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Planting the Seeds of Polygraph's Practice A Brief Historical Review

Истоки практики использования полиграфа. Краткий исторический обзор

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Connecting the dots between body and mind (psychophysiology)

The notion that the cognitive decision to lie carries physical cues has been practiced since ancient times as can be found in some of ancient detection of deception tests such as: the Hindu rice chewing or Bedouin hot spoon licking which are based on the belief that a deceptive person cease to produce saliva or in were the famous physician Erasistratus measured the Assyrian's Prince Antiochus pulse in 300 B.C., are but just a few examples. Only in 1728 the celebrated Roman court physician, Giovanni Lancisi, perceived that emotion may be produced through the close dependence of mental functions upon the nerves, ganglia, and the coronary vessels of the heart. Emotions are produced, he thought, by more or less forceful heart action. From this he inferred that the characteristics of the mind derived from the structure and physical changes going on in the body (Trovillo 1938).

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Toward the end of the 19th century, the development of medical measuring tools enabled scientists and researchers to harness them for the research and later practice of the detection of deception.

Most of the polygraph profession's pioneers have not invented the modern instrument. Their observations and research in the field of emotions and deception utilizing existing measuring devices led subsequently to the nowadays instrument called "polygraph" or as nicked name by laymen the "lie detector".

According to Gina Ferrero (Ferrero 1911) Lombroso in 1902 used the hydropletysmograph to detection of lie in criminal cases¹.

Angelo Mosso an Italian physician who was appointed in 1876 as a pharmacology professor and later as a physiology professor in Turin university, was encouraged in his studies of emotions by his tutor Lombroso. In 1875 Mosso demonstrated, by means of a "plethysmograph" periodic undulations in man's blood pressure caused by the respiration cycle and his studies of the circulation of the blood in the brain opened up new avenues for the study of the influences of fear. He not only performed many carefully controlled experiments on blood pressure and pulse in emotion, but his observations of pallor and blushing, of respiration, of trembling, of facial expression, and of maladies produced by fear are all of unusual significance to research in deception. One of the most unusual and elaborate attempts ever made to measure the influence of fear was performed by Mosso when he devised his "scientific cradle". It was the blood pressure curves but, in the respiration, also (Trovillo 1938).

The Italian experimental psychologist a member of the Austrian school of "Act Psychology" Vittorio Benussi reported in 1914 a partial success in detecting deception by the "inspiration-expiration" ratio; Benussi measured the recorded respiratory curves utilizing a pneumograph and found that if length of inspiration were divided by length of expiration, the ratio was between true teller and deceptive was different (Trovillo 1938).

The German-American psychologist Prof. Hugo Münsterberg who was a Harvard professor of experimental psychology and director of the Psychological Laboratory developed in the early years of the 20th century an apparatus which indicated deception via measurement of heat of skin, heart beat rate and speed of speech (Münsterberg 1907).

¹ In the *Introduction* to English edition of the book *Criminal Man* by famous Italian criminologist and physician Cesare Lombroso, his daughter Gina Ferrero mentions.

Münsterberg zealous Harvard student William Moulton Marston who hold to a law degree and in 1921 received his doctorate degree in psychology reported in 1918 the results of his specific work on blood pressure symptoms of deception using the “discontinuous” technique of reading the systolic blood pressure which involves the repeated inflation of a pressure cuff to obtain readings at intervals during an examination for deception. Marston’s work was done on German POW (December 12 1918, report to The Surgeon General of the US Army Division of Psychology).

John Augustus Larson who considered to be the first US policeman with a doctorate degree (PhD in physiology), joined California’s Berkley Police department in 1920 as a patrolman. After reading one of Marston’s articles, Larson realized the potential use of Marston’s deception test for law enforcement. With the assistance of Berkeley’s physiology department, he built an instrument that continuously recorded blood pressure and breathing naming it the “cardio-pneumo-psychograph” and informally “the apparatus” (Carlsen 2010). His instrument can be named as the first modern polygraph.

The use of the galvanometer, or psychogalvanometer, for detecting deception, is of comparatively later date; although Galvani, the Italian physiologist, after whom the modern instrument is called (GSR), published his paper on animal electricity in 1791. Following Galvani, other researchers developed the idea and made extensive and complex revisions of apparatus. Probably the earliest suggestions for the application of psychogalvanic reactions to forensic problems came from Sticker, in 1897. Sticker was convinced that a strong emotional connection was responsible for the phenomenon. Sticker based his proposals on the experimental ground work of several predecessors such as Adamkiewicz, who in 1878 was the first to offer experimental proof that the secretion of sweat is closely linked to psychological processes (Troville 1938). After numerous researches (M’DoWALL 1933) were done Leonarde Keeler started in 1933 to measure the electrodermal activity as a mean of detecting deception.

Leonarde Keeler is one of foremost contributor to modern polygraph. While in high school, he worked for the Berkeley Police Department for August Vollmer and assisted John Larson during his early polygraph work testing criminal suspects. Later while a student at Stanford he conducted experiments. Late he moved to Northwestern University scientific crime lab in where he developed various polygraph models and test formats (Stevens 1994).

Keeler, like Larson and others, did not invent a lie-detector. They modified and applied existing apparatus. Keeler’s position was that (Keeler 1934): “To begin with, there is no

such thing as a 'lie-detector'. There are no instruments recording bodily changes, such as blood pressure, pulse, respiration, or galvanic reflex, that deserve the name 'lie-detector' any more than a stethoscope, a clinical thermometer, or a blood count apparatus with a microscope can be called an 'appendicitis detector'. However, deception, guilt, or innocence can be diagnosed from certain symptoms just as appendicitis, paranoia, or any other physical or mental disorder can be diagnosed. In every case, the examiner must make his diagnosis from tangible symptoms, using whatever mechanical aids he has at his disposal.

Early years suggested practice

Once the connection between body and mind was established, once there were measuring tools to record those psychophysiological responses, and once those measuring tools were used to detect deception, techniques that can differentiate and determine deception were implemented in real life practice. The ongoing trial and error questioning and testing techniques laid the foundation to today's polygraph test formats and practice. A brief review of early days publication pertinent to core issues such as: general approach, question types, chart analysis and scoring, etc. follows:

General Approach

Keeler (Keeler 1934) wrote that: "There are five main factors involved in the diagnosis of deception, all of which must be considered in conducting the tests. These are:

1. Mental processes involved in the act of conscious deception;
2. Voluntary and involuntary changes in the physiological processes which accompany the mental processes;
3. A suitable combination of instruments for recording bodily changes involved in the deception syndrome;
4. An examination procedure for stimulating the mental processes in order to touch upon guilt complexes without otherwise disturbing the psycho-physical equilibrium;
5. An experienced examiner to properly conduct the examination and interpret the resulting combination of symptoms".

Regarding the manner, examiners should practice Keeler (Keeler, 1930) made the following observation: "Most important in this type of test that no methods shall be resorted to which will excite the suspect. All exciting factors must be eliminated, so that the responses will be due only to the case in question and not to physical or other

psychological disturbances. The subject must be treated kindly and with respect at all times, in order to induce relaxation and as far as possible to eliminate emotional tension. Best results are obtained when the operator works on the theory that the subject is innocent and attempts to obtain as regular a curve as possible”.

Test Procedure

William Moulton Marston (Marston 1921) suggested that “it was of great practical advantage to request the person (examinee) to tell -his entire story first in his own way without either prompting or questions from the examiner. Irrelevant matter was next interposed, and the cross-examination (test questions) could then be built up with great effectiveness upon the elements of the defendant’s own voluntary story”. In addition, Marston (Marston 1921) suggest that: “in each particular case, best enable the operator to determine the normal blood pressure of the subject and also the normal blood pressure plus the fixed increase presumably present throughout the whole examination due to the excitement caused”.

Between 1920 to 1923 John Augustus Larson tested hundredth of suspects (Carlsen 2010). In 1922 Larson detailed the following text he was using to explain the test to the examinee: “This test is to determine whether you are in any way responsible for the thefts committed at X. The test will prove whether or not you are telling the truth. The questions are framed with a view to obtain your emotional reaction to them. And in so far as it is possible, we would like to have you analyze your feelings at the end of each question and explain to us later just what your feeling was following each of the questions. We solicit your co-operation and beg of you not to divulge the questions here propounded to any other person. You are especially enjoined not to attempt to make any explanation of our feelings or to comment on the questions asked you. Larson’s observation as of the manner the test should be practiced was: “There is still one important variable to be controlled and that is the method in which the questions are applied, for the subject can get many hints from the manner of intonation of the examiner. To obviate this the questions should be delivered in uniform monotone, with no, change of inflection, and by one experienced in conducting such examinations. However, this objection can be wholly overcome by having’ all questions or important association words written and placed on a drum which is made to rotate before the subject, who should face this drum and who should be screened off from the sight of any other drums or the examiner. Their questions can be timed and by the use of a suitable device, such as pegs projecting from the top of the drum which will automatically make and break a circuit and by means of a signal magnet, these instantly can be recorded underneath the pressure readings” (Larson 1922).

Keeler (Keeler 1930) followed his teacher's approach and advised the examiner to ask the questions" in a quiet monotonous voice. Time is allowed between questions for the bodily responses to occur and to return to equilibrium... (and that the examinee should be) seated comfortably with his back to the apparatus"

Test Formats & Test Questions

One of the most important factors affecting the test is the test format and test questions. The American Polygraph Association (APA) went as far as investigating the matter for five years (2007 to 2011) prior to its recommendations as of the valid test formats.

Comparison question: At the beginning the relevant-irrelevant (RIR) test format was practiced. In this format the relevant question was compared to the irrelevant question, the CQT format that included the comparison question was introduced only in 1947 by John Reid (Reid 1947). Yet, already in the beginning of operational practice Larson (Larson 1922) suggested: "...a series of tests the questions were alternated. That is, a control question, or one not concerning the subject under investigation, and yet calculated to stimulate various emotions, was alternated with one pertinent to the investigation". Reid's CQT type format was practiced a decade earlier by one of the less famed researchers who was way ahead of his times, Fordham's University head of psychology department professor Rev. Walter G. Summers (Summers 1939) who suggested the following test format and questions which included three "significant" questions (relevant) such as in a theft case:

- Do you know who took the money?
- Did you take the money?
- Have you the money on your person?"

Each significant question was followed by an emotional standard question (Krapohl, Handler, Sturm 2012). The emotional standard was an emotion-provoking question to which the examinee answers truthfully, but one that the examinee would prefer to hide. It was included in a test series so the reaction evoked by it could be compared with the reaction elicited by relevant questions. The questions were discussed extensively in the pretest e.g.:

- Where you ever arrested?
- Do you own a revolver?

In addition, non-significant questions (irrelevant) such as were asked (Summers 1939):

- Are you wearing a black coat?
- Did you eat breakfast this morning?

The questions were asked three times and then the significant questions were compared to the emotional standard questions. "If the reactions to the significant questions are consistently greater than the deflections to the emotional standards, the individual is consciously trying to deceive the examiner. If, on the other hand, the deflections to the critical questions are not consistently greater than those to the emotional standards, the individual is truthfully expressing his state of mind. This is the essential criterion" (Summers 1939).

Directed Lie Question: As in the comparison question case already in 1922 Larson used a type of a directed lie question as he wrote: "In one case an individual was told to lie deliberately. This being a person from whom certain articles were taken, and although the subject lied about every other question this was manifested by a very perceptible pressure change, although the individual said there was no definite motion involved in the lie, such as pleasure or pain, except that there was a feeling that something was being done which should not normally take place" (Larson 1922).

Recognition Test: Are recognized to be a valid test format even by CQT opponents. (Trovillo 1938) practiced a similar idea: "If after talking to the patient on indifferent subjects, the examiner suddenly mentions persons, friends, or relatives, who interest him and cause him a certain amount of emotion, the curve registered on the revolving cylinder suddenly drops and rises rapidly, thus proving that he possesses natural affections. If, on the other hand, when alluding to relatives and their illnesses, or vice-versa, no corresponding movement is registered on the cylinder, it may be assumed that the patient does not possess much affection".

The German-American psychologist Prof. Hugo Münsterberg suggested on his 1907 book *On the Witness Stand*: "The real use ... confined to those cases in which ... a suspected person knows anything about a certain place or man or thing. Thus if a new name, for instance, is brought in, the method is reliable ; the' innocent, who never heard the name before, will not be more excited if he hears that one among a dozen others; the criminal, who knows the name as that of a witness of the crime, will show the emotional symptoms" (Münsterberg 1907).

The searching POT test was commonly used by Keeler who already in 1926 experimented it with his Stanford University Professor Miles. He described the "Map Test" (Keeler 1930): "The experiment developed from the card experiment and subsequently has been found of value in criminal cases where the location of hidden loot or a buried body is in question. In the experimental test, a hypothetical case is read to the subject who is instructed to imagine himself a murderer who has buried a body somewhere in the state. A map sectioned off into ten squares numbered from one to ten, is held

in view of the subject, and as each section is pointed to, the question “did you bury the body in section one?” (or other numbered section as the case may be) is asked. The subject answers “no” in each case, or he may refrain from answering. The resultant curve is identical to that obtained in the use of the cards, tension indicated by increase in blood-pressure developing up to and including the chosen map section, followed by lack of interest and relaxation. Every section is gone over before the analysis of the record is made”.

Chart Analysis

Numerical Scoring: As the case with the comparison question, the numerical scoring that was introduced by Cleve Backster in 1960 and since was refined and became more and more accurate by Krapohl, Nelson and others. Yet, John E. Winter (Winter 1936) already practiced a scoring method in where the breathing curve was rated as regular or irregular; light or deep. The blood pressure curve was rated as regular or irregular, and medium or strong. Winter gave three levels of significance to the results of each of the methods: 0 for “no significance, nothing to indicate guilt;” 1 for “some significance and points in direction of guilt;” and 2 for “distinct signs of guilt.

Another scoring method was used by the FBI examiners who examined suspects and witnesses in a 1936 Nazi spy ring in New York. Leon G. Turrou the FBI NY based agent who was in charge of the investigation wrote in his book *Nazi spies in America* (Turrou 1938): Each examinee was asked many relevant questions. The examiner conclusion to each of the questions were reported in accordance with the response intensity: one asterisk after a question indicated a mild emotional reaction, two a strong emotional reaction, and three asterisks, very strong emotional reaction.

Deceptive Responses: The deceptive responses were precisely described by many early researchers and practitioners. A typical example is Keeler (Keeler 1930) description: “The blood-pressure response to each lie causes an increase in both systolic and diastolic pressure of from four to ten mm Hg. Usually the diastolic pressure increases considerably over the systolic pressure. During a test lasting ten minutes, the general pressure rises from 8 to 20 mm Hg depending on the individual. The respiration becomes more rapid, and in most cases the subject attempts to control his responses at periods following deception. The majority tend to shorten their inspiration and expiration and to breathe slower. In consequence, there is a period of oxygen debit and on the following questions, if pertaining to the crime, an occasional deep breath is taken. If the post questions are irrelevant to the crime, normal respiration is resumed, usually of greater magnitude than the preceding normal respiration. The innocent suspect has no such

fear, and is not prompted to control his emotional responses. His respiratory curve becomes more regular as the test progresses”.

The different deceptive responses found in early publications is displayed in the following table:

Name	Lombroso	Benussi	Larson	Larson	Marston	Trovillo	Inbau
Year	1911 (Lombroso 1911)	1914 (Benussi 1914)	1923 (Larson 1923)	1930 (Keeler 1930)	1938 (Marston 1938)	1942 (Trovillo 1942)	1948 (Inbau 1948)
Respiration							
I/E Ratio		✓	✓	✓	✓	✓	✓
Repression			✓				
Loss of baseline			✓				
Rhythm Changes			✓	✓			
Suppression				✓		✓	✓
Block (apnea)						✓	
Baseline rise						✓	
Irregularities							
Electrodermal							
Duration						✓	
Amplitude increase						✓	
Gradual rise						✓	
Different patterns						✓	
Cardiovascular							
BP Decrease	✓		✓			✓	✓
BP Increase			✓	✓	✓	✓	✓
BP Increase & Decrease			✓	✓	✓	✓	✓
Amplitude increase			✓				
Frequency Increase			✓				
Incomplete inhibition			✓				
Complete inhibitory effect			✓				
Irregular fluctuations			✓				
Combination of any two			✓				
Pulse rhythm changes						✓	✓

Test Affecting and contaminating factors

Awareness to situational or psychological or other affecting the test were discussed long before the “damping” or “super-damping” (“outside issue”) concept was introduced. Keeler (Keeler 1930) wrote that: “In a criminal case, “self protection” is the dominant factor. The suspect has his reputation, his liberty, his life or his money to lose if he is found guilty of an anti-social act, and so, if he is guilty of the act attributed to him, he will be dominated by fear. In a criminal case, the emotions of fear, anger and rage enter as important factors. A man either innocent or guilty, accused of a criminal act, will have a considerable degree of apprehension. He may fear false accusation and conviction, and may fear the treatment he believes is in store for him at the hands of the police. On the other hand, he may be angered by the accusation. The other emotions will play but an insignificant role in the general play of emotions. Responses to both fear and anger, in most cases, produce an increase in systolic and diastolic blood-pressure, and in consequence, the examination procedure must be so formulated with full consideration of all the possible factors involving emotional disturbance”.

Keeler also suggest the manner in which an examinee who is in custody should be treated: “The customary steps are as follows: The suspect is brought into the laboratory and immediately those in whose custody he had been are dismissed. In all probability, he has been “grilled” for some time before being subjected to the deception test, and has come to view these officers with suspicion. Immediately on entering the laboratory, he is surrounded by completely new environment and different personnel. The case is reviewed from the investigating officer’s reports, after which he is briefly interviewed as follows: “Well, old fellow, I can’t see that they have much of a case against you. As far as I am concerned, you have as much in your favour, if not more, than these officers here”.

Paul Trovillo who was a forensic psychologist with the Scientific Crime Detection Laboratory of the Chicago Police Department describe (Trovillo 1941) the different personality types and its’ influence on the test: “It is because of just such situations and personalities as here illustrated that competent lie-detection examiners cannot always render a definite report as to the subject’s innocence or guilt. Because of the very nature of a lie detector test, occasionally a report must be indefinite, and this is true even when the examiners are exceptionally well prepared for their work.

- A man who understands more than he wishes to admit! He is setting out to delay and confuse the examiner and thereby prevent a deception diagnosis.
- The examiner would be happier if only our friend could understand that last question; and if he could experience the all-essential fear of detection.
- The insane make better subjects for the psychiatric clinic than for the lie-detection laboratory.

- A lie-detection test is most successful if made before extensive accusation of the suspect elsewhere.
- Some people complain unduly about the pressure applied to the arm during the test. Their usual reason for complaining is to discourage further testing.
- if only he had not partaken of so much of the liquid shortly before appearing for his test as
- a key witness! This fellow has just been given a first-class beating by some of his outraged neighbours.
- A satisfactory recording of the blood pressure, pulse, and respiration cannot be obtained on”.

Prof. Fred Inbau who worked with Keeler and Trivillo in the Northwestern University Scientific Crime Detection Laboratory which was later merged into the Chicago Police Department in where Inbau became its' first director described the different situations and examinees personalities type affecting the test (Inbau 1950): “No one in his right mind would expect a medical technician to conduct a satisfactory metabolism test on a patient who had just emerged from a fist fight or who had been chased up a flight of stairs or who had been verbally abused and threatened while on his way to the examination room. Yet the thought apparently seldom occurs to some police investigators that a person may be rendered unfit for a lie-detector test by an extensive interrogation based upon frequent and constant accusations of guilt. In many of these instances, the lie-detector examiner is unable to make a diagnosis that he considers reliable; his report is “indefinite” or “inconclusive”, and so the press report reads too. In cases where the extensive interrogation is accompanied by actual physical abuse, the positive suggestions of guilt constituting part of the “third degree” procedure may produce test reactions which will simulate true deception criteria in an innocent person’s record.

The same pre-test experience also may so condition a guilty subject that his enmity toward the investigators becomes the centre of his thinking rather than the offense itself, and the ordeal may actually, relieve him of whatever mental conflicts are present because of his criminal act. In this event it is highly probable that a “third degree” victim’s deception may not be detected by the lie-detector technique, and another lie-detector failure will probably find its way into the press reports. Any testing which is attempted under the conditions just described is unfair to the lie-detector technique and to the examiner as well.

What can the police-employed lie-detector examiner do to remedy the present situation? Three things:

1. Establish a practice of refusing to test a subject who has been physically abused.

2. Where the circumstances are in the extreme, refuse to examine a subject who has been extensively interrogated, even though no direct physical abuse has been administered.
3. Try to develop a procedure within the particular police department whereby lie-detector tests will ordinarily be conducted during the early stages of an investigation or interrogation rather than as a last resort when all else has failed.

Posttest

Deceptive responses displayed on a polygraph chart does not necessarily indicate the examinee's guilt. Keeler (Keeler 1930) suggest the following step that should be taken by the examiner upon reading such charts: "At the completion of the initial test, he is shown his record which is carefully explained to him. The operator shows considerable concern over certain responses recorded thereon and asks the man, to explain his emotional stress".

Point of Views

In spite the fact that the polygraph profession pioneers laid quite a solid foundation to nowadays practice, needless to mention that changes have occurred. The question what type of changes occurred in the last 100 years will be answered by nowadays prominent professional researchers and practitioners.

As mentioned, these researchers and practitioners will ask to answer the following question:

Suppose you were a polygraph examiner already in the early years of the profession, when the practice was evolving please, outline the foremost changes you have witnessed in the last 100 years.

Please, disregard technical instrumental development dur to the fact that those were basically developed by out of polygraph professionals and were later harnessed to the polygraph needs.

Their valuable and worthy answers will be published in the next issue of *European Polygraph*. Follow this publication author's point of view:

While researching these old publications the similarities between old days practice and current practice was surprising and somewhat annoying. Yet, in spite of the similarities it seems that hundred years ago, examiners practiced an **intuition-based practice** while today, examiners are practicing an **evidence-based practice**. Old days prac-

tice leaned on individual examiners personal experience which led to different schools of thoughts and practices while today practice regardless of the different approaches should be validated by researches.

Last 100 years excelled in revolutionary scientific changes, a revolution that seems to neglect the polygraph practice. In spite of not witnessing a revolution there is an ongoing evolution that hundred years later can be considered as a revolution.

And to all those innovation and ground-breaking zealots and fanatics who claim “stagnation”, keep the wheel in mind. The wheel was invented some 8000 years ago. The basic shape and form stayed the same since. Innovation and advancement came in the shape of material: from stone thru wood thru metal to nowadays rubber with steel walls. Yet, the original shape and form stayed the same for an obvious reason: ‘If it’s ain’t broke don’t fix it’!

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