

NORMAL BEHAVIOUR VS. SIMULATED BEHAVIOUR

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Abstract: *Simulated behavior is based on a principle known since the antiquity: the psycho-somatic interdependence, meaning the logical report between the functioning of the body (the somatic general laws) and the 'soul' (the general psychic laws).*

Even though there are still unknown factors in this field, it is without a doubt that some physiological phenomena appear accompanied by determined psychic phenomena, which in actual fact means that the appearance of one of them represents proof of the other's existence.

Key words: *Simulated behavior, polygraph, forensic biodetection.*

1. Short history of simulated behavior

Vittorio Benusi used the recording of respiratory changes in order to discover lying, and W.M. Marston resorted in 1917 to capturing the systolic blood pressure for the same purpose. One of the greatest predecessors of the present technique was psychologist Hugo Munsterberg, who dealt with the problem witnesses' false statements. In 1908, James MacKenzie named his device 'The Ink Poligraph' and in 1922 J.A. Larson perfected it and thus appeared the modern cardiopulmonary-psychograph, representing the first generation of the modern polygraph. An important improvement was made in 1945 by John Reid, who establishes the connection between unobserved muscular activity and blood pressure.

In Romania, biodetection starts to be used in 1975, especially in murder cases. The first field work is made by university

Professor Tiberiu Bogdan – 'Psychological investigation of simulated behavior'.

The modern scientific bases of forensic biodetection were set in the 1970's, when the cybernetics principles specific for human beings were formulated, following the research conducted in the field of psychophysiology. In the specialized literature, the biofeedback is defined as a general principle according to which an individual placed in a certain situation emits responses with frequencies and intensities that rise if their consequences are positive, and they decrease if the consequences are negative or null [2].

Based on this scientific principle, the self-control or relaxing method has been elaborated, according to the recording of some involuntary physiological phenomena and their transformation into perceivable signals, in order for them to be used as indicators of the state of relax and for highlighting self-control. One can achieve operative control for a series of functions, such as: vasodilation, cardiac

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rhythm, cerebral rhythms, blood pressure, stomach contractions etc. Multiple operative conditioning possibilities for the neurovegetative system and the system of smooth muscles have been highlighted in psychophysiological research.

The main particularity of the forensic experimental detection method is that it is an active form of human intervention in the development of conscience-related psychological phenomena, whose result represents the increase of knowledge for the cause found on the dockets, by verifying and proving, at the level of the person who is experimented upon, the knowledge, and the surplus of information, respectively, that the said person offers [12].

Like any type of experiment, biodetection is a deliberate act, made step by step, based on some anticipations, hypotheses or simple presumptions that refer to accurately determined objectives.

2. Short history of the polygraph

Throughout time, the scientific and technical progresses were looked at with skepticism and the inventors had to overcome the obstacles meant to stop them, in order to impose their ideas.

The discovery of the lie has been a passion of people since the oldest times and it has motivated them in their research, in order to elaborate a device that could help track down simulated behavior.

In West Africa, murder suspects were obligated to pass an egg from hand to hand, during a ritual. The person that would break the egg was considered to be guilty, starting from the premise that the cause for breaking the egg was nervousness. In 1895, Cesare Lombroso tested the 'hydrosphygmograph', a primitive device that measured pulse variations with the help of a cylinder that had carbon black applied on it, as it was

spun by a clock mechanism. In 1917, W.M. Marston tried to detect lies, by recording systolic blood pressure, and Vittorio Benussi recorded modifications in breathing. One of the largest predecessors of the actual technique was the German-American psychologist Hugo Munsterberg, who was very much preoccupied with the problem of witnesses and their true or false statements. In the same year, 1908, James MacKenzie, the famous British cardiologist, named his device „The Ink Polygraph”, being a model for J.A. Larson, who then build the cardiopulmonary-psychograph, in 1922, thus being the first generation of the perfected polygraph which is still used to this day [13].

John A. Larson, who, in collaboration with psychology Professor Robert A. Gesell, created in 1920, a portable polygraph device, an instrument capable of recording three physiological phenomena continuously – blood pressure, pulse and respiration; he especially used it while he was working for the Berkley police [8].

Keller, who had followed the first works of Larson, built in 1925 with the help of the Northwestern University, an improved polygraph, under the name 'Keller Polygraph', but it didn't go beyond the stage of recording the classical parameters: blood pressure, pulse and respiration. With this device, he established the basis for the industrial polygraph [9].

In 1938, the Company for Associated Researches from Chicago makes additions to the Keller device, by getting inspiration from the works of Walter Summers on the galvanising reactions of the skin, a recorder capable of measuring its variations.

An improved form is made in 1945 by John Reid, who established the connection between the unobservable muscular activity and blood pressure, as the 'Reid' polygraph could record: blood pressure – pulse, respiration, the electrical-dermal-galvanising reaction and neuromuscular reactivity.

The achievements in this field were possible, on the one hand, due to the necessity imposed by practice for detecting the dissimulation of the truth and, on the other hand, due to the preoccupation of some ingenious minds to parlay in a superior manner the results of psychophysiology.

Subsequently to these first starts, there was a considerable advance of the polygraph, in a strictly technical sense as well as regarding the methodology for using the device. On a statistic level, the Chicago Police Detection laboratory has made a number of 1127 tests during 1938 and 1941. In 84% of the cases, guilt was shown in the records. Throughout time, the polygraph device was the object of some thorough research that has benefited from major investments from the US government, in order to be used for testing in the American Secret Services, the Department of Defense, as well as in forensic police. At the moment, the polygraph test is known as being the only test capable of identifying the sincerity of some statements, with a 98% accuracy.

The first use of the polygraph in Romania took place in the year 1971, at the Department of Psychology of Babes-Bolyai University from Cluj-Napoca. The polygraph model 'Stoelting' was bought from the United States of America by Professor Alexandru Roşca, in order to perform some experimental studies in the field of psychophysiology, research continued by his successors.

During 1972-1974, psychologist Ioan Buş, who was at that time a student at the Faculty of Psychology from Cluj-Napoca, made experiments with that polygraph in order to show the emotional factor on school performance. The results of the research materialized in the Bachelor paper defended at the graduation of the faculty. During 1980-2001, psychologist Ioan Buş made examinations with the polygraph technique solely in the forensic field, in the

psychology laboratory within the Police Inspectorate of Cluj county for the detection of simulated behavior,

In the forensic field, the polygraph has been used since 1975, especially in murder cases. The tests were made with portable polygraph devices of Japanese origin.

The devices were bought by the Forensic Institute from the General Police Inspectorate, with the input of Dr. Ion Anghelescu, the head of the institute. The tests were conducted in the institute's laboratory or on field, at the headquarters of county police inspectorates.

The expert Tudorel Butoi, graduate of the Faculty of Psychology from Bucharest, was the first psychologist that used the polygraph in the forensic field, in order to detect simulated behavior. During the same period of time, forensic experts Dr. Mircea Constantinescu and Ion Sandu from the Forensic Institute of Bucharest, also made examinations using the polygraph technique. Along with the polygraph technique, the Forensic Institute from the Ministry of Interior also used the Psychological Stress Evaluator – PSE, having Jean Nichifor as an expert.

There are 13 inter-county functioning laboratories for the detection of simulated behavior (the Forensic Institute from Bucharest, the Metropolitan Capital Police, the County Police Inspectorates: Cluj, Iaşi, Timișoara, Constanța, Bacău, Braşov, Brăila, Prahova, Bihor, Hunedoara, Dolj, Galați, listed in the order of their establishment), equipped with modern polygraphs from America, where all the country's Counties are assigned, with the perspective of founding 8 more laboratories. The methodology of using the polygraph technique is unique, as it is approved by the Ministry of Interior.

In these laboratories there are 14 specialists conducting their activity, and

the average amount of tests performed is of approximately 500 persons per year.

In June 1994, upon being invited by Frank S. Horvath and Gordon H. Barland, outstanding representatives of the American Polygraph Association (APA), a delegation of Romanian specialists in the polygraph technique (Adrian Coman and Gabriel Taru – the Laboratory of the Forensic Institute from Bucharest, and Ioan Buş – the Laboratory from Cluj), participated at an international symposium organized in Budapest. Also, Prof. PhD. psychologist Gordon H. Barland, the head of the Research Institute on the Polygraph Technique (USA) and Eng. Lavern A. Miller, manager in managerial strategies – Polygraph (USA), travelled to Romania in order to get informed and document the activity carried out with the help of the polygraph.

Based on the evaluation made, in January 1996, as recognition of the value of the Romanian school for the polygraph technique, 7 Romanian specialists in this field have been accepted as members in the American Polygraph Association (APA).

On September 13th, 1997, through the civil sentence no. 651, the County Court of Bucharest Municipality, the department of contentious administrative and civil matters, decided the admittance of the request through which the establishment and the ordering of legal personality is granted to the ‘Romanian Polygraph Association’, based in Bucharest.

3. Normal behavior versus simulated behavior

3.1. The behavior

In a wider sense, behavior represents the specific manner through which the human organism is determined to respond to the physical or social reactions that come from the environment through a set

of reactions, by seeking to adapt through it to the new arrived necessities. Behavior represents the global expression (glandular, motor, verbal, effective, etc.) of a person in a given situation. Through this total reaction, the human organism responds to a feeling had, depending on the stimulations of the environment and its internal tensions. Behavior is not just a range of reactions provoked by stimuli, but a complex, dynamic activity, determined in a biological, psychological and social manner, through which the person adapts its reactions to the environment.

In the life of a person there are often situations that appear, which affect him/her in a discrepant manner. Certain social conveniences can enter in contradiction with the momentary state or even with the intimate beliefs of the person, with his/her own system of values. In this case, ambivalences of behavior appear, as getting over them implies that the person be socially mature, have a psychic plasticity and a graceful behavior.

Understanding the conduct of a person in different situations implies in a necessary manner that one knows the reasons that inspire the said person, as well as his/her aims that foreshadow and lead the behavior beforehand. By interfering between the reasons and the aims, human behavior is in a direct connection with conscience [10].

A particularity of behavior is the learned, earned character. The learning process represents a phenomenon that extends to the level of the entire human life, by this understanding any acquisition that the human subject is capable of making and that, in turn, will influence the behavior. The person that knows oneself from life trials through the behaviors that he/she had developed, the success or failure of these types of

behavior represent the aspects of learning which reflect on him/her.

An important role in learning some types of behavior pertains to reward and sanction, which contribute by either facilitating new acquisitions, or by eliminating the ones that are inappropriate.

Overt behavior includes the externalized reactions of a person, that can be observed directly, such as spoken or gestural language, mimic, the activity of moving the members or the body.

Covert behavior includes internal changes, which accompany the thinking, emotional, language processes, etc., out of which we mention: the change of respiratory rhythm, changes in cardiac rhythm, changing of salivary secretion, intensification in sweat glands' activity, change in the chemical and hormonal composition of the blood, increase of the electrical conductivity of the skin, etc.

Other overt as well as covert means are the aspects of a wide behavior with a unique characteristic for that moment. The forms of covert behavior are mandatorily correspondent to an overt behavior, but not all covert manifestations correspond to manifestations of overt behavior.

Forensic psychology is primarily interested in the thing that represents deviation in the behavioral area. From a statistic point of view, deviation represents an exception from the average. The average represents the conformist behavior, related to social norms, and deviant behavior as an exception signifies the deviations in a negative sense, anti-value, of the type of everything referred to in generic terms as antisocial behavior, misdemeanor, delinquency or crime [3].

Through the process of socialization, society transmits to its members the normative and cultural model made up of the set of social norms and values. They

allow the normal existence of a social life, ensuring behavior rationality, as well as the social system's stability. Socialization represents a fundamental process, that facilitates the integration of the individual into society, by assimilating the culture of the group that he is part of, as well as the social roles that he is asked to fulfil in this group.

The written or unwritten norms of this society that can help appreciate the adequacy of a certain conduct are formulated for all the members of that society. The individual's culture or subculture contributes to the development of some deviant behaviors. Various forms of deviant behavior are learned either by observing (indirect learning), either through personal experience (direct learning), as they combine in shaping deviant behaviors. Deviance has a negative significance, as well as a positive one; thus, in some situations, deviation facilitates the functioning of the company. The gravity of the deviance depends mostly on the values and norms that are broken, as well as the public reaction towards these exceptions and infringements.

3.2. Simulation

The most frequent problem in forensic activity is the simulated behavior of the people involved in various criminal causes. Depending on the purpose sought after, the situation and the interests of the aimed person, common behavior can take the form of a simulated behavior.

Through simulated behavior one tries to falsify reality, as the aimed person gives intentionally false responses, masking the expression and attitude. Simulation is not a simple error, but an intentional mistake, which sometimes proves to be necessary. In order to get over the critical moments in life, the person defends its ego, in a

conscious or unconscious manner, through hope, trust and optimism. In order for a simulation to be successful, its subject must maintain his/her coherence. Simulation is always motivated, it is the method of achieving the purpose.

Simulation appears in various situations: to give an alibi, to protect someone, coming from the need for protection, coming from the wish for revenge, to resist the pressures and coercive norms of the community. Simulation is made through different strategies: reduction, addition, omission, substitution, transformation, silence, etc.

Simulation can be presented in different forms: through total simulation (falseness is present throughout the entire behavioral manifestation); through interactive simulation (there are also grains of truth); simulation through willing omission of the real information; exaggeration or the generalization of some unimportant aspects in the detriment of the essential; presenting truth as a lie and a lie as truth. Knowing the reality and using language, the person that performs simulation operates on an elastic logic, in order to reach the targeted aim faster.

The person that performs simulation is convinced that he/she can control himself/herself by reducing the level of stress, but this effect is not automatically recorded. Following an experimental study, it was found that by controlling stress, the said action does not lead to reducing it, but in some cases stress can be intensified.

3.3. Psychophysical correlations of simulated behavior

Emotion forms a complex configuration of reactions, a psychophysiological response in accordance with the events.

Emotional processes are defined as complex psychic phenomena characterized by a conduct marked with emotional expressions, out of which we distinguish: cognitive changes, organic changes, vegetative (the activity of the circulatory system, increase of cardiac activity, changes of muscular tension, electric conductivity of the skin, etc.), behavioral changes (verbal expressions, reactions, mimic, gestures). These three psychic behavioral changes cannot be taken separately, they interact simultaneously.

Apparently, among all these emotional response categories, the most eloquent for the observer is the facial expression, as it is considered to be an emotional barometer; thus, joy, sadness, anger, fear etc. can be read very easily on a person's face. An indicator that could tell us more about the subjective feeling that a person is having is the vocal expression in emotion; that is translated by changes in the tone of voice, in intensity, accent, quality, as they are determined by the level of tension in the muscles. Another element is the vocal tremor (muscular microtremor), determined by psychological stress.

Physiological stress has a maximum intensity when a person is not stressed. During the installation of stress, the vocal tremor decreases in intensity or is eliminated.

The physiological indicators used to highlight an emotion are: electroencephalogram (E.E.G.), cardiac activity and the activity of the circulatory system (E.C.G.), respiration rate, changes in the electrical conductivity of the skin (G.S.R.) etc.

The Electroencephalogram represents a measure of the emotion at the central physiological level. Cardiac activity and the activity of the circulatory system are some of the most frequent and eloquent

presences of psychophysiological indicators of emotion.

Blood pressure, which is very much used in emphasizing emotion, reflects the rhythm of heart beats (the volume of circulated blood), as well as the local vasomotor tonus per time unit. The effect of the vasomotor changes reflects the increase or the decrease in blood volume at the level of different body parts (finger, hand, etc.), a result of vasoconstriction.

The respiration rate is one of the most ancient indicators of emotion. This can be registered pneumatically (at the level of the thorax and of the abdomen for the polygraph), or thermoelectrically (at the level of the nose). The rhythm and the aptitude of the respiratory waves, their duration, the inspiration/respiration rate etc, are affected by the type of emotion (aggression, fear, agitation, etc.)

Muscular tension can be locally or generally recorded through mechanical recorders or E.M.G.

The high intensity emotions can be exteriorized in tremor. The changes of the electric conductivity of the skin represent some of the most sensitive indicators of the vegetative physiologic activity of emotion.

3.3.1. Electroencephalogram – EEG

It is the expression of slow potential variations at the level of cortical pyramidal neurons, whose dendrites radially and perpendicularly oriented on the cortex form alternate somatodentric electrical bipolars [1].

The electrical field produced by the possible neuronal post-synapses (EPSPS) is emergent at the level of the scalp, where it is measured with the help of electrodes. The changes of potential have been associated with specific cognitive and perceptive events [6], as they are referred to as potentially evoked (PE) and

event-related potentials (ERP). While the potentially evoked (PE) reflect the cortical processes of the physical stimuli, the event-related potentials (ERP) are caused by the superior cognitive processes, which can imply memory, expectancy, attention or different mental states. Rosenfeld, Farwell and Donchin reported the first results regarding the use of EEG in the detection of simulated behavior, by identifying some specific ERPs that have been correlated with the recognition of some information that has culpability values. Out of all the types of ERP, the potential P300 have the highest predictive validity for detecting simulated behavior. The acronym used for their denomination indicated positive polarity and latency time (300 milliseconds at the appearance of the stimuli).

The most powerful signal of these waves is most often measured in the area of the parietal lobe. The presence, the amplitude, the duration and the place of this signal are often used as elements for measuring the cognitive function in the processes of decision making. The potential P300 has two components, known as P300a signals (also known as ‘non-target’) and P300b also known as ‘target’). These signals singularize the answer to different stimuli: the P3a component reflects front-parietal pre-attentive processing whereas P3b reflects temporoparietal processing, associated to the attentional and memory mechanisms. The P300 variability is associated with some neurologic illnesses, the aging phenomenon, alcohol consumption and addictions in general, but also with the level of reward/loss that the subjects estimate in different decisional alternatives. There is a wide range of uses for the P300 potential in scientific research, which varies from clinical studies to the investigation of some

cognitive processes (decisional processes, detecting stimuli etc.).

The credibility of this technology is also due, in part, to the involuntary and uncontrollable character of the potential P300 and to the fact that they have no connection to the emotional reaction of the subject. The examination procedure targets the presentation of a list of three categories of stimuli: target stimuli (known by the suspect), irrelevant stimuli and investigation stimuli (information pertaining to the crime). The subject responds through a motor reaction (pushing some buttons), depending on the presence/absence of stimuli recognition. The cortical mechanisms generate changes of the potential P300, in a split-second, from the time when an individual recognizes and processes the stimuli received, only if it is significant or important to him. In the case of irrelevant stimuli, these activities do not occur, which allows the discrimination of situations when a subject holds or doesn't hold information related to the crime. Subsequently, the dynamic P300 was integrated into a complex of electroencephalographic reactions associated to the amnesic processes, generically named MERMER (memory and encoding related multifaceted electroencephalographic response). The research on the use of this technique is in continuous development. The advantages of EEG/ERP in detecting simulated behavior are determined by the temporarily high resolution of the recordings (in milliseconds) and the use of some portable equipment; the disadvantages invoked are the low spatial resolution and the inconveniences related to the configuration of some electrodes, as well as the discomfort that it generates during the interrogation.

We must also register the vulnerability of these techniques to some

countermeasures (artifices for eluding detection) which are used by the subjects.

3.4. Cortical neurophysiological correlations of simulated behavior

Cortical imagery has identified four main regions for activating the brain during simulated behavior: prefrontal and frontal, parietal and subcortical [5].

3.4.1. The prefrontal and frontal region

The prefrontal activation is significant during manipulation and integration of information, planning strategies and during control and performance strategies. Activation of the frontal-polar-prefrontal region (BA 10 – short for Brodmann area 10) is a manifestation of the process of fixing the primary and secondary objectives. The activations from the dorsolateral area of the prefrontal region (BA 9 and 46) are specific in anticipating the performance, in intentional updating, in representing the work memory, in cognitive control and in the selection of updating strategies involved in the simulation processes. Activating the prefrontal cortex was reported in many studies regarding the tasks with a high level of demand, long-lasting or for manipulating information in the work memory.

In conclusion, prefrontal activation reflects the state of the work memory during temporary retention of integrated information, namely the request, duration or manipulation of the work memory [4].

3.4.2. The parietal region

Activating the BA 40 region was reported by Lee in 2002 in an experiment where one of the subjects' tasks was comparing series of three numbers consecutively presented and to respond

honestly/insincere if the series are identical.

The result is identical with previous studies regarding the implication of the frontal-parietal network in the comparison and arithmetic calculus tasks [7]. Even though it is obvious that the medial parietal region represents an extended cortical area and there are probably many associated functions, this functional segregation is relatively little known. It is considered that the front part of the medial parietal region is only activated when the subjects had mental charts where they could place the new, received information [11].

3.4.3. The temporal region

Activating the BA 21 area is specific to the visual stimulation and was also highlighted in simulation experiments for simulating the deterioration of memory, when the subjects were presented with images that they had deliberately withheld (for instance, they said that it was figure no. 8, when in fact they were looking at 3).

3.4.4. The subcortical region

Activating the subcortical regions, the caudate and posterior cingulate (BA 23), was associated with inhibiting the rules learned before and the simulation of memory errors.

It was suggested that an important role of the back cingulate region is that of 'coupling' the information received to the repertory of activated knowledge, thus forming a coherent representation of the discourse. Common activation of the front medial parietal region/back cingulate region reflects the direct insertion of information into an actual mental chart.

This opinion is in agreement with the observations made during some experiments where all the participants had had mental frames established for simulation, long before they were subjected to the fMRI scan. In 2000, Amos reported an increase in errors when the activation units, represented by wavy neurons, were reduced, as it happens to people affected by Parkinson or Huntington syndrome. These discoveries suggest the important role of the caudate lobe in inhibiting the usual response and in monitoring performance errors when a person tries to simulate the alteration of memory.

In conclusion we can claim that the activation of the prefrontal (BA 10/9/46), parietal (BA 40) and subcortical (caudate and back cingulate) circuits can constitute important neural 'markers' that allow the development of some valid and sensitive methods for detecting simulation.

The cortical correlations of simulation are not entirely understood yet, as they are a complex behavior which implies answers that are intensely processed, while truth, sincerity, are characterized by routine responses, mediated by back cerebral structures. Sometimes, inter-subject variability is so large that, by analyzing the image information resulted, following an experiment with 14 participants, it was identified as being common in 71% of the cases, just by activating the medial prefrontal cortex.

There are case studies where activations of limbic structures have also been identified (the amygdala and the hypothalamus). Thus, it opens the possibility of introducing it into the prefrontal-parietal model of simulation of limbic structures, along with their emotional and cognitive correlation.

The investigation of some subjects from the clinical area and using some different experimental paradigms can lead to subsequent theoretic refinements.

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