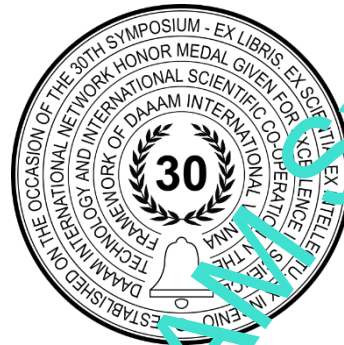


# SECURITY CLEARANCE AND POLYGRAPH EXAMINATION

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## Abstract

This research provides the insight into the problematics of the security clearance process that is very important in the field of national security. The security clearance must be passed by everyone who has the access to sensitive information. One of the steps in this process is polygraph examination that verify the trustworthiness of the applicant. The purpose of this paper is to show that the polygraph results are valuable although there are still doubts about its accuracy in scientific community.

**Keywords:** Security Engineering; Security Clearance Process; Polygraph Examination; Detection of Deception.

## 1. Introduction

The security clearance, as a verification process of the person determining the trustworthiness of an individual, dates back to the early 1950s. Whether the person applies for employment as a border patrol or FBI agent, he or she has to complete successfully the security clearance process. A security clearance must hold anyone whose job requires access to classified national information or restricted areas. There are a lot of cleared careers – federal, military, and government positions or jobs in intelligence agencies. Although polygraph is mainly used in law enforcement and criminal investigation [1], it finds its use also in this type of investigation and represents an important step in the security clearance process that has to be passed by candidates. It has evolved since the 1920s and till now it is the world's best-known and most efficient tool for detecting deception and for profiling people of interest. Despite that, there are doubts about the polygraph measurement results occurring in some sources or scientific community and sometimes the polygraph examination is considered controversial. That is why this research focuses on the polygraph screening process with the use of the security clearance questions and evaluates the polygraph measurement results [2].

## 2. Security Clearance Process

When receiving a conditional job offer, the candidate must go through a security clearance process to obtain a final job offer from a government agency that provides it. Figure 1. shows the entire process which takes a few months depending on the required level of security clearance.

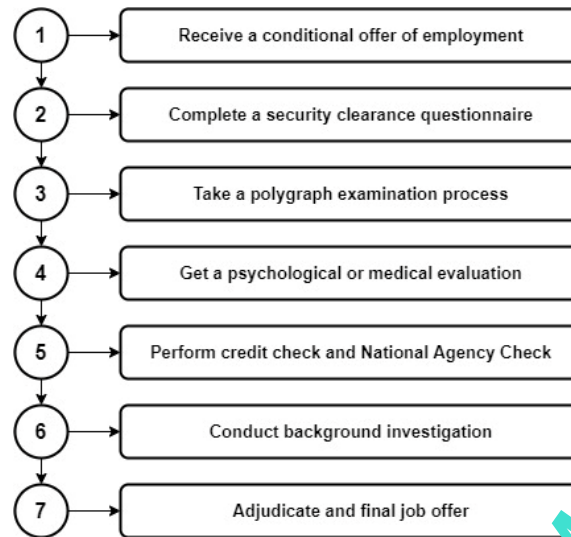


Fig. 1. Security clearance process

There are three levels of security clearance related to the sensitivity of the information to which the person will have access:

- Confidential, the access to information that could cause damage to national security when it was unauthorized uncovered.
- Secret, the access to information that could cause serious damage to national security if it were unauthorized uncovered.
- Top Secret, the access to information that could cause exceptionally grave damage to national security when it was unauthorized uncovered.

The security clearance determines the eligibility against:

- Criminal conduct
- Foreign influence
- Financial considerations
- Allegiance to a given state
- Handling protected information
- Use of information technology systems
- Drug involvement and alcohol consumption
- Psychological conditions and personal behaviour.

The security clearance investigation has two types of polygraph examination - lifestyle and counterintelligence. The first one is based on the security clearance questionnaire and it focuses on personal questions regarding to illegal activity, drug use, sexual misconduct, mental health issues, and family relationships, or falsification of the information on the questionnaire provided. In general, it determines if a potential employee is trustworthy. The second type of examination deals with the questions related to spying, including the areas of espionage, sabotage, and terrorism [2], [3].

### 3. Polygraph Measurement

Detection of deception by polygraph is based on analysis of physiological changes in the body that occur during a stressful situation. A such stressful situation may be the asked questions during the polygraph examination process. The physiological changes can be changes in the heart rate, pulse rate, blood pressure, respiration rate, or skin conductivity. In addition, the minor and major movements are measured [4].

The polygraph system is composed of the following sensors that are connected to the data acquisition subsystem and simultaneously measure physiological values:

- Blood Pressure Cuff.
- Pneumograph tubes tied around the torso to measure breathing.
- Electrodermal (EDA) Electrodes attached to fingers to detect the increased skin conductivity caused by the activation of the sympathetic nervous system.
- Activity Sensor Seat, Arm, and Foot Pads in the form of pouches place under the seat, arms, and feet and detect every movement.
- Photoelectric Plethysmograph recording the rapidly occurring changes in pulse blood volume [5], [6].

In this research, the first four sensors were used for the measurement – blood pressure cuff, pneumograph tubes, EDA electrodes, and activity sensor seat pad. These sensors are depicted in Figure 2. Those are the polygraph components of a state-of-the-art computerized polygraph system known as LX6. With the use of the special LXSoftware and the data acquisition subsystem, the signals from all sensors can be recorded, stored, and analysed.



Fig. 2. LX6 Polygraph components used for measurement

For evaluation of data was used modified variation of 3-position scoring [7], [8]. Values of -1, 0 and 1 were assigned to changes after each question for each measured channel (pneumograph, blood pressure cuffs, movement sensor and electrodermal). Negative value was assigned to greater reactions to question compared to benchmark question, positive value to smaller reactions and 0 was assigned for measurements without any noticeable difference [9]. For implying of detection of potential deception sum of values from all channels had to be negative. Values of scores from all channels separately were also used for final evaluation of usefulness of each sensor.

#### 4. Results

Measured dataset has total of 140 answers with 14 sets of 10 questions that were asked repeatedly. Total number of lies reported by examinee was 36 and out of this number just 3 (8,4%) remained undetected. This means that 91.6% lies were successfully detected. Number of true answers scored as potential lies (false positives) were 29 out of 114 (25,4%).

From this evaluation It can be implied that there is high probability of raising question marks on lies, and if the answers are evaluated as true, there is low probability of deception that remained unnoticed. In the Figure 3. is the example of detected lie that was clearly visible on multiple channels during questioning.

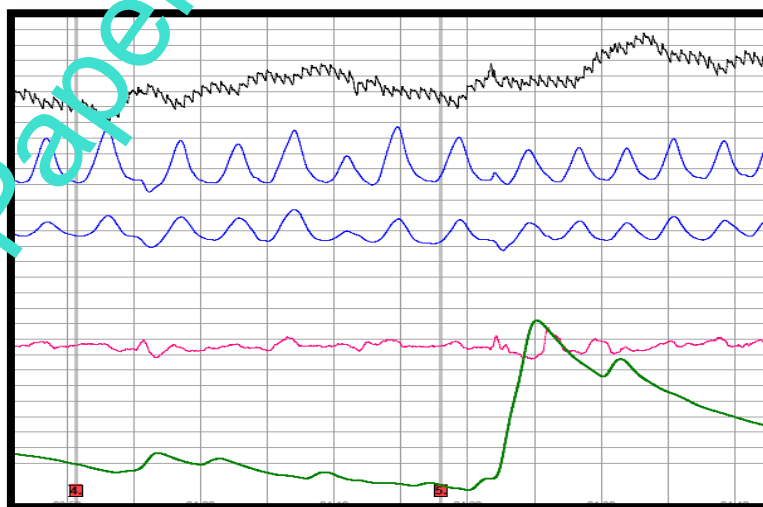


Fig. 3. Polygraph chart - example of detected lie on polygraph (5. question)

On the other hand, answers that are marked as potential lies must be inspected in more depth because there is small but still significant chance of false positive evaluation. For more accurate measurements, important questions can be asked again with slightly different wording, and this should confirm lies and reduce chance of false positives.

## 5. Conclusion

The use of the polygraph in security clearance investigations has a long and controversial history but this analysis shown that polygraph is effective tool which has its place in lie detection. The best evaluations from measurements were from blood pressure cuffs, their evaluation detected 16 lies and just 7 false positives. Most changes were detected on electrodermal with 30 lies and 23 false positives. Both movement sensor and pneumograph had similar scores, movement sensor detected 10 lies and 7 false positives and pneumograph 13 lies and 9 false positives so even these two sensors with worst results are still showing useful.

Data also showed that answers on questions asked 1 or 2 questions after lie are less likely to be evaluated as false positives. There were just 2 false positives for questions right after the measured lie and 3 false positives for two questions after a lie. This is probably because changes in measured values are more distinct, easier to be interpreted and change of physiological response is more noticeable after the examinee calms down when the moment of his lying pass.

In the future, research could use the other polygraph sensors for measurement and the Virtual Reality for better profiling of the people. In addition, it could be tested on a larger sample of people.

## 6. Acknowledgments

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