

Newer Techniques and Recent Advances

1. POLYGRAPH –

A **polygraph** ('lie detector') is a device which makes a continuous record of several *physiological variables*, such as **blood pressure, heart rate, respiration and electrodermal reaction***, while a series of questions are being asked, in an attempt to detect lies (as shown in the figure below). The above measurements are believed to be indicators of anxiety due to sympathetic stimulation that accompanies the telling of lies. However, if the subject exhibits anxiety for other reasons, a measured response can result in unreliable conclusions.

*It is also known as **galvanic skin response (GSR)**, **electrodermal response (EDR)** or **skin conductance response (SCR)**—a method of measuring the electrical conductance of the skin, which varies with its moisture level.

- A polygraph test is also known as a **psychophysiological detection of deception (PDD) examination**.

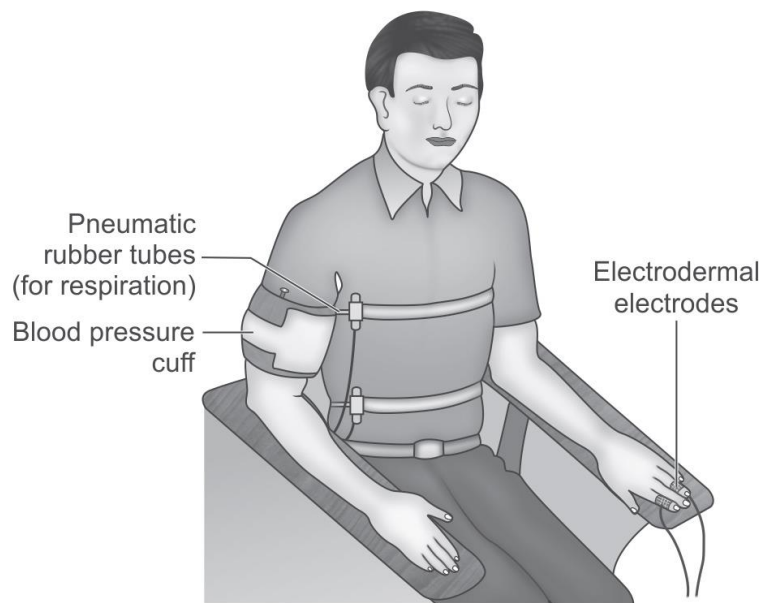


Figure: Polygraph Test

Procedure:

- There are two major testing techniques in use—the **Relevant/Irrelevant Technique (RIT)** and the **Control Question Technique (CQT)**.
- Polygraph test starts with a *pre-test interview* to gain some preliminary information which will later be used for '*control questions*' (CQ).

- Some of the questions asked are ‘*irrelevant*’ or *IR*, others are ‘*probable-lie*’ control questions that most people will lie about, and the remainder are the ‘*relevant questions*’, or *RQ*, that the tester is really interested in. The different types of questions may alternate.

Accuracy:

Examiners maintain that the accuracy is **90%** and the errors tend to be false negative rather than false positive, i.e. a person who actually lied is reported as ‘truthful’.

Admissibility of Polygraphs in the Court:

- While lie detector tests are commonly used in police investigations in the US, no defendant or witness can be forced to undergo the test. The US Supreme Court left it up to individual jurisdictions as to whether polygraph results could be admitted as evidence in court cases.
- In most European jurisdictions, polygraphs are not considered reliable evidence and are not generally used by police forces.
- In Canada, the use of a polygraph is sometimes employed in screening employees for government organizations. However, in the 1987, the Supreme Court of Canada rejected the use of polygraph results as evidence in the court.
- The Australian High Court has not yet considered the admissibility of polygraph evidence.

2. Brain Fingerprinting (Brain Mapping) –

Brain mapping is a group of neuroscience techniques based on the *mapping of quantities or properties (biological) onto spatial representations of the brain*. While various brain imaging techniques (e.g. CT, MRI, PET, SPECT) measure properties such as cerebral blood flow, metabolism or structural integrity, **QEEG [quantitative electroencephalography (EEG)]** measures **electrical activity of the brain** which is usually known as **brain mapping**. Brain fingerprinting, invented by **Lawrence Farwell**, is a *computer-based test* that is designed to *discover, document and provide evidence of guilty knowledge regarding crimes*. This test detects the *presence or absence of information and not guilt or innocence* per se.

Procedure:

- An **elastic cap (headband)** with **19 electronic sensors** is placed on the *shaven scalp* of the subject and connected to the recording device that measures the EEG (as shown in the figure below). The *subject is shown stimuli consisting of sounds, words, phrases or pictures on a computer screen*.



Figure: Brain Mapping

- It detects responses to the stimuli related to the crime or other investigated situations. *The theory is that the suspect's reaction to the details of an event or activity will reflect if the suspect had prior knowledge of the event or activity.* As the test is based on EEG signals, it does not require the subject to issue verbal responses to questions or stimuli.

Principle:

Farwell's brain fingerprinting originally used the **P300*** **brain response** (emitted from an individual's brain approximately **300 milliseconds** after it is confronted with a stimulus of special significance) to detect the *brain's recognition of the known information*. Later, he used the **MERMER** ('**Memory and Encoding Related Multifaceted Electroencephalographic Response**'), which includes the *P300 and additional features* and is reported to provide a *higher level of accuracy than the P300 alone*.

*The P300 is a specific ERP (event-related potential) that emerges approximately 300 milliseconds after the presentation of a stimulus.

Uses:

- **Criminal cases:** Investigators use it to determine if a suspect is telling the truth or make him reveal facts pertaining to a case.

- ii. **Medical diagnosis:** Brain functioning evaluation for early detection of Alzheimer's and other cognitive degenerative diseases.
- iii. **Advertisement:** Evaluate the effectiveness of advertising by measuring brain responses.
- iv. **National security:** Screening employees, especially in military and foreign intelligence and counterterrorism.
- v. **Insurance fraud.**

Drawbacks:

The test may not be useful in a case in which:

- Two suspects were present at a crime—one as a witness and the other as a perpetrator.
- Investigators do not have sufficient information about a crime to test a suspect for crime-relevant information stored in the brain.

Brain Fingerprinting vs Polygraph:

Since it depends only on information stored in the brain and cognitive brain responses, *brain fingerprinting does not depend on the subject's emotions, nor is it affected by emotional responses*. Brain fingerprinting fundamentally differs from the polygraph as *it measures emotion-based physiological signals*. Also, unlike polygraph testing, *it does not attempt to determine whether or not the subject is lying or telling the truth*.

Legal Aspects:

- An Iowa Court in the US accepted brain fingerprinting as scientific evidence in the reversal of the murder conviction of Terry Harrington.
- Data from **Brain Electrical Oscillation Signature (BEOS) profiling** has been **admitted as evidence in the court in a murder trial in India**.
- There has been not even a single case in which the court has convicted a subject based only on the brain fingerprinting results. In fact, in the cases, wherein the results of such tests were positive but were not supported by other oral or documentary evidence, the subjects in those cases have been acquitted of the charges against them.

NOTE:

- **Brain Signature Profiling (BSP) or BEOS** is another EEG procedure that was developed in 2003 by **CR Mukundan** and is similar to brain fingerprinting.

- In the case mentioned above, the woman was convicted of murdering her former fiancé based on the BEOS profile. But subsequently, the Mumbai High Court suspended her sentence and released her on bail due to a lack of sufficient evidence.

3. Narco-Analysis –

Definition: It is a scientific procedure to obtain information from an individual in a **natural sleep-like state**.

Principle: The narco-analysis procedure dwells upon the **effect of bio-molecules on the bioactivity of an individual**.

- A person can *lie by using his imagination*. During the test, the *subject's imagination is neutralized by making him semi-conscious*. In this state, *it becomes difficult for him to lie, and his answers would be restricted to facts he is already aware of*.
- The subject is *not in a position to speak up on his own* but *can answer specific and simple questions*.
- In such a *sleep-like state*, *efforts are made to obtain 'probative truth' about the crime*.

Procedure: The individual is put into a *trance-like state* and *loses all his inhibitions by administering sodium amytal or thiopentone sodium*, (known as '**truth drug**' or '**truth serum**') **2.5–5% solution, slow IV**.

Other Methods:

- 0.5 mg *scopolamine hydrobromide* (commonly used) subcutaneously, followed by 0.25 mg every 20 minutes (average 3-6 injections), till the proper stage of questioning is reached.
- 100 mg *sodium seconal*, 15 mg *morphine* and 0.5 mg of *scopolamine hydrobromide* may be given IV.

The dose is dependent on the *person's sex, age, health and physical condition*. A wrong dose can result in a person going into a coma or even death.

The team required: A team comprising of an **anaesthetist, psychiatrist, clinical/forensic psychologist, audio-videographer and supporting nursing staff** does the test. The forensic

psychologist will prepare the report about the revelations which will be accompanied by a compact disc of audio-video recordings.

Legal Aspects:

- The Supreme Court has recently declared that *narcoanalysis, polygraph tests and brain mapping cannot be done without the consent of the individual*. If the person consents to such methods, then any information obtained can be used for further probe. The results of such tests will not be admissible as evidence, even if done with consent.
- Use of such methods is illegal and against the constitution. As per *Article 20(3)* of the Constitution, '*No person accused of any offence shall be compelled to be a witness against himself*'. Therefore, a suspect of the crime cannot be compelled to disclose facts which he can recall from his memory, and likely to implicate him in a crime in which he was involved.
