. For this purpose I suggest the systematic use of the test called *Crown Crisp Experiential Index*, which is composed by a series of scales able to identify dysfunctional levels regarding the following parameters: anxiety, phobias, obsessions, somatizations, depression and hysteria. The test was expressly developed for the screening of normal subjects' samples (Crown, Crisp, 1979).

Patients group

The diagnosis must be made with a standard diagnostic and statistic system, the Diagnostic and Statistical Manual of the American Psychiatric Association (American Psychiatric Association, 1997) or the International Classification of Diseases of the World Health Organization (World Health Organization, 1992).

Conditions of state

Besides assess that in the control subjects, there are not pathologies, using the Crown and Crisp questionnaire, can be useful to measure the subjective valuation of the patient, his emotive condition in the *here and now*. For example, if you want to study the effect of a meditation technique or of the music listening in a specific group of subjects, you could combine the measurements obtained through the MindLAB Set with the self-valuation of the condition of state made by the patient answering to the Profile of Mood States questionnaire made by McNair, Lorr and Doppleman (1991).

When you have to proceed at the publication of the work, is necessary to keep in mind the classic presentation in accord with the international rules, which I report for convenience:

- Introduction
- Subjects, Materials and Methods
- Results
- Discussion
- Conclusions
- Bibliography

In the ambit of the items *Materials and Method*, is necessary to indicate the MindLAB Set and the used methodology, it can be easily described by copying and pasting the following lines:

Materials

The measurements of the exosomatic electrodermal activity, tonic and phasic, were made using a MindLAB Set by Psychotech (www.psychotech.it), connected to a computer through the express supplied cable. The computer was equipped with the software supplied with the MindLAB Set. In the research ambit was used the *MindSCAN* software (or, depending on the specific case, the *Psychofeedback* software).

Method

The patient (or the subject) was comfortably sitting in a quiet and thermally conditioned environment (temperature of 20° in winter and 24°-25° in summer).

The electrodes supplied with the MindLAB Set were applied on the index and medium fingertips of the dominant hand, after having wiped the hand with a dry tissue without the use of a conductive paste.

For what concerns the *task*, for the patient, do not forget to describe it accurately.

Remember that you have to provide to another eventual researcher all the elements to exactly repeat your research. Moreover, in order to be sure that what you tell to every subject or patient is homogeneous, I advise to write down the task and read it to make sure you always use the same words!

Results

Make your statistical analysis on the data related to the *Skin Conductance Level*. If you will report some records remember to accurately delete the personal data of the patient in order to do not break the privacy regulations. Notice that the data obtained with the MindLAB are *sensitive data*, since they concern the psychic health condition!

21. Training and information about Clinical Psychophysiology and Biofeedback

The developments of the neuroscience and of the clinical psychophysiology are constant and rapid. Therefore is useful to be always updated to learn the new acquisitions of the research that can be applied in clinical ambit.

Taking into account such need, I advice to the readers to keep informed, visiting periodically the following websites:

- ALETEIA International (www.aleteiainternational.it)
- Psychotech (www.psychotech.it)

Seminars, workshops and stage, even residential, will be organized periodically. Furthermore it will be possible to be updated about the scientific developments relative to the MindLAB set acquiring the results of the researches made at the Superior Institute for the Cognitive Science and about the new programs and new hardware gradually developed.

If you make innovative experiences or researches, using the MindLAB Set, inform the Psychothech (psychotech@virgilio.it). The best contributes will be published on the ISSCO & ALETEIA News bulletin and reported on the website www.psychotech.it.

References

- Ackrill, J.L. (1993). Aristotele. Bologna: Il Mulino.
- Ainsworth, M (1989). Attachment beyond infancy. *American Psychologist*, 44, 709-716.
- American Psychiatric Association (1997). *Diagnostic and Statistical Manual of Mental Disorders*. Whashington D.C.: APA Press.
- An, J.L. (1989). *Psychophysiology: Human Behavior and Physiological Responses*. Hillsdale: Lawrence Erlbaum Associates, Publishers.
- Andreassi, J.L. (1989). *Psychophysiology: Human Behavior and Physiological Responses*. Hillsdale: Lawrence Erlbaum Associates Publishers.
- Bara, B. (2005). *Nuovo manuale di Psicoterapia Cognitiva*. Torino: Bollati Boringhieri.
- Basaglia, F. (1968). *L'istituzione negata*. Torino: Boringhieri.
- Baumann, R., Ziprian, H., Godicke, W., Hartrodt, W., Naumann, E., Lauter, J. (1973). The influence of acute psychic stress situation on biochemical and vegetative parameters of essential hypertensive at early stage of the disease. *Psychotherapy and Psychosomatics*, 22, 131-140.
- Baumeister, R. F. Vohs, K.D. (2006). *Handbook of Self Regulation*. New York: The Guilford Press.
- Beck, A.T. (1979). *Cognitive Therapy of Depression*. New York: The Guilford Press.
- Berlyne, D.E. (1961). Conflict and orientation reaction. *Journal of Experimental Psychology*, 62, 476-483.
- Bertolotti, G. (2005). *Il rilassamento progressivo in psicologia*. Roma: Carocci
- Biondi, M. (2008). *Biologia della Psicoterapia* nello studio degli esiti e del processo terapeutico. *Giornale Italiano di Psicopatologia*, Volume 14, March Supplement.
- Birket-Smith, M., Hasle, N., Jensen, H.H. (1993): Electrodermal activity in anxiety disorders. *Acta. Psychiatrica Scandinavica*, 88:350-355
- Blanchard, E.B., Andrasik, F. (1987). Biofeedback treatment of vascular headache. In: J.P. Hatch, J.G. Fisher, J.D. Rugh (Eds.), *Biofeedback: Studies in clinical efficacy*. New York, Plenum Press.
- Boucsein, W.(1992). *Electrodermal Activity*. New York: Plenum Press, New York.

Bowlby, J.(1988). A Secure Base. London: Routledge.

Braune, S, Albus, M, Frohler, M, Hohn, T, Scheibe, G (1994). Psychophysiological and biochemical changes in patients with panic attacks in a defined situation of arousal. *European Archives of Psychiatry & Clinical Neuroscience*, 244(2):86-92.

Brener, J.A. (1974). A general model of voluntary control applied to the phenomena of learned cardiovascular hanger. In: P.A. Obrist, A.H. Di Cara, A.H. Black, J.A. Brener, L.V. Di Cara (Eds.). *Cardiovascular psychophysiology: Current issues in response mechanisms, biofeedback and methodology*. Chicago: Aldine.

Calciolari, G. (2006).L'ipnosi, la ripetizione, il cerchio. Www.heliosmag.it

Cartesio, R. (1986). E. Garin (Ed.), *Opere filosofiche*. Bari: Laterza, Bari.

Coleman, J.C.(1976). *Abnormal psychology and modern life*. Dallas: Scitt, Foresman.

Curtis, B.A., Jacobson. S., Marcus, E.M., *An introduction to the neurosciences*, W.B. Saunders.

Chalmers D.J. (1995). The Puzzle of Conscious Experience. *Scientific American*, 273, 80-86.

Chiari, G. , Mosticoni, R. (1979). Biofeedback and systematic desensitization in the treatment of agoraphobia. *Journal of Behavior Therapy and Experimental Psychiatry*, 10- 109113.

Chiari, G., Scrimali, T. (1984). I fattori psicoterapeutici del biofeedback. *Psicologia Contemporanea*, Vol. XI, 62, 44-49.

Clark, D.A. (1995). Perceived limitations of standard cognitive therapy: A consideration of effort to revise Beck's theory and therapy. *Journal of Cognitive Psychotherapy: An international Quaterly*, 9, 153-172.

Cozolino, L. (2002) *The Neuroscience of Psychotherapy*. New York: Norton & Company.

Cozolino, L. (2006). *The Neuroscience of Human Relationship*. New York: W.W. Norton and Company.

Craig, A. (1990). An investigation into the relationship between anxiety and stuttering. *Journal of Speech & Hearing Disorders*, 55(2), 290-294.

Crebelli, M., Delle Chaie, M.,Valletta, M. (1984). L'EMG-biofeedback training nella terapia dell'ansia cronica. Uno studio su 119 pazienti. In: Pancheri P (Ed.): *Terapia in Medicina Comportamentale*. Roma: Il Pensiero Scientifico Editore.

Craig, A.R., Clearly, P.J. (1982). Reduction of stuttering by young male stutterer using EMG feedback. *Biofeedback and Self-Regulation*, 7, 241-255.

- Crown, S. (1966). The Middlesex Hospital Questionnaire. *British Journal of Psychiatry*, 112, 917-929.
- Crown, S., Crisp, A.H. (1979). *Crown-Crisp Experiential Index*. Firenze: Organizzazioni Speciali.
- Davey, G.C.L., Wells, A. (2006). *Worry and its Psychological Disorders*. Chichester: John Wiley & Sons.
- Davis, R.C.(1929). Factors affecting the galvanic reflex. *Archives of Psychology*, 18 (115).
- De Waal (2009). *L'animale e l'uomo*. MicroMega. Supplemento: Darwin 1809-2009.
- Diels, H., Kranz, W (1976). *I presocratici. Testimonianze e frammenti*, a cura di Angelo Pasquinelli. Torino: Einaudi, Torino.
- Eccles J.C. (1994), *Come l'Io Controlla il suo Cervello*. Milano: Rizzoli.
- Edelberg, R. (1967). *Methods in Psychophysiology*. Baltimore: Williams and Wilkins.
- Edelberg, R. (1970). The information content of the recovery limb of the electrodermal response. *Psychophysiology* n. 6, pp. 527-539.
- Edelberg, R. (1972), *Electrical Activity of the Skin: Its Measurements and Uses in Psychophysiology*. In: Greenfield N.S., Sternback R.A. (Eds), *Handbook of Psychophysiology*: new York: Holt, Rinehart and Winston.
- Edelman G.M. (1987). *Neuronal Darwinism: The Theory of Neural Group Selection*. New York: Basic Books.
- Fowles, D.C. (1973). Mechanism of electrodermal activity. In: R.F. Thompson & M.M. Patterson (Eds), *Methods in physiological psychology*. New York: Academic Press.
- Fredrikson, M., Dimber, U., Frisk-Holmberg, M (1980). Arterial blood pressure and electrodermal activity in hypertensive and normotensive subjects, during inner and outer-directed attention. *Acta Medica Scandinavica*, 646, 73-76.
- Freud, S. (1989). *Opere*. Torino: Bollati Boringhieri
- Frith, C.D., Stevens, M., Johnstone, E.C., Owens, D.G.C. (1984). The effect of chronic treatment with amytriptiline and diazepam on electrodermal activity in neurotic outpatients. *Physiological Psychology*, 12, 247-252.
- Fuller, G.D. (1977). *Biofeedback Methods and Procedure, in Clinical Practice*. San Francisco: Biofeedback Press.
- Furedy, J.J. (1983). Operational, analogical and genuine definitions of Psychophysiology. *International Journal of Psychophysiology*, 1, 13-19.

- Germer, C.K., Siegel R.D., Fulton, P.R (2005). *Mindfulness and Psychotherapy*: New York: The Guilford Press.
- Giommi, F. (2005). Il potere dell'attenzione: la prospettiva della mindfulness In: B.G. Bara (Ed.), *Nuovo Manuale di Psicoterapia Cognitiva*. Torino: Bollati Boringhieri.
- Goodal, McC. (1970). Innervation and inhibition of eccrine and apocrine sweating in man. *Journal of Clinical Pharmacology*, 10, 235-246.
- Gruzelier, J. H., Hammond, N.V. (1978). The effect of chlorpromazine upon psychophysiological, endocrine and information measures in schizophrenia. *Journal of Psychiatric Research*, 14, 167-182.
- Gruzelier, J., H., Venables, P.H. (1975). Evidence of high and low levels of physiological arousal in schizophrenics. *Psychophysiology*, 12, 66-73.
- Guidano, V.F.(1988). *La Complessità del Sé*. Torino: Bollati Boringhieri.
- Guidano, V.F. (1992). *Il Sé nel suo divenire*. Torino: Bollati Boringhieri.
- Guidano, V.F. (2007). *Psicoterapia cognitiva post-razionalista*. Milano: Franco Angeli Editore
- Guidano V.F. (2008). *La Psicoterapia tra arte e scienza*. Milano: Franco Angeli Editore.
- Guidano, V.F., Liotti. G. (1983). *Cognitive Processes and Emotional Disorders*. New York: The Guilford Press.
- Harlow, H.F. (1958). The Nature of Love. *American Psychologist*, 13, 673-685.
- Hobbes, T. (1994) [1651/1668]. *Leviathan*. E. Curley (ed.), Indianapolis: Hackett
- Hofmann, S.G., Moscovitch, D.A., Brett, T., Kim, H.J., Davis, LL., Pizzagalli, D.A. (2005). The worried Mind: Autonomic and Prefrontal Activation, During Worrying. *Emotion*, December, Vol. 5, N.4 464-475.
- Huxley, T.H. (1874). [On the Hypothesis that Animals are Automata and its History](#). *Nature*, 10 (1874): 362-66; *Science and Culture, and Other Essays*; CE 1: 199-250
- Iacono, W.J., Lykken, T.D., Pelloquin, L.J., Lumry, A.E., Valentine, R.H., Tuason, V.B. (1983). Electrodermal activity in euthymic unipolar and bipolar affective disorders. A possible marker for depression. *Archives of General Psychiatry*, Volume 40, Number, 5, May
- Isamat, F. (1961). Galvanic skin responses from stimulation of limbic cortex. *Journal of Neurophysiology*, 24, 176-181.
- Isola, L., Mancini F. (2007). *Psicoterapia Cognitiva nell'infanzia e nell'adolescenza*. Milano: Franco Angeli Editore.

- Jacobson, E. (1929). *Progressive relaxation*. Chicago: University of Chicago Press.
- Johnson, L.C., Lubin, A. (1966). Spontaneous electrodermal activity during sleeping and waking. *Psychophysiology*, 3, 8-17.
- Jung, K. G. (1906) *Studies in Word Analysis*. The Journal of Abnormal Psychology, Vol. 1, June.
- Kabat-Zinn, J. (2005). *Vivere momento per momento*. Milano: Corbaccio Editore.
- Keck, P.E., McElroy, S.L. (2002). Carbamazepine and valproate in the maintenance of bipolar disorder. *Clin. Psychiatry*, 63 Suppl. 10 13-17.
- Krick F.H.C. (1995) *The Astonishing Hypothesis: The Scientific Search for the Soul*. New York: Simon & Schuster, Inc.
- Kuhn, T.S. (1977). *The essential tension*. Chicago: Chicago University Press.
- Lacey, O.(1947). An analysis of the appropriate unit for use in the measurement of level of galvanic skin resistance, *Journal of Experimental Psychology*, 37, 449-557.
- Lader, M.H., Wing, L.(1964). Habituation of the psycho-galvanic reflex in patients with anxiety states and in normal subjects. *Journal of Neurology, Neurosurgery and Psychiatry*, 27, 210-218.
- Lader, M.H., Wing, L. (1969). Physiological measures in agitated and retarded depressed patients. *Journal of Psychiatric Research*, 7, 89-100.
- Lazarus, R.S. (1975). A Cognitively Oriented Psychologist Looks at Biofeedback, *American Psychologist*, 30, 553-561.
- Lemche, E., Giampietro, V. P., Surguladze, S. A., Amaro, E.J., Abdrew, C. M., Williams, S.C.R., Brammer, M.J., Lawrence, N., Maier, M.A., Russell, T.A., Simmons, A., Ecker, C., Joraschky, P., Phillips, M.A.(2005). Human attachment security is mediated by the amygdale: Evidence from combined fMRI and psychophysiological measures. *Human Brain Mapping*, Volume, 27, Issue 8, 623-635.
- Liotti, G. (2001). *Le discontinuità della coscienza: etiologia, diagnosi e psicoterapia dei disturbi dissociativi*. Milano, Franco Angeli.
- Lorenzini, R., Sassaroli, S. (1997). *Attaccamento, conoscenza e disturbi di personalità*. Milano: Raffaello Cortina Editore
- Mahoney, M. J. (1988). *Personal Change Processes: Notes on the Facilitation of Human Development*. New York: Basic Books.
- Mahoney, M. J. (1991). *Human Change processes*, New York: Basic Books.

- McGinn C. (1991). *The Problem of Consciousness*. Oxford: Basil Blackwell
- Mc Nair, D., Lorr, M., Droppleman, L.F. (1991). *Profile of Mood States* (adattamento italiano a cura di M. Farnè, A. Sebellico, D. Gnugnoli, A. Corallo). Firenze: Organizzazioni Speciali
- Meichenbaum, D. (1976). Cognitive factors in Biofeedback Therapy. *Biofeedback and Self Regulation*. 1, 201-216.
- Malmo R.B., Shagass C., (1949). Physiological studies of reaction to stress in anxiety states and early schizophrenia, *Psychosomatic Medicine*, 11, 9-24.
- Mangina, C.A.(1983). Towards on international consensus defining psychophysiology, *International Journal of Psychophysiology*, 1, pp. 93-94.
- Mathews A.M., Gelder M.G, Psychophysiological investigations of brief relaxation training, *Journal of Psychosomatic Research*, 13, 1-12,1969.
- Miller, N.E. (1969). Learning of visceral and glandular responses. *Science*, 163, 434-445.
- Miller, S. Konorski, J. (1928) On a particular type of conditioned reflex. *Proceeding of Biological Society*, 99, 1155-1157
- Miller, G., Galanter, E., Pribram, K.(1960). *Plans and Structure of Behavior*. New York: Holt, Rinehart and Winston.
- Ohman, A. (1981). Electrodermal Activity and Vulnerability to Schizophrenia: A Review. *Biological Psychology*, 12, 87-145.
- Paillard, J., (1973). L'uso degli indici fisiologici in psicologia. In: Fraisse P., Piaget J. (Eds.) *Trattato di Psicologia Sperimentale*. Torino: Einaudi.
- Palomba, D., Stegagno, L., (2004). *Psicofisiologia Clinica*. Roma: Carocci.
- Palomba, D., Stegagno, L. (2006). *Psicofisiologia Clinica*. In: Psicologo Moderato, P. Rovetto, F: (Eds.): *Lo Psicologo verso la Professione*. Milano: Mc Graw Hill
- Pavlov, I. P. (1903). *Psicologia Sperimentale e Psicopatologia degli Animali*. In: *I riflessi condizionati*, Roma: Newton-Compton.
- Pancheri, P. (1979). *Biofeedback*. Roma: Bulzoni.
- Pancheri, P., Chiari, G. (1979). *Biofeedback e Psicosomatica*. *Psicologia contemporanea*, 6, 11-17.
- Penrose, R. (2000). *La Mente Nuova dell'Imperatore*. Milano: Rizzoli

- Peper, E., Gibney, K.H. (2003). Taking control: strategies to reduce hot flashes and pre-menstrual moods swings. *Biofeedback*, 31 (3), 20-24.
- Perris, C. (1989). *Cognitive Therapy with Schizophrenic Patients*. New York: The Guilford Press.
- Piaget, J. (1954). *The construction of reality in child*,. New York: Basic Books.
- Pinel, P (1987). *La Mania. Trattato medico-filosofico sulla alienazione mentale*. Venezia: Marsilio
- Popper, K.R. (1972). *Objective Knowledge: An Evolutionary Approach*: Oxford: Clarendon.
- Popper K.R., Eccles, J.C. (1977), *The Self and its Brain*. Berlin: Heindelberg.
- Prokasy, W.F., Raskin, D.C. (1972) *Electrodermal Activity in Psychological Research*. New York: Academic Press.
- Rappaport, H. (1972). The modification of avoidance behaviour: Expectancy, Autonomic Reactivity and Verbal Report. *Journal of Consulting and Clinical Psychology*, 39, 404-414.
- Reale, G., Antiseri, D. (1983). *Il pensiero occidentale dalle origini ad oggi*. Firenze: Editrice La Scuola.
- Reale, G. Antiseri, D. (1997). *Storia della filosofia*. Firenze: Editrice La Scuola.
- Reda, M. (1986). *Sistemi Cognitivi Complessi e Psicoterapia*. Roma: Nuova Italia Scientifica.
- Rossi, A. (2006). *Psichiatria e Neuroscienze*. Milano: Masson.
- Schultz. H.J. (1960). *Das Autogene Training*. Stoccarda: Verlag.
- Scrimali, T. (2000). *Conoscenza della Mente e Modelli di Conoscenza*. In: B. Nardi (Ed.). *Vittorio Guidano e l'Origine del Cognitivismo Sistemico Italiano*. Ancona: Accademia dei Cognitivi della Marca.
- Scrimali, T. (2001). *La Psicoterapia cognitiva dalla teoria dell'human information processing alla logica dei sistemi complessi*. *Il Pendolo*, Anno I, N. 2, 42-51
- Scrimali, T. (2003). *Processi della Mente e Disagio Psicico. L'Orientamento Complesso in Psicologia Clinica*. Enna: Istituto Superiore per le Scienze Cognitive Editore.
- Scrimali, T. (2006 a), *Entropia della Mente ed Entropia Negativa*, Franco Angeli Editore, Milano.
- Scrimali, T. (2006 b), *Synchronic Mind Training e Psicoterapia*. Enna: Istituto Superiore per le Scienze Cognitive Editore.

Scrimali, T. (2007). Assessment psicofisiologico e psicodiagnosi: prolegomeni per una psicodiagnostica strumentale. In: Scrimali, T, Alaimo, S.M., Grasso, F. : Dal Sintomi ai Processi. L'orientamento costruttivista e complesso in psicodiagnostica.

Scrimali, T. (2009). MindLAB Set. Dalle Neuroscienze al Setting in Psicologia Clinica, Psichiatria, Psicosomatica e Medicina della Salute. In preparazione.

Scrimali, T., Alaimo, S. M., Grasso, F. (2007). Dal Sintomo ai Processi. Milano: Franco Angeli Editore.

Scrimali T., Cardillo A., Caruso F., Caniglia S., Macaudo C., Rapisarda V., Organizzazione e conduzione di un laboratorio per il monitoraggio sistemico della resistenza cutanea, Bollettino della Società Medico-Chirurgica di Catania, XLV, 1-2, 1977.

Scrimali, T., Grimaldi L. (1982). Il biofeedback della attività elettrodermica. Milano: Franco Angeli Editore.

Scrimali, T., Grimaldi, L. (1991). Sulle Tracce della Mente. Milano: Franco Angeli Editore.

Scrimali, T., Grimaldi, L. (2003). Fineo & Tantalò. A Complex Systems Oriented Approach to the Treatment of Patients with Eating Disorders. Archives of Psychiatry and Psychotherapy, Volume 5, N. 1, March 15-30.

Scrimali, T., Grimaldi, L. Aguglia, E. (1978). Impiego clinico dello skin resistance biofeedback in un caso di nevrosi d'ansia. Bollettino della Società Medico-Chirurgica di Catania, Vol. XLVI, 1-2, 201-204.

Scrimali, T., Grimaldi, L., Cultrera, G., Santagati, M., (1995). L'assessment multidimensionale del clima emotivo familiare nella schizofrenia. Complessità & Cambiamento, Volume IV, n. 1, 14-31.

Scrimali, T., Grimaldi, L. Rapisarda V., (1983). La ristrutturazione cognitiva mediante elettrodermofeedback ed evocazione sperimentale della risposta neurovegetativa di allarme in paziente ansiosi. Formazione Psichiatrica, n. 1 67-71.

Scrimali, T., Grimaldi, L. Rapisarda, V., Giordano Nestler, F. (1984). Le tecniche di biofeedback nella integrazione scolastica. Milano: Atti del V Congresso della Società Italiana di Biofeedback.

Scrimali, T., Grimaldi, L., Rapisarda, V., Lombardo C., Alberghina, G. (1982). Analisi comparativa tra attività elettrodermica e livelli plasmatici di amitriptilina. Formazione Psichiatrica, n. 4, 27-32.

Scrimali, T. Tomasello, D. (2009). MindLAB Set ed Educazione alla salute. L'esperienza di un progetto formativo per la Scuola Media Secondaria. Babele, in pubblicazione nel corso del 2009.

- Segal, Z., Williams, J. M., Teasdale, J. D. (2006). Mindfulness. Al di là del pensiero, attraverso il pensiero. Torino: Bollati Boringhieri.
- Semerari, A. (Ed.), (1999). Psicoterapia cognitiva del paziente grave. Metacognizione e relazione terapeutica. Milano: Cortina.
- Sibilia, L., Borgo, S.(Eds.), (1993). Health Psychology in Cardiovascular Health and Disease. Roma: C.R.P.
- Siegel, S.J.(1999). La Mente Relazionale. Neurobiologia della esperienza interpersonale. Milano: Cortina
- Siegel, D.J. (2007). The Mindful Brain. New York: W.W. Norton & Company
- Snyder, C., Noble, M. (1968). Operant conditioning of vasoconstriction. Journal of Experimental Psychology.77, 263-268.
- Skarda, C.A., Freeman, W. J. (1990). Chaos and the new science of the brain. Concepts in Neuroscience, Vol. 1, No. 2 (1990) 275–285
- Skinner, B.F. (1976). About behaviourism. New York: Random House Inc.
- Sokolov, E.N. (1963). Neuronal Models and Orienting Reflex. In Brazier M.A..B (ed.): The central nervous system and behaviour. New York: Josiah Macy Jr. Foundation.
- Stegagno, L. (Ed.), (1986). Psicofisiologia, Volume I: Indicatori fisiologici del comportamento umano. Torino: Bollati Boringhieri
- Stegagno, L. (Ed.), (1991). Psicofisiologia, Volume II: Correlativi fisiologici dei processi cognitive e del comportamento. Torino: Bollati Boringhieri.
- Tarchanoff, P.E. (1890). Uber die galvanischen erschemunger an der haut des ameuschen bei Reizung der Sinnesorgane und bei verchhiedenen Former der psychisohen Tatikkeit. Pfluger Arch. Fur die gesamte Physiologie, 46, 46-55.
- Tarrier, N., Borrowclough, C., Porceddu, K., Watts, S. (1988). The Assessment of Psychophysiological Reactivity to the Expressed Emotion of Relatives of Schizophrenic Patients. British Jurnal of Psychiatry, 152, 618-624.
- Tarrier, N., Sommerfield, C., Connell, J., Deakin, B., Pilgrim, H., Reynolds M. (2002). The Psychophysiological Responses of PTSD Patients: Habituation, Responses to Stressful and Neutral Vignettes and Association with Treatment Outcome. [Behavioural and Cognitive Psychotherapy](#), 30: 129-142.
- Taylor, A.E. (1968). Platone. L'uomo e l'opera. Firenze: La Nuova Italia.
- Taylor, J. (2004). Electrodermal reactivity and its association to substance use disorders. Psychophysiology, 41, 982-989.

- Taylor, J., Carlson, S. R., Iacono, W. G., Lykken, D. T., & McGue, M. (1999). Individual differences in electrodermal responsivity to predictable aversive stimuli and substance dependence. *Psychophysiology*, 36, 193-198.
- Taylor, J G (1992). Towards a neural network model of mind. *Neural Network World*, 2, 797-812.
- Teichner, M.H., Glod, C., Cole, J.O. (1990) Emergence of intense suicidal preoccupation during fluoxetine treatment. *American Journal of Psychiatry*, 147: 207-210.
- Thorell, L.H., Kjellman, B.F., d'Elia, G. (1987). Electrodermal activity in antidepressant medicated and unmedicated depressive patients and in matched healthy subjects. *Acta Psychiatrica Scandinavica*, Dec., 76 (6): 648-692.
- Turpin, G. (Ed.), (1989). *Handbook of Clinical Psychophysiology*. Chichester: Wiley,.
- Valente, G. (1990). L'Italia ed il *Decennio del Cervello*. *Fidia Biomedical Information*, 6-7, 17-18.
- Varela, F. (1986). Complessità del cervello e autonomia del vivente in *La sfida della complessità*. Milano: Feltrinelli.
- Van Den Akker, S., Steptoe, A. (1980). Psychophysiological responses in women reporting severe pre-menstrual symptoms. *Psychosomatic Medicine*, 51, 319-328.
- Vaughn, C., Leff, J., (1976). The Measurement of Expressed Emotion in the Families of Psychiatric Patients. *British Journal of Social and Clinical Psychology*, 15, 157-165, 1976.
- Venables, P.H., Martin, I. (1967). *A manual of psychophysiological methods*. New York: Wiley.
- Walter, S. (2006). *Irritable Bowel Syndrome: Diagnostic Symptoms Criteria and Impact of Rectal Distensions on Cortisol and Electrodermal Activity*. Linköping University Medical Dissertations, ISSN 0345-0082
- Weber, C.M., Smith, A. (1990). Autonomic Correlates of Stuttering and Speech Assessed in a Range of Experimental Tasks. *Journal of Speech and Hearing Research* Vol.33 690-706 December.
- Wells, F.L., Forbes, A.. () On certain electrical processes in the human body and their relation to emotional reactions. *Archives of Psychology*, 2 (10), 1-39, 1911
- Wheatstone, C. (1879). *Scientific Papers of Sir Charles Wheatstone*. London: Physical Society of London.

Wiener, N. (1966). Introduzione alla cibernetica. Torino: Boringhieri.

Wolpe, J. (1958). Psychotherapy by reciprocal inhibition. Stanford: Stanford University Press.

World Health Organisation, (1992). The ICD-10 classification of mental and behavioural disorders: clinical description and diagnostic guideline. Geneva: WHO Press. Versione Italiana a cura di Kemali, D., M.Maj, F. Catapano, Giordano, G., Saccà. C., Milano: Masson.

Zahn, T.P., Frith, C.D., Steinhauer, S.R. (1991). Autonomic functioning in schizophrenia: electrodermal activity, heart rate, pupillography. In: Steinhauer, S.R., Gruzelier, J.H., Zubin, J. (Eds), Handbook of schizophrenia, Vol. 5, Amsterdam: Elsevier.

Zahn, T.P., Insel, T.R., Murphy, D.L. (1984). Psychophysiological changes during pharmacological treatment of patients with obsessive, compulsive disorder. The British Journal of Psychiatry, 145, 39-44.

Young, J.(1999). Cognitive Therapy for Personality Disorders. A schema-focused Approach. Sarasota: Professional Resources Press.