



## Review Paper

# Polygraph and its legal fallacies

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## Abstract

Nowadays, there are various techniques like Polygraph, Narco analysis, Brain mapping, Voice change analysis are used for detecting deception. Out of all these, Polygraph is the oldest and the most used technique because of its simplicity, non-invasive nature and ease of combining other PDDs techniques. Polygraphs are of great help in solving crime and their use is increasing day by day in our country. This is also known as lie detector; however, the term is a misnomer. Albeit it's great importance, this test individually is not of great relevance in court but it is preferred over 'third degree methods' because of its easiness to get concealed information. In this paper, the instrumentation of polygraph and different format of conducting test have been reviewed. An attempt has been made to discuss in detail various limitations of this test and the reasons behind questionable acceptance of this test in the scientific and legal community especially in India.

**Keywords:** Pneumograph, Cardio—Sphygmograph, Galvanograph, CQT, GKT, SPOT.

## Introduction

Polygraph is a combination of instruments combined such that they measure bodily activities and record any minor change occurring in those activities and a graph is drawn for these activities from which it may be concluded if a person is lying or not. The most common bodily activities recorded are breathing, heart beat rate, blood pressure and palmar sweating. This term "Polygraph" is made from two words "poly" meaning many and "graph" meaning writing<sup>1</sup>. Thus polygraph as a term signifies recording (writing) many bodily activities. The efficacy of this equipment lies in the fact that lying is accompanied by a series of bodily changes because of the prevailing thought in the society that lying is immoral<sup>2</sup>.

The history of polygraph can be traced back to 1878 when Angelo Mosso developed an instrument "Plethysmograph"<sup>3</sup>. Lombroso is credited as the first criminologist who used an instrument called "Hydro-sphygmograph" designed to measure physiological responses in criminal investigation in 1895<sup>4</sup>. B. Sticker developed a method to measure Galvanic Skin Response in 1897 which later became a component of polygraph. In 1906, Dr. James MacKenzie developed "ink polygraph" which was for clinical use. Vittorio Benussi developed breathing based detection system in 1914. This led to development of an early form of lie detector by Dr. William Morston in 1915. Lindbergh's kidnapping case is an important case in which Dr. Marston offered his services to Lindbergh's family in 1930. The modern polygraph was developed by John A. Larson in 1921 which was further modified by Leonarde Keeler. He opened "Keeler Institute" which was the first institute in the world devoted specifically to polygraphy<sup>5</sup>.

## Principle of polygraphy

Polygraph is based on a simple principle that changes in bodily activities occur if there are some emotional changes. These changes are involuntary and automatic; caused by the autonomic nervous system which is a part of peripheral nervous system (PNS). Autonomic nervous system comprises of nerves that lead from brain and spinal cord to the smooth muscles in many parts of body, glands, heart and to blood vessels. The autonomic nervous system has two parts: i. The sympathetic system. ii. The parasympathetic system.

While the former of these systems is active during emotionally aroused state leading to increase in heart rate, blood pressure, blood sugar level; the latter is more active during relaxed state causing a decrease in blood pressure, heart beat rate etc.

During emotional activity, somatic nervous system which is also a part of PNS activates the striped muscles of the human body. The changes related to muscular tension during lying is brought to by somatic system<sup>6</sup>.

## Components of polygraph

Since polygraph is not one instrument but a combination of few instruments. These combinations may vary as per the client's requirement and companies may modify the instrument to a varying extent. However, all the modern polygraphs contain three basic components:

**The Pneumograph:** Pneumograph is also known as "Pneumatograph" or "Spirograph". It records the force of chest

movement and its velocity while the subject breathes. It has two tubes which are filled with air. One of this is placed around subject's chest to record thoracic breathing while the other is placed around his/her abdomen to record abdominal breathing response caused due to tension in the muscles during breathing. As these tubes are filled with air, air pressure inside it changes when the subject breath. This component of polygraph is based on Ohm's law, according to which, resistance is more when lungs is filled with air. This device sensitively records any deviation from normal baseline breathing as air pressure inside tube changes immediately with the change in rseponse<sup>7</sup>.

**The Galvanograph:** This unit of polygraph records the variation in sweating pattern while answering the questions asked. It is called galvanometers which consist of electrical sensors that are attached to fingertips of subject. Skin of palmar surface contains much more sweat glands than any other part of body thus making it best location for measurement of perspiration. This instrument is based on principle that sweat is a good conductor of electricity. More sweating during lying reduces electrical resistance thus increasing the flow of electrical current. However, this unit of polygraph is extremely vulnerable to environmental conditions<sup>8</sup>.

**The Cardio – Sphygmograph:** This unit of polygraph is same as the one used to record blood pressures for clinical purpose. Its purpose is to measure blood pressure and record heart beat pattern and any changes in these during “in test” phase are very sensitively recorded. It is a very sensitive device consisting of a cuff which is wrapped around a subject's arm. This cuff is inflated with air which serves the purpose of transmitting the sound generated by the movement of blood in subject's veins to the bellows. These bellows amplify this sound and a graph is developed according to magnitude and frequency of sound generated during test. The changes in the magnitude and frequency of sound gives information about blood pressure and heart beat respectively<sup>9</sup>.

## Procedure of polygraphy

Polygraphy is a comprehensive test in which results are not only based on the recording of bodily activities but it also depends the manner and mode in which this test is conducted. Polygraph tests usually take one to three hours varying according to circumstances. It is conducted in three or four interview phases:

**The “pre-test” interview:** The examiner provides information about the examination, equipment and ensures that person is familiar of his legal rights. This interview is generally focussed on collecting information on subject's background and is used for designing questions. Reid advocated the format where subject is asked questions regarding his/her suspicion on anyone in the given crime and what he feels about the test<sup>10</sup>.

**The “stimulation test” phase:** In this phase, examiner demonstrates how a polygraph works. Its goal is to make subject

believe that this combination can catch their lies and differentiate between truth and deception. It is also known as “stim test” and “acquaintance test”. There are two common methods which are currently in use for this purpose (Maschke & Scalabrini): i. Deck of card method, ii. Number method.

**The “in-test” phase:** After the end of pre-test interview, the actual response recording starts. Subject's initial baseline response is recorded for 10 to 15 seconds before the questioning starts. The examiner waits for 15 to 20 seconds after completion of each question before he asks another question. In general, examiner conducts this test in series and each series consists of 10 questions and each question being repeated 2 to 3 times. The questions asked are not subjective but yes-no types and subject has to answer while sitting straight and keeping his/her eyes open<sup>11</sup>.

**The “post-test” phase:** It is done after “in test” phase. This phase may or may not be conducted. In this subject may be asked questions about his response to any particular question. This is mostly done when the examiner thinks that subject is employing some countermeasures or result is inconclusive. However, it can also be done if deception is indicated in the chart to extract confession or more information<sup>12</sup>.

## Chart scoring

The chart of polygraph tracing has following bodily responses 1) Thoracic breathing; 2) Abdominal breathing; 3) Electro dermal activity and 4) Cardiac activity. The graph contains of vertical lines with spacing of ½ inch and indicates 5 second. These charts are rolled at 6 inches per minute. A ‘+’ sign indicate Positive reply and ‘-’ shows negative reply. Following are the scorable responses according to Department of Defense Polygraph Institute (DoDPI):

**Respiratory responses:** Apnea, decrease/increase in rate, respiration ratio, decrease/increase in amplitude, progressive decrease/increase in amplitude and temporary change in baseline.

**Electro dermal responses:** Amplitude change, complex response and response duration and return.

**Cardiac responses:** Baseline increase/decrease, amplitude increase/decrease and rate increase/decrease.

## Polygraphy questioning techniques

**Relevant/Irrelevant Test (R/I Test):** It was the earliest form of polygraph questioning technique introduced by William Marston. Larson used this technique with some modifications. In this test only two types of questions are asked; relevant and irrelevant. Relevant questions are named as such as they are relevant to the issue for which polygraph is being conducted.

Irrelevant questions are general questions that has no bearing to the case in hand. Scoring is done by comparing the response of relevant question to irrelevant questions.

Example: I – Is today Monday?, R – Did you steal that money?, R/I Test is no longer in use as it has many shortcomings and was criticised by several researchers<sup>13</sup>.

**Control Question Test (CQT):** CQT was introduced by John E. Reid during 1945-1947 as an improvement to the existing method of R/I Test. There are three types of questions in this method; irrelevant questions, control question and relevant question. Control questions or Comparison questions are designed such that they arouse a subject who is non-deceptive more compared to a subject who is deceptive. In this method irrelevant questions are not scored and comparison of responses is between control and relevant question. Irrelevant questions indicate if a subject is well enough to take test but examiner sometime tricks the subject by telling them as control question to detect countermeasures<sup>14</sup>. I – Is today Monday?, C – Have you ever cheated anyone?, R – Do you have any contact with this bank manager?

Backster (1963) further modified this test and named it Zone Comparison Test (ZCT). This consists of three zones and each zone indicate a different type of question. Red zone, green zone and black zone indicate relevant question, irrelevant question and outside issue respectively.

This test method does have some limitations. Subject may show activity due to fear and nervousness and there is lack of standardisation of test method<sup>15</sup>.

**Directed Lie Test (DLT):** DLT is a more standardised form of CQT and it was developed to remove the problem of non-standardisation associated with CQT. In this form of test, the subject is asked to lie to the questions asked. In this method examiner instructs the subject to think before answering which is also one of the major fallacy of this test<sup>16</sup>.

**Guilty Knowledge Test (GKT):** Concealed Information Test (CIT) and Peak of Tension (POT) test are the other names of this test. This test is one of the more accurate method of polygraph tests. The biggest advantage of this test is that answers to the questions asked are only known to the interrogator and culprit and not to an innocent suspect.

Illustration: Ten bikes have been stolen on any particular day. The questions framed maybe as:

Q. Two out of ten bikes stolen were from XYZ company?

Q. Three out of ten bikes stolen are from XYZ company and two are from ABC company?

Q. None of the bikes stolen were from ABC company?

Innocent subject won't show any change in response to any question while guilty person will show change in activity for

correct option. This reduces the chances of false positive result which were common in CQT. The limitation to this technique is that not always, the concealed information is available to interrogator<sup>17</sup>.

**Searching Peak of Tension Test (SPOT):** This test removes the limitation of GKT, i.e., unavailability of concealed information to interrogator.

Illustration: Let's assume a case where an antisocial element is caught and interrogator has no idea to which group he belongs but have suspect on few groups. Following questions maybe asked:

Q. Did you have contact with ABC group?

Q. Did you have any contact with XYZ group?

Q. Did you have any contact with PQR group?

The theory in this test is that if a subject is truthful his bodily response will be similar to all options. Even if he is scared or anxious his bodily responses won't change very much for any particular option if he don't know anything about the crime. Culprits who know that particular option is true maybe caught if they show a varying response to a particular option.

Other forms of testing methods used are Mixed General Question Test (MGQT), Silent Answer Test (SAT) etc.<sup>18</sup>.

## Discussion

Relation between nervous system and emotions have been known since long and accepted among scientific community and this is the basis of polygraphy. However, this technique has not got the support and faith from scientific community and judiciary system. These are three major reasons for failure of this technique to gain acceptance in scientific community and make to court.

**Instrumental inaccuracy:** Polygraph only tells about bodily responses to emotional situations and not lies. It may give false positive results due to fear, nervousness, non-standardised and generalised technique and wrongful interpretation by examiner. In a survey carried during 1980, accuracy of 98% was found where examiner was directly involved. In another survey where evaluator was not directly involved accuracy was found to be 90%<sup>19</sup>. Sheila D. Reid developed a special form of CQT for espionage and found false positive result percentage of 9.4%<sup>20</sup>. In another survey CQT was able to detect 83 to 89% of guilty subject while DLT showed 12-47% false positive result. Even GKT showed 1-6% false positive result. False negative result is due to countermeasures applied by subject and there is no effective method or questioning technique that can control it. The subject showing more change in response to relevant question compared to comparison question is considered as guilty. Following are some of the countermeasures employed<sup>21</sup>:

- Psychological reactions may be suppressed or altered during control question or relevant question. This can be attempted by

applying mental countermeasures which includes meditation, self-hypnosis etc. ii. Drugs, iii. Subjects sometime enhance their response by inflicting pain (physically or mentally) to comparison questions. iv. Old-tack-in-shoe method, v. Anal sphincter contraction.

**Violation of Constitutional rights:** Polygraph was introduced in the court for the first time in District of Columbia in 1923 in case *Frye v. United States*, in which Marston testified but was not accepted by trial judge on the ground that technique was yet to gain acceptance in scientific community. However, in 1993 with Daubert standard being set as base for accepting scientific evidence it opened new doors for polygraphy. US Supreme Court ruled in the case *United States v. Scheffer* that acceptance of polygraph in court would be based on the circumstances and the merits of the case and left its acceptance to the facts in case and trial judge's intelligence<sup>22</sup>. In Canada, it is used in investigation of crimes and for interrogation purposes but courts don't allow it as an evidence. Admissibility of polygraphic evidence was ruled out by the Supreme Court of Canada in *R.V. Beland* case in 1987 (*R. v. Béland*, [1987] 2 S.C.R. 398)<sup>23</sup>. In Japan, polygraph is acceptable in Court of law since 1968<sup>24</sup>. Indian Courts do not admit polygraph as an evidence in Court because it violates some of the rights provided to citizens of India by Constitution and other laws of the state:

**Right against self-incrimination:** People of India has been provided a right under Article 20(3) of The Constitution of India which states that no person accused of an offence shall be compelled to be a witness against himself/herself. Supreme Court of India gave a landmark judgement in 2010 in *Smt. Selvi and others v. State of Karnataka* case that these tests violate Article 20(3) provided by Indian Constitution<sup>25</sup>. This right only applies to accused person<sup>26</sup>. Criminal Procedure Code, 1973 under section 161(2) provides immunity to a person from answering such questions that could lead him to prosecution under criminal charges or forfeiture and also protects him from Section 161(1) which give authority to police officers to question any person who knows the case facts during investigation. Section 313(3) and section 315(1) b of Criminal Procedure Code provides that accused can't be considered guilty because of silence during trial stage.

**Right to life and personal liberty:** Article 21 of Constitution of India provides this right to all Indian citizens. Supreme Court of India ruled in *Smt. Selvi v. State of Karnataka* that these psychological deception detection tests violate Article 21 of Constitution of India so these psychological deception detection tests like polygraph, narco tests and brain mapping can only be done voluntarily and with the permission of Court. This article protects from Section 156(1) of CrPC, 1973 under which police doesn't require permission of a jurisdictional magistrate to investigate in a cognisable offence.

These tests are conducted according to guidelines given by NHRC in 2000.

Recently, courts have shown a positive attitude towards these tests. Recently Tamil Nadu High Court ruled in favour of polygraph in *Dinesh Dalmia v. State of Tamil Nadu* stating that scientific method of investigation may be used to discover the truth if accused refuses to cooperate (Crl. R.C. No. 259 of 2006).

In a similar decision, High Court of New Delhi said in *Shailendra Sharma v. State of New Delhi* that these psychological deception tests like polygraph, narco tests, brain mapping etc. acts as a necessary aid in investigation (Crl. W.P. No. 532 of 2008). If a test is administered voluntarily and some evidence is found based on the information gained from that test, then that evidence is admissible in court of law under Section 27 of Indian Evidence Act, 1872 (2010(7) SCC 263).

**Ethical issues:** This test has been called unethical due to following reasons: i. Polygraph is seen as a psychological third degree torture used by investigators to extract confession. ii. During the pre-test and stim-test; subject is told that this test is capable of detecting lies which is not true as it can only detect emotional responses which can be controlled. iii. Some people have reported that personal questions not related to case whatsoever was asked to them during polygraph<sup>27</sup>.

## Conclusion

It's true that polygraph measures bodily activities or physiological responses accurately but this doesn't always guarantee detection of lies. Most of the studies carried in this subject are lab based and not field based. Error rates are high for this which can be reduced but this technique can never be 100%. Researchers should be encouraged to do research in this subject and use it with other psychological deception detection (PDDs) to lower the error rate.

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