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*European Polygraph* is an international journal devoted to the publication of original investigations, observations, scholarly inquiries, and book reviews on the subject of polygraph examinations. These include jurisprudence, forensic sciences, psychology, forensic psychology, psychophysiology, psychopathology, and other aspects of polygraph examinations.

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Dear Readers,

the year 2020 will be the jubilee year marking the centennial of the first practical use of polygraph. Although irregular instances of using instrumental lie detection for criminological purposes had occurred before, it was only the use of polygraph examinations by John A. Larson to determine the perpetrator of thefts in 1920 that initiated the regular practice of using the polygraph.

The Editorial Board of *European Polygraph* announces the year 2020 the year of John A. Larson. To commemorate that anniversary and the memory of John A. Larson, we announce a competition for an article devoted to the pioneer of polygraph research. Selected by the Editorial Board, the best article will be published in *European Polygraph*. The deadline for submissions is the end of February 2020.

At the same time, following the idea of our author and regular columnist, Tuvya Amsel PhD, we turned to a group of persons of great merit in polygraph examinations, both academics and practitioners from all over the world, to answer two questions:

1. 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.
2. Please, disregard technical instrumental development due to the fact that those were basically developed by out of polygraph professionals and were later harnessed to the polygraph needs.

All the answers submitted by the end of January 2020, will be published in the following issue of *European Polygraph*.

We would like to inform our readers and authors that beginning with 2020, *European Polygraph* will be published semi-annually. The annual volume of our journal will not change, only that instead of quarterly it will now be published semi-annually.

We encourage all our readers to publish their works in *European Polygraph* and kindly ask members of the Editorial Board to promote our journal in their milieus and encourage publication of both experimental studies and descriptions of interesting practical cases. We also request reviews and bibliographic notes on books on polygraph examinations, and reports from conferences and symposia on the subject.

*European Polygraph* belongs to all of us. The journal is indexed in several dozens of databases and carries an Impact Factor of 0.63.

Professor Jan Widacki

Editor-in-Chief of *European Polygraph*

# Articles







Jan Widacki\*

Andrzej Frycz Modrzewski Kraków University,  
Kraków, Poland

# Attempts at Lie Detection Based on Scientific Premises on the End of 19 Century and in the First Half of the 20 Century

Попытки выявления лжи на основе научных предпосылок  
в конце XIX – первой половине XX века

**Key words:** history of lie detection, scientific basis of lie detection

## 1. The word associated test

In 1892, in the psychological conference, Hugo Münsterberg expressed the belief that it is not a lie that is detected, but the emotions that accompany it (Burt 1965). The **Word Association Test** proves that the reactions accompanying a lie consist not only of emotions but also a certain intellectual effort, necessary on behalf of the lying person. It goes without saying and is supported by Trovillo (Trovillo 1938/39) that the first to have described the essence of a test using word associations was Francis Galton (1822–1911) in 1879 (Galton 1879). Later some other researchers, notably Wilhelm Wundt, Max Wertheimer, and Melanie Klein, but also Carl Jung, conducted experiments with the test and tried to use it to justify their theories and hypotheses (as ex-

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plained below). The assumptions of the word association test are as follows: there is someone suspected of having assaulted a woman in a park, snatching her handbag and terrorising her with a knife, and now denies it, claiming that he not only made no assault but moreover knows no circumstances of the event. A special list of clues that include such words as “knife”, “park”, and “handbag” is drafted for him. Then the suspect is instructed that as the list will be read out to the suspect, who is supposed to answer immediately with the first word that comes to mind on hearing it. Reading the cues one by one, the experimenters measure the time after which the subject uttered the word associated with the cue. In advanced laboratory experiments, both of the researcher and the subject spoke to the so-called sound key, in which the airwave produced by the utterance broke an electric circuit, and the sound key was connected to a timer. In more primitive cases, time was measured with a stopwatch. It was assumed that on hearing “the critical words” (in this case, “knife”, “park”, and “handbag”) the person who lies saying that he or she does not know the details of the event will take a longer time to build associations than in the case of the remaining cues. That extension of the reaction time is caused by the subject’s self-control, as they control themselves so as not to “spill” some information. Briefly speaking, in case of the critical queues, a liar (deceptive person hiding information) is forced to a greater intellectual effort, which firstly extends the time of response in a way automatically, and secondly calls for mobilisation of the attention and increases the activity of the organism.

Udo Undeutsch informs that late in the 19th century Professor Hans Gross (1847–1915), a pioneer of criminalistics, at the time lecturing at the German University in Prague, presented students with novelties from literature in the field and also told them about Wundt’s work on the verbal associations test. One of his students was Max Wertheimer (1880–1943), who took interest in the test of verbal association, recognising it a perfect tool for identification of the perpetrator. Wertheimer became so much hooked on forensic psychology that he abandoned his legal studies to enrol into the Department of Philosophy and study psychology. In 1906 he defended a doctoral dissertation devoted among others to the verbal association test at the University of Würzburg.

At the same time a Swiss psychiatrist, Eugen Bleuler (1857–1939), known especially for coining the term “schizophrenia”, applied the word association test to check whether there are differences in word associations between sane and insane individuals (Undeutsch 2007). One of his assistants was Carl Jung (1875–1961), who, influenced by Bleuler, tried (together with Franz Riklin) to use the word association test to verify empirically some claims of Freud (Jung, Riklin 1905). Thus, the word association test was used mostly in psychology and psychiatry, to test memory, the subconscious, and associations in both sane and insane individuals. However, Jung improved the test for forensic purposes and used it himself successfully in two criminal cases.



Fig. 1. Carl G. Jung

A Russian physiologist, Alexander Luria (1902–77) complemented the method of lie detection with the use of verbal association by the simultaneous studying of involuntary movements of fingers. Luria believed that a lie entails the conflict of two reactions. Answering a verbal hint (stimulus), the subject selects a true or false word. Luria believed that such a conflict disorganises the subject's behaviour, and therefore that it would be enough to find a simple behavioural scheme that will be disorganised. Luria made his subjects press a key (a rubber bulb connected to a sensor) at the time of uttering the associated word, holding the other hand on an identical key. Both the keys were so constructed that they recorded not only the main presses, conscious and purposeful, but also all the changes in the pressure. In this way, Luria registered not only the time of reaction (extended after the critical cues, i.e. connected to the event) but also the uncertainty and hesitation of the subject, manifested in the change of the force with which the key was pressed (Luria 1932).

## 2. First attempts at instrumental lie detection based on the observation of physiological correlates of emotions

### 2.1. Lie detection based on plethysmograph indications

The plethysmograph was one of the first instruments constructed to observe and measure the changes in the volume of the body resulting from the changes in blood supply. The first plethysmograph (hydroplethysmograph) was, constructed by Angelo Mosso, and made use of the comments of Karl Ludwig. It is also known that Mosso's experiments and devices were used by Cesare Lombroso for his purposes, as he also tried to prove empirically the hypotheses about the physiological distinctiveness of born criminals. It is not aware of any experiments in lie detection using this device.



Fig. 2. Angelo Mosso

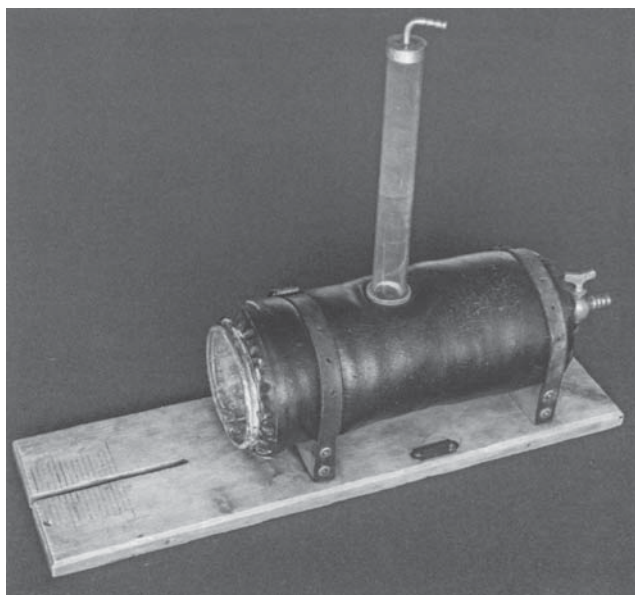


Fig. 3. Hydroplethysmograph (Jagiellonian University Museum)

Should one believe Lombroso's daughter, Gina L. Ferrero, in March 1902 Lombroso interrogated, or perhaps just questioned, a suspect and observed his reactions with hydroplethysmograph in a case concerning the killing of a six-year-old girl. Gina claims that Lombroso used a plethysmograph to observe the suspect's reactions while being shown a photograph of the victim. On these grounds, Lombroso is believed to pass a judgement about the suspect's innocence. Gina Ferrero quotes this information in the introduction to the English translation of Lombroso's fundamental work *The Criminal*

*Man.* Lombroso himself mentioned the use of the hydroplethysmograph in another case, which concerned the forced entry and stealing of 20,000 francs (Ferrero 1911). Still, the date of that case remains unknown. The information was publicised in the work of P.V. Trovillo entitled *History of Lie-Detection* and is most often mentioned in the context of that work. I have found no other published sources quoting more detailed information on the subject, and especially corroborating the information given by Gina Ferrero.



Fig. 4. Cesary Lombroso

## 2.2. Attempts at detecting lies based on changes in the breath

Beginning from the 19th century two methods of recording the breathing functions have been known. The first consists in the measuring of the volume of the inhaled and exhaled air, and the latter on the measuring of changes in the circumference of the chest or diaphragm. The volume of the exhaled air is measured with spirometers, and in turn the measurements of the changes in the circumference of the chest or diaphragm are performed with pneumographs.

The first are primarily used for medical diagnosing, as they allow observation and recording of the volumes of the air going in and out (inhaled and exhaled) and also the breathing rate. Pneumographs found application primarily in psychophysiological examinations. Moreover, in the latter half of the 19th century, pneumograph was connected with a kymograph, which allowed to obtain complete recordings of breathing functions. Such a recording reflected the breathing rate (the number of breathing cycles: inhalation – exhalation per unit of time) and the depth of breathing measured with the amplitude of breathing, and made it possible to compare the duration of the inhalation and exhalation.

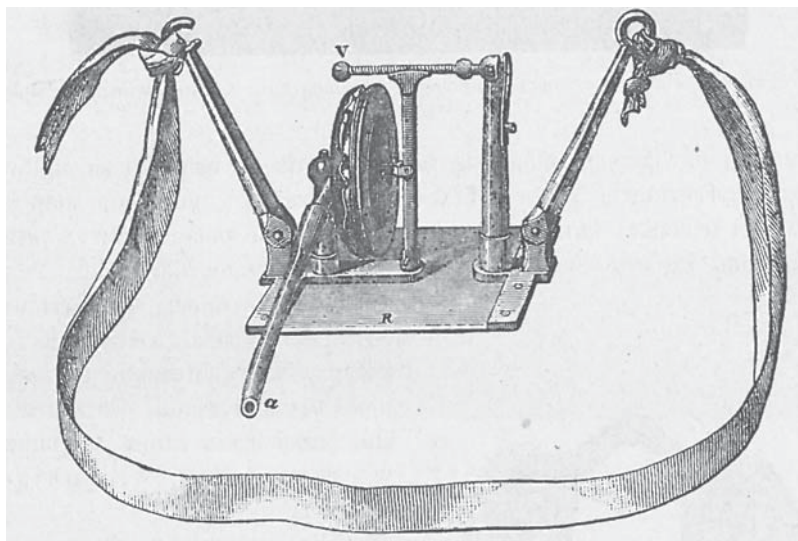


Fig. 5. Pneumograph (N. Cybulski, 1891)

Experimental studies, conducted by physiologists and psychologists (among others Angelo Mosso in Torino, Vittorio Benussi in Graz, and Edward Abramowski in Warsaw) in the late 19th and early 20th centuries proved a link between changes in the activity of an organism and the changes in the process of breathing captured in the recording. Today, knowing the physiological mechanism of emotions, we can explain and justify this link. The first observations of changes of the pneumographic recording under the influence of strong emotions (fear) were observed and described by Mosso (Mosso 1891, 100). He believes that the first breath after receiving the stimulus as a rule becomes deeper (Mosso, 1891, 100). This is followed by an intermission in breathing, after which the breath speeds up.

Abramowski found recurring changes following such stimuli as noise, touch, sudden flash of light, and sound, while similar changes were present when the subject solved tasks or “strained imagination” (Abramowski 1913, 89). In turn, Rehvoldt described the speeding up and deepening of breathing in excitement. Other researchers operating later also discovered changes in the course of breathing caused by the impact of various stimuli (Rehvoldt 1911).

The studies by E.E. Blatz (Blatz 1925) proved that the emotion of fear slows down the pace of breathing from the average 14 cycles a minute to 11. He also noted that if the fear-inducing stimulus occurred at inhalation, it was extended, yet if it occurred during exhalation, the egress of air was interrupted to allow inhalation to begin. The recording

of breathing functions made it possible to determine not only their qualitative shape of the curve but also its quantitative assessment. Besides the frequency of breathing, it also made it possible to measure its amplitude, duration of the inhalation and duration of the exhalation, and in consequence, to count the ratio between the inhalation and exhalation. That proportion is known as the “Störing’s breathing ratio” (Störing 1906). If  $I$  denotes the duration of an inhalation and  $E$  – the duration of exhalation then  $Q$  (breathing ratio) equals  $I/E$ .

Vittorio Benussi, an Italian working at the University of Graz, was the first to try to use the assessment of the recording of the breath for lie detection (Benussi 1914).



Fig. 6. Vittorio Benussi

His experiment consisted in presenting the subject with multiple sheets of paper with letters and numbers written on them in certain special positions. There was also a sheet with a drawing of a generally known object. Every other sheet also featured a red star. If the subject received a sheet without a star, the task was to describe the placement of the elements on the sheet, informing whether they are numbers or digits, and also stating the number of the elements. The following task of the subject was to read out all the elements according to a predefined order. If there was a drawing on the sheet, the subject was to describe it. If, however, the subject received a sheet with a star, his task was to make up the content of the sheet, and the description was to be entirely false. While the subjects described the contents of their sheets, Benussi used Marey’s pneumograph to register their breathing.



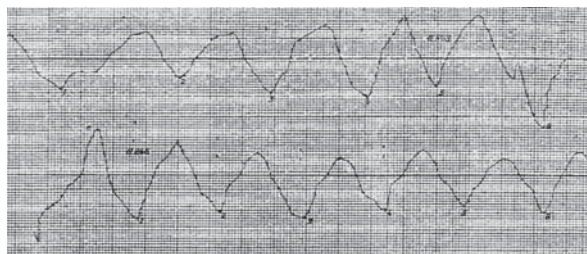


Fig. 7. Recording of the breath performed by Benussi (based on H.P. Huber, *Die Vermessung der Seele*. Psychologische Laborgeräte, UniGraz Museum 2013, p. 28)

The researcher conducted his experiment on 160 people altogether, and was capable of discerning honest answers in 100% and deceptive ones in 97.5% of cases. Benussi discovered that while telling the truth,  $Q_v > Q_n$  where  $Q_v$  – is the averaged breath coefficient for 3–5 breaths before the statement, and  $Q_n$  – an identical coefficient for the breaths following the completion of the statement. In turn, in case of untrue statements  $Q_v < Q_n$ .

To test whether the changes observed in the breathing functions were caused by insincerity (lie) or perhaps a mental effort caused by the need to change elements of the description, Benussi complemented his studies by repeating the experiment, this time, however, agreeing with the subjects whether they will tell the truth or lie. Even though the mental effort was identical as in the first experiment, the subjects knew that they did not deceive anyone and did not experience the tension whether the lie will out or not. In this experiment, the ratio of  $Q_v$  to  $Q_n$  ended up as identical with the results in non-deceptive utterances.

Encouraged with his results, Benussi expressed the conviction that his method would be useful in investigative practice. However, the results of other authors who repeated his experiments were far less encouraging (Burt 1921). Only his student, Mussatti, obtained results close to Benussi's (Mussatti 1930). Eager to avoid the artificial quality of the situation developed in Benussi's experiments, Mussatti agreed with the subjects that he would ask them personal questions, and they can answer truthfully or deceptively (i.e. tell the truth or lie). Then the subjects wrote introspective testimonies in which they admitted when they told the truth and when they lied. In 19 series of the experiment, Mussatti was capable of answering correctly when the subjects told the truth and when they lied in 15 cases. Thus, the correct results were obtained in 78.9% of cases. A result still worse than obtained by Benussi, even though the questions which the subjects answered were certainly far more emotion-genic than in Benussi's experiment.



### 2.3. Attempts at lie detection based on the assessment of changes in the cardiovascular system

Changes in the work of the heart, and the ensuing changes in the entire circulatory system, have long been considered a good indicator of emotional changes. It is not a coincidence that heart was portrayed as the home of all the feelings. Initially, the operation of the cardiovascular system was primarily observed through changes in the pulse, which was the effect and at the same time the indicator of contractions of the heart. The first devices capable of objective observation and registration of the phenomenon were sphygmographs.

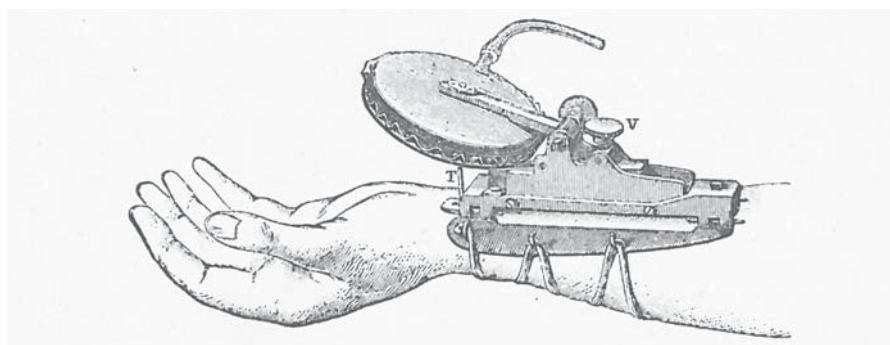


Fig. 8. Sphygmograph (N. Cybulski, 1891)

Changes in blood pressure were another way to observe the work of the cardiovascular system. Measurements of blood pressure began early in the second half of the 19th century. Around 1896 Luigi Riva-Rocci constructed the first device for measuring blood pressure, the so-called sphygmomanometer. The concept of examination with sphygmomanometer is based on balancing the blood pressure with the external pressure of the cuff of the device connected to a mercury-based manometer (or aneroid; today usually digital). When the external pressure, caused by the pressure of the cuff into which air is pumped through a rubber pump matches and slightly exceeds the pressure of the blood in the artery, pulse measured below the cuff disappears. The pressure of air inside the cuff, necessary to offset arterial blood pressure, can be measured with the manometer. The electrocardiograph, constructed by Walter in 1887 to assess the condition of the heart and study its operation, was subsequently enhanced by Einthoven in 1903 (string galvanometer), and later repeatedly perfected (with amplifier tubes and moving mirror introduced in the 1920s). (Kwoczyński 1972). It allows to observe the electric activity of the heart muscle, which has it used for medical diagnostic purposes. However, for psychophysiological purposes, and especially for researching emotions,

sphygmographs were, however, still in use as they registered the pulse (using the sphygmograph), relative oscillations of blood pressure (with the sphygmomanometer), and optionally also changes in blood supply and consequently in volumes of the organs (with the use of plethysmograph).

The first attempts at detecting lies by observing changes in the cardiovascular system were conducted early in the 20th century by an American, William Moulton Marston (1893–1947), a graduate of Harvard University (BA in 1915 and LLB in 1918) awarded a doctorate in psychology (PhD) in 1921.



Fig. 9. William Marston

It is worth remembering that, as a student of Münsterberg, Marston both studied and worked under his guidance in the laboratory of psychology of Harvard University (Krapohl, Shaw 2015). Interested in the issues of lie detection, Marston conducted an experiment with ten students. Their role consisted in playing witnesses asked to defend a friend, who was agreed to have been accused of certain perpetrated crimes. In the experiment, the witness (subject) was to provide the defendant with an alibi, selecting either a true or a made up one. In the experiment, both during the examination and during the breaks in the examination, Marston measured the blood pressure of all the subjects. Out of his 107 indications of “true accounts” and “false accounts” no fewer than 103 were correct, which corresponds to approx. 96% accuracy. Marston realised that the arterial blood pressure of people telling the truth during the examination, i.e. giving true accounts, increased by no more than 5mm Hg. In people who made untrue accounts, the increase in the blood pressure was significantly higher, as on average it amounted to 16mm Hg. (Marston 1917). In controlled experiments, in which Marston had his subjects count, tell stories, etc., no increase in blood pressure was detected. Using this premise, Marston concluded that Münsterberg was right to claim that detection of a lie actually means detection of emotions accompanying it. Emotions, and

not for example, the straining of the mind (Marston 1917). Marston's experiment convinced him and other researchers that changes in the operation of the cardiovascular system are a good indicator of emotional changes accompanying lie, and through this, they are indirectly a good indicator of lie. He also emphasised that a regular blood pressure device is unsuitable for such purpose, yet what could make greater sense is one that would continuously record blood pressure. Beyond doubt Marston's experiments were the proverbial milestone in the instrumental detection of lie.

In 1929 Marston's experiment was repeated by Chappell, yet, with only 87% of correct indications, the results he obtained were slightly poorer. Chappell also made a somewhat different description of symptomatic changes in the blood pressure. In his studies, the arterial blood pressure in people telling the truth during the examination, increased on average by approximately 5mm Hg, and only in some it exceeded 12mm Hg. In the case of liars, the average increase in blood pressure was 19mm Hg, remaining below 18mm Hg only in some individuals. Moreover, Chappell's studies confirmed that changes of pressure were not connected to the lie itself but only to agitation (emotion) accompanying it (Chappell 1929). The researcher recorded no increase in blood pressure whenever the subject lied in circumstances in that his lie caused no agitation (I.e. the subject uttered false sentences without fearing consequences of his lies being uncovered.) as the fact that the subject lied was known to the researcher. Today, this goes without saying: a lie can only be detected when there are consequences for the liar connected to its detection, which is the reason why lies are accompanied by emotions (Burt 1921, 1965, Woodworth, Schlosberg 1966, Widacki, Dukala 2015).

#### **2.4. Attempts at lie detection based on observation of muscular tension and body tremors**

Muscular tension and the possible tremors are known to be symptoms of emotions. A special complex device was constructed to observe and measure them.

Early in the 20th century, the University of Graz (Karl-Franzens-Universität Graz) was certainly one of Europe's key academic hubs in what was broadly construed as criminological sciences. The contemporary Graz is often referred to in literature as "the criminological capital of Europe" (Mueller 1957). Enough to recall that the world's first the Institute of Criminalistics (Kriminalistische Institut, Karl-Franz-Universität in Graz) set up by Professor Hans Gross and the psychological laboratory founded by Professor Alexius Meinong (1853–1920), a pioneer of experimental psychology, operated here. One of Meinong's students was Vittorio Benussi, who conducted above-mentioned studies in lie detection with the new pneumograph. In the 1920s, Professor Ernst Seelig

(1895–1955), successor to Hans Gross in his chair of the University of Graz, tested Benussi's method and modified it to suit his needs, recognising it hardly useful for court practice, however (Seelig 1927). It must be remembered that Seelig was a lawyer, holder of a doctorate in criminal law, criminology and criminalistics at the University of Graz (Mueller, 1957), little wonder therefore that he tried to fit Benussi's method to the binding criminal procedure. Aware of its requirements, he decided to develop such a lie detection technique that would be consistent with it.

Seelig proposed his lie detection technique, and tried to use an improved device of a German psychiatrist and neurologist, Otto Lowenstein (1889–1965) for that purpose. Lowenstein was a physician, a doctor of medicine (with doctorate from the University of Bonn obtained in 1914), and a military doctor during the First World War. To investigate psychological shock in soldiers, he constructed among others a special device helpful in distinguishing tremors caused by organic changes from ones caused by psychological trauma resulting from wartime experiences.

The machine simultaneously recorded a number of functions that Lowenstein believed to be manifestations of expression, and therefore helpful in psychiatric diagnosing. Seelig, who had critically examined Benussi's experiment even earlier, decided to use Lowenstein's device in an experiment of his design. For his criminalistic purposes, he adapted both Lowenstein's technique and method. The intended purpose for his device was the registration of the involuntary expressions of experiences, gleaned from the charts of no fewer than six curves (records) drawn in parallel by the kymograph: chest breathing, diaphragmatic breathing, and the relative changes in the position and movement of arms, feet, and head (Seelig 1927).

The subject set on a tall chair with arms suspended by leather belts, with pneumograph sensors girdling the chest and the abdomen at the diaphragm, also recording the movements of the subject's head, arms and feet, and transferring all their movements to the markers of the kymograph. The kymograph itself was placed behind the back of the subject. The styluses of the kymograph drew altogether seven curves on a smoke-blackened sheet of paper stretched on a drum, allowing the experimenter to follow the course of "expression" of the subject.

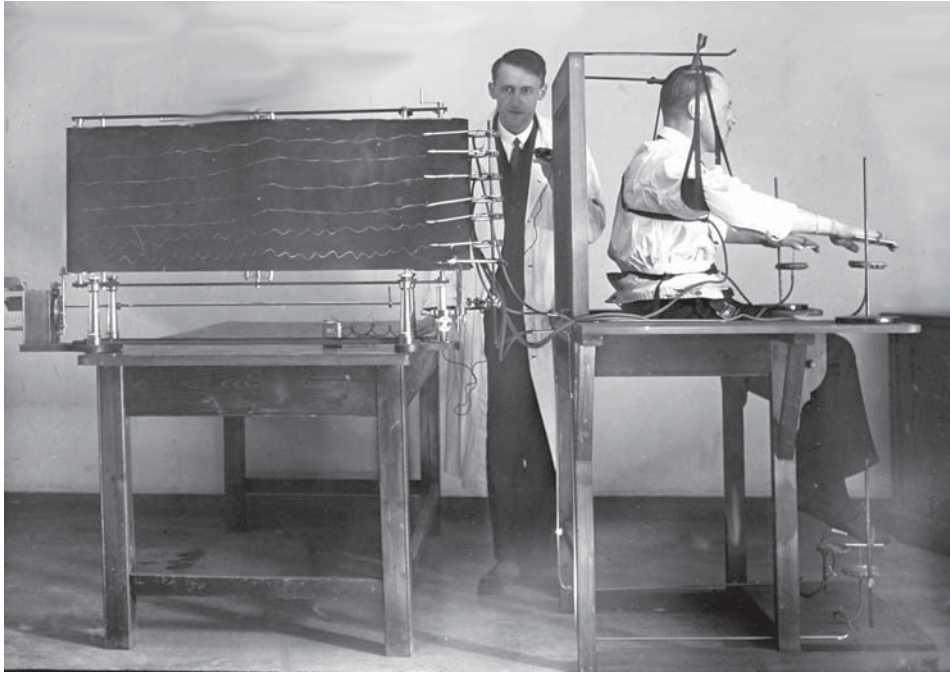


Fig. 10. Lowenstein's device (based on Ch. Bachhiesl, *The Search for Truth by "Registration of Expression". Polygraph Experiments in Graz in the 1920s*, *European Polygraph* 2013, 7, 2(24), p. 61)

Seelig wanted to check whether the subject still holds experiences of emotions from the past. In other words, the examination was to provide a proof whether there are mental traces (whether related to memory or emotions) of crime retained in the consciousness (subconsciousness) of the subject. Therefore, it can be said that, like Lykken would do several decades later, Seelig rather than try to detect lie or deception, ascertained whether the subject has the knowledge of a deed, and knows details of the crime, despite denying it. Lykken mentioned above used the term "guilty knowledge" to refer to such a state (Lykken, 1960).

Christian Bachhiesl (Bachhiesl 2013) reminds that the paths of Lowenstein and Seelig parted suddenly. After Hitler grabbed power, Lowenstein first emigrated to Switzerland and then to the US, where he died in 1965, never continuing his European studies. He became primarily involved in the physiology of the eye, including studies of the change of pupil diameter in different lighting conditions and measurements of the pupillary reflex. Today he is considered the pioneer of pupillography. A year before his death, Lowenstein was granted an honorary doctorate of the University of Bonn. Seelig did not continue studies on lie detection either. He was busy with various aspects of crimi-

nology, criminal sciences, and law of evidence. After the annexation of Austria, Seelig joined the NSDAP and transformed his chair, founded earlier by Hans Gross, into the Institute of Forensic Biology, developed even further by Adolf Lenz into a Nazi hotbed of racism. After the war, Seelig left Austria for Germany, where he opened the Institute of Criminology at the University of Saarbrücken (Bachhiesl, 2005).

Although the experiments of Lowenstein and Seelig had no direct continuators, David T. Lykken might have, perhaps quite unaware, made a reference to Seelig's concept. However, none of his works mentions the Austrian.

The observations of the movements of the head and extremities, and the tremors registered by Lowenstein were advanced, and the devices used for the purpose were significantly modernised in attempts to discover conscious disruptions of polygraph examinations recordings.

## **2.5. Attempts at lie detection by observing changes in electroencephalograms**

Electroencephalography (EEG), that is a method of monitoring electric activity of the brain has been routinely used in psychiatry and neurologic diagnosing at least since the 1940s. The electroencephalograph uses the electrodes installed on the head of the subject, to capture the rhythmical bioelectrical discharges in the brain, amplified and recorded on the recording device. Independent of diagnostic purposes in neurology and psychiatry, the electroencephalographic is used for research purposes in both these sciences as well as in experimental psychology as such. It allows direct monitoring of the brain's electric activity, and uses it to assess the level of activity of the organism and its reaction to stimuli. Therefore, it also allows to follow emotions. When the brain is resting, the alpha waves are the fundamental rhythm of its activity. They have a relatively high amplitude and small frequency of around 10 Hz. As soon as a stimulus, whether internal or external, is received, the alpha rhythm is blocked, and the alpha waves yield to ones of lower amplitude and higher frequency (Hilgard 1967). The changes in the EEG are correlated with the changes in the electrocardiogram (ECG), the galvanic skin response (GSR), and other indicators of emotional changes (Lindsley 1951).

Obermann used EEG for experimental lie detection, and that with good results, as early as in the 1930s (Oberman, 1939). Nonetheless, experiments using the electroencephalogram for lie detection were discontinued for a long time. It was only early in the 1970s that Orne at al. (Orne at al. 1972) realised that an electroencephalogram can be useful in lie detection.



Moreover, the electroencephalograph was used in parallel with the polygraph (recording changes in breathing, blood circulation, and GSR) in experiments conducted by Dufek and co-authors in Czechoslovakia in the 1960s and 70s (Dufek, Richter 1970).

Description of Dufek's experiments is fairly limited, as he only concludes that the EEG can be as useful in lie detection as the physiological correlates of emotions recorded by the polygraph.

Soviet authors, Gulyayev and Bykhovskiy, describe using a 15-channel electroencephalogram "Alvar-2" for experimental lie detection (number and similar tests). Unfortunately, there is no precise description of the experiment, and the description of the changes in the EEG curves (records) when the subject lied is missing (Guljajew, Bychowskij 1972).

It seems that the EEG is more useful for researching the mechanisms of emotions than for detecting them as such. Should one even assume that emotions, coupled with the intellectual effort accompanying lie trigger reactions visible in the electroencephalogram, as it happens in the recordings performed with a classical polygraph (functions of the respiratory and cardiovascular systems, the GSR) it has to be remembered that electroencephalographic examinations suffer from plenty of specific limitations. First, it is a highly sensitive method and as such is vulnerable to both external and internal (e.g. thinking processes) stimuli, which makes it difficult to differentiate between reactions caused purposefully by the researcher (e.g. by asking the test questions) from reactions caused by other stimuli of both endogenous and exogenous nature that can be purposefully triggered by the subject who is keen on corrupting the results, as well as on the subject's will and even consciousness. Moreover, despite the development of devices used in encephalography, recording of action currents in the brain is fairly complicated and cumbersome for the subject. Hence the conviction that electroencephalographic examination is useful only to a limited degree in lie detection, and is not fit for routine application (Widacki 1981).

Recently, the interest in using EEG examinations for lie detection (see below) has been on the rise again in the wake of the discovery of the P - 300 wave (Wojciechowski 2014).

## **2.6. Attempts at using the galvanic skin response for lie detection**

It is noteworthy that the galvanic skin response (GSR, aka electrodermal activity) discovered and described in the 19 century by Fere and by Tarkhanoff (Féré 1883, Tarkha-

noff 1890) and considered a perfect indicator of emotional changes unanimously in Europe and the US was long not used for attempts at lie detection.

In 1907 Charles Richter and Carl Jung, at the time still a *Privatdozent* lecturer of psychiatry in Zürich, jointly announced a study entitled *Further investigation on the galvanic phenomenon and respiration in normal and insane individuals* (Richter, Jung 1907).

The phenomenon of the galvanic skin response was also the object of studies and descriptions of his contemporary Polish researchers (see: Hortyński 1907, Abramowski 1913, Ochorowicz 1914).

Unlike in the West, many Japanese researchers investigated the galvanic skin response already in the 1920s, as they found it an indicator of emotions (Matte 1996), and suggested the possibility of using it for lie detection. Early in the 1930s Akamatsu, Uchida, and Togawa (Fukumoto 1982), and later Akamatsu and Togawa (Akamatsu, Togawa 1938), Akamatsu, Uchida, Togawa, and Miyata (Akamatsu et al. 1939) suggested the possibility of using the indicator for lie detection. In 1937 Akamatsu, Uchida, and Togawa (Akamatsu et al. 1939) announced that they successfully used the psychogalvanometer for lie detection. In 1938 and 1939, they announced the positive results of the successive experiments in lie detection. Fukumoto informed that Togawa was probably the first to use the observation of the galvanic skin response (electrodermal activity, EDA), while examining spies (Fukumoto 1982).

A “lie detector” with the psychogalvanometer being its key part was constructed in Japan in the 1930s, and Yokokawa Denki Company marketed the Denki Psychogalvanometer during the Second World War. The device was used by Tokyo Metropolitan Police since 1947, and later also by majority of departmental police forces (Matte 1996) Psychogalvanometers were used by the Japanese police until the introduction of the American Keeler polygraph (model 302) in 1953, and later the development of proprietary polygraphs manufactured by Takei Kikikogyo Company and Yamakoshi Seisakusho Company (Fukumoto 1982).



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

Истоки практики использования полиграфа. Краткий исторический обзор

**Key words:** history of polygraph, polygraph practice

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 19<sup>th</sup> 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 nicknamed name by laymen the "lie detector".

According to the Gina Ferrero (Ferrero 1911) Lombroso in 1902 used the hydropletysmograph to detection of lie in criminal cases<sup>1</sup>.

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 20<sup>th</sup> century an apparatus which indicated deception via measurement of heat of skin, heart beat rate and speed of speech (Münsterberg 1907).

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<sup>1</sup> 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 (Trovillo 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. (Trevillo 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 (Kedler 1930)	1938 (Marston 1938)	1942 (Trovillo 1942)	1948 (Inbau 1948)
<b>Respiration</b>							
I/E Ratio		✓	✓	✓	✓	✓	✓
Repression			✓				
Loss of baseline			✓				
Rhythm Changes			✓	✓			
Suppression				✓		✓	✓
Block (apnea)						✓	
Baseline rise						✓	
Irregularities							
<b>Electrodermal</b>							
Duration						✓	
Amplitude increase						✓	
Gradual rise						✓	
Different patterns						✓	
<b>Cardiovascular</b>							
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 due 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’!

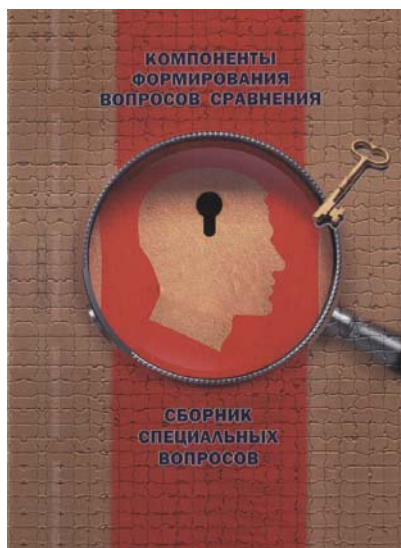
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# Book review





*I.P. Uskikov, R.V. Tschernenko,  
Komponenty formirovania  
voprosov sravnieniya.  
Sbornik spietsialnih voprosov,  
Kyiv 2019. [Components  
for phrasing control questions],  
in Russian; 102 pp.*

A book by two leading Ukrainian experts in polygraph examinations, Igor Uskikov and Roman Tschernenko, with sets of sample irrelevant, relevant, and control questions for polygraph examinations. A course book useful for polygraph examiners, especially still honing their skills in the craft. The book draws from Ukrainian experiences and practical examinations of real criminal cases.

The authors are Igor Uskikov and Roman Tschernenko, both experienced in the use of the polygraph for criminal cases. Uskikov is the general director of the East European Centre for the Security of Human Resources and Ukrainian Bureau for Psychophysiological Investigations in Security. He began his career at the Ministry

of Internal Affairs of the Ukrainian Soviet Socialist Republic in 1986 to move to the Ministry of the Interior of the independent Republic of Ukraine. Since 2006, Uskikov has been a retired colonel of the Ukrainian Ministry of Internal Affairs. He is the Ukrainian representative of American company Axcition, and chairman of the Ukrainian College of Polygraphologists.

Roman Tschernenko is a psychologist and holds a doctorate in psychology and law. An expert of the Ukrainian army in 1990–2018, he is a retired colonel of the Ukrainian army and a member of the Ukrainian College of Polygraphologists.

As a course book for beginner polygraph examiners, the book is highly recommended for all who embark on the practice of polygraph examinations in criminal cases.

J.W.

# Report Discussions, Polemics







## *Report from the 54th Seminar of the American Polygraph Association*

The 54th Seminar of the American Polygraph Association was held in Orlando from 25 to 30 August 2019. The keynote lecture following the official opening, on a motivational and patriotic tone, was delivered by Greg Steube Senator for Florida, and a former Green Beret. The subjects of the other papers focused on psychophysiological examinations using polygraph and covered among others:

### **1. Comments on procedures in institutions employing polygraphers**

- a) questions referring to polygraph use in screening applicants to work or service, supported by empirical evidence:
  - acts of intolerance, e.g. on ethnical, racial background, home violence/family violence,
  - criminal behaviours in adult life, contacts with people connected to criminal groups,
  - problems with previous employers (disciplinary sanctions),
  - current and regular drug taking in a specific period of time (without attempts at detecting cases of occasional substance use in distant past).
- b) scientifically proven predispositions of candidates for good polygraphers (significant for recruitment and choice of training):
  - openness to new experience,
  - meticulousness,
  - developed needs of achievement, power, and belonging,
  - ability to notice and appreciate emotions.

## **2. Methodological suggestions, notably:**

### **a) suggesting the approach in post-examination interviews in case of results typical of deception:**

- Communicate directly, unambiguously, and assuredly to the subject that he or she did not tell the truth, refer to the obvious results of the test, and refer to the other evidence, whether actual or implied. You must be self-assured and certain of the data on the curves. (There is no place for any doubts, hypothetical claims, or pointing to alternative solutions).
- This is when denial usually sets in. Interrupt immediately, retaining contact with the subject. Bereave the subject of all hopes that they will be able to persuade that an error was made in test results. If need be, talk uninterruptedly to the subject, even for 10 minutes, using such words that he or she actually begins to listen. Emphasise the importance of your statement. Should you at that moment allow the subject's denial, he or she will later find it more difficult to revoke it.
- Then give the subject hope, saying that the world does not end with negative test results and there is still an opportunity to improve their position and explain the offence committed – underline that the examinee is actually no professional criminal only someone who committed a mistake that is probably not habitual.
- Should the subject lay the blame on “the machine” emphasise that it is not the machine that makes the decision as it only records, like a voice recorder or a thermometer, and the results come directly from the subject's organism.
- Suggest reasons for admitting (rationalisation of behaviour, projection on other people, diminishing the importance of the case), never lay the blame.
- Prevent the withdrawal of the subject: come closer, you may e.g. touch the shoulder, lower the tone of your voice, speak more slowly, call the subject by the first name.
- Observe the non-verbal signs of “giving up” including head nodding, eyes down, heavy sighs, and/or tears.
- Once your interlocutor has admitted to a detail, reinforce that he or she has done well and continue to obtain more information.

### **b) ways to reduce the inconclusive test results:**

- using test data for analysis: special decision points, proper for the ESS-M system with doubly weighted EDA parameter,
- conducting an appropriate interview with the subject; presenting clear operational definitions using thematic maps,
- quality assurance procedures,
- greater automation of examination process,
- use of PPG sensor,
- recording additional curves,

- improved selection of critical questions for verification and amendments of the content of the questions.
- c) comments on measurements of the electrodermal activity (EDA):
- record electric conductivity (rather than resistance) of the skin and analyse data at the lowest filtering level,
  - in CQT tests, average latency of the onset of electrodermal reaction is 2.2 seconds after the stimulus; limitations of the nervous system make it never come earlier than after 1.2 seconds,
  - use latency typical of a specific individual as a guideline for assessment whether reaction on the EDA channel began at the proper time,
  - return of the EDA curve to homeostasis is not always necessary for definition of the start of a reaction: focus on the point of change and tendencies typical of the subject,
  - the optimum minimum difference between reaction to a critical question and reaction to a comparative question in ESS test data analysis systems, federal three-level scale, and “greater is better” principle should be within the range of 10÷20%,
  - the EDA parameter can even be assessed in the case of movement and deep breath, if there are no reasons to believe that this caused a change of reactions; a lower EDA amplitude coupled with movement or deep breath can be assessed in comparison to a greater EDA amplitude in question is free from artefacts (however, the opposite should not be done, that is a stronger EDA reaction with artefacts should not be compared to a weaker EDA reaction without artefacts).
- d) guidelines on good practices in conducting pre-employment screening tests include:
- avoid overextensive relevant (critical) questions, e.g. referring to the credibility of answers in the whole questionnaire,
  - use only and solely such tests and methods of data analysis that are scientifically validate,
  - do not provide initial instructions concerning breathing,
  - use thematic maps in the interview,
  - use additional motion sensors and photoplethysmograph.

### 3. **Psychological issues**, including

- a) various distortions of psychological nature that decide whether a given individual can be polygraph tested. It was recommended that polygraphers pay attention to the following circumstances deciding whether individuals can be subjected to polygraph examinations:
- faculty of abstract thinking, understanding the significance of the situation,

- fundamental understanding of good and evil, and differences between truth and lie,
  - understanding benefits from and consequences of lies and various behaviours,
  - maintaining coherent orientation in time and space,
  - presence of any form of psychosis,
  - doubts concerning the minimum level of intelligence of the subject,
  - inability of unassisted coping with psychological issues.
- b) theoretical considerations concerning psychological foundations of polygraph examinations – the theoretical concept of Relevant Issue Gravity (RIG):
- The force caused by the accrual of features of the critical issue that attracts the attention of the subject, which results from the fact that the verified issue is of critical character for a given test due to specific circumstances of the case and personal circumstances of the subject. This concerns everyone, whether sincere or insincere, and a significant disregard for other test questions and stimuli is a side-effect.
  - under normal conditions, truthful people do not have memories of the event that the investigation concentrates on, as they were not involved; on the other hand insincere individuals carry a burden of memory traces and true emotions resulting from their connection to the event. This makes the force of RIG greater in non-truthful/deceptive individuals. For them, the critical question is of utmost significance in the examination. Other factors that influence the force of RIG are of emotional and motivational nature, and include the cognitive burden. The force of RIG regulates the level of free attention that can be assigned to comparative questions.
  - Other factors that may be of significance for RIG include the severity of legal consequences; the emotional load connected to the specific issue of a given case, independent of legal qualifications; personality traits; criminal history; past experience with polygraph tests; social status; gravity of collected evidence of guilt; the course of prior interrogation; and media coverage of the case.
- 4. Issue of distorting correct results of the examinations (countermeasures).**
- a) benefits from applying Masseter Headset, mandible muscle activity sensor, capable of identifying countermeasures undetectable by other sensors. Additionally, the headset that contains the sensor limits external sonic stimuli. However, pointing specifically to the type of activity observed is discouraged while issuing instructions checking excessive motions of the subject.
- b) laboratory tests concerning mental countermeasures conducted by Colombian polygraphers: results obtained prove that using mental countermeasures (erotic thoughts and counting backwards) according to instructions provided allow all people who previously had direct contact with polygraph (professional polygra-

phers and employees of polygraph school not practising such examinations) to false test results. Every other subject from the basic course efficiently altered test results. The ploy had no significant effect in the group of people entirely from outside the profession.

However, the results of studies from Colombia diverged significantly from other results obtained previously in the area. As far as they confirmed that countermeasures (also mental) are not efficiently used by people without specialist training, results of “combating polygraphers” by people having knowledge of polygraph examinations obtained in Colombia were much higher than ever before. The reason behind is believed to lie in the limitations of laboratory experiments (too weak motivating stimuli for critical questions, lack of real threats and consequences for the examinees) as well as alleged competency insufficiencies of Colombian researchers. Independent of these, Manuel Novoa-Bermúdez, president of the Colombian Polygraphers Association, announced continuation of the experiment this time entering a potential antidote into the extermination procedure, namely keyword repetition together with the answer given for the given critical question.

## **5. New technologies to be used in the detection of deception and for purposes of investigations**

- a) neuroimaging: a meta-analysis of the results of several dozens of published scientific studies allowed to determine the areas of the brain activated by deception. Activation by deception occurs in the prefrontal cortex and parts of the telencephalon. In turn, telling the truth significantly activates the postcentral gyrus and also a part of telencephalon. This part is used for processing negative emotions. However, further examination of the role of these areas of the brain in deception and truthfulness requires further examination.
- b) application of virtual reality (VR) for forensic procedures: reconstitution of crime scenes, reinforcement of spatial memory of the interrogated individual.

There was numerous labs on polygraph examination standards and legal issues, including argumentation justifying evidence from expert polygrapher witnesses. Presentations of criminal cases that resorted to polygraph examinations were inspiring, and concerned among others arson, missing/killed children, extortion, and a bank robbery. The new president of APA, Darryl Starks, a polygrapher with long-term work experience for American prosecution was presented. The following annual APA seminars are planned to be held in New Orleans (2020), Chicago (2021), Las Vegas (2022), and again in Orlando (2023).



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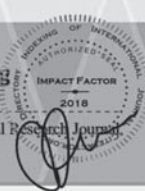
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