The Use and Application of the Polygraph Technique in the Analysis of Simulated Behavior from a Tactical-Forensic Perspective

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Abstract: *In judicial practice, one of the fundamental objectives is to investigate the sincerity of persons suspected of committing acts provided for by criminal law, as well as of those who possess information or knowledge relevant to elucidating the circumstances of an act. Establishing the truth is essential not only for finding guilt or innocence, but also for ensuring a fair trial and the correct substantiation of acts of justice. Truth thus constitutes a central pillar of the criminal process, and any method that contributes to its identification must be used with responsibility and rigor. In this context, the polygraph technique has acquired an important role as a complementary tool in the investigation of crimes. The polygraph, by monitoring the physiological parameters of the subject during the interview, can provide useful clues regarding the veracity of the statements, supporting the judicial investigation. However, the efficiency of this method depends largely on compliance with standardized procedures, the operator's training and the correct understanding of its limits. The application of the polygraph is not an autonomous solution and cannot substitute other investigative methods, but functions as an auxiliary tool that complements traditional evidence. At the same time, the success of its use requires a thorough knowledge of the psychological and forensic paradigms involved, as well as a critical evaluation of the results obtained. Only by combining technical expertise with ethical and legal principles can the polygraph effectively contribute to identifying the truth and strengthening the act of justice.*

Keywords: *forensic science; truth; legal basis; professional employee; relevant techniques; knowledge testing*

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1. Introduction

The polygraph technique can be useful in detecting lies and in assessing the veracity of statements made by individuals involved in a criminal investigation. However, the controversial aspects related to the accuracy and reliability of this tool, as well as the ethics of its use, must also be considered.

The specific procedure is carried out within the framework of the scientific investigation of crimes, using the polygraph technique. This method is integrated into the investigative process to assess the sincerity of individuals who are involved in a criminal investigation or who possess information relevant to establishing the truth in a criminal case. The use of the polygraph technique is aimed at identifying indications of falsity or veracity of statements made by suspects or witnesses, thus providing an additional tool in determining the truth within the judicial process.

In the use of the polygraph technique, several states use two distinct examination paradigms:

1) the control/comparison question test paradigm (CQT-TIC) (Raskin & Kircher, 1982) – includes a set of tests in which the subject's sincerity or insincerity is determined by comparing the psychophysiological reactivity to relevant questions with the psychophysiological reactivity characteristic of the control questions. In this test, subjects are subjected to questions relevant to the ongoing investigation and to control questions that are not directly related to the suspected crime. By monitoring the psychophysiological reactions during the answers to these questions, the polygraph can detect discrepancies that could indicate the subject's insincerity;

2) the knowledge of hidden information test paradigm (KQT-TCA-CIT) (Ben-Shakhar & Furedy, 1990) – consists of a set of tests in which the subject's sincerity or insincerity is determined by comparing the psychophysiological reactivity to the specific question, the answer to which is known exclusively to the author, with the physiological reactions to similar questions, but which are not informationally related to the situation under investigation. In this method, subjects are tested for knowledge or ignorance of certain information relevant to the case under investigation, and discrepancies in psychophysiological reactivity may indicate possible dishonesty.

These two paradigms provide a framework for conducting polygraph tests and help interpret the results obtained during the examination of subjects. The appropriate use of these paradigms is essential for obtaining reliable and relevant results in judicial investigations.

2. Basic Content

In the United States and Canada, law enforcement agencies use three distinct paradigms in applying the polygraph technique:

1) the relevant-irrelevant technique (Lykken, 1998) – focuses on creating a contrast between relevant questions, which are specific and directly related to the event under investigation, and irrelevant questions, which are completely unrelated to it. For example, the subject might be asked "Did you rob a bank on Friday?" as a relevant question and "Is today Monday?" or "Are you in Bălți?" as irrelevant questions. Stronger physiological responses to relevant questions than to irrelevant ones are interpreted as an indication of deception. Although this technique has numerous scientific limitations (Raskin et al., The Scientific Status of Research on Polygraph Techniques: The Case for Polygraph Tests, 2022, pp. 446-483), it is used in criminal investigations and in some federal employee security screening programs, for example, at the National Security Agency;

2) control or comparison question testing (Reid & Inbau, 1977, pp. 138-139) – compares responses to relevant questions with responses to other questions that are designed to elicit physiological responses even in honest individuals. In one version of this technique, comparison questions are selected to create a temptation to cheat: for example, "Have you ever stolen a small item from your workplace?" or "Have you ever violated a minor traffic law?" These so-called probable lie questions are assumed to be like relevant questions in creating a level of concern about truthfulness. For honest examinees, this level of concern is assumed to be higher than for relevant questions, to which the examinee can be honest without much anxiety. For examinees who may be deceptive about the events being investigated, relevant questions are assumed to create a higher level of concern and therefore a stronger physiological response. Comparison question tests are used both for investigations of specific events and for screening. A version of this technique, the Espionage and Sabotage Test (TES), is a key element of the U.S. Department of Energy's employee security screening program;

3) concealed information test (Rosenfeld, 2018) – includes questions about details of an event under investigation that are known only to investigators and those with direct knowledge of the event. These tests are called concealed information tests because they are applicable even when an examinee who possesses information is not guilty. The questions are presented in multiple-choice format.

To illustrate the application of the Concealed Information Test (CIT) in criminal investigations. These models illustrate how to formulate and select relevant questions to detect knowledge of facts by the subject.

However, it must be emphasized that this test format requires the confidentiality of information in the criminal process. If the testee has information about the details of the crime from other sources (such as the media), then the test can no longer be considered reliable or applicable. Maintaining confidentiality and isolating information are fundamental elements for the integrity and effectiveness of the polygraph test. Thus, to ensure the validity of the results, it is essential to strictly control access to information and avoid its disclosure to the testees before the test is administered.

Regarding the control question method (CQT), Japan has adopted a more cautious approach, considering it to be insufficiently precise (Fukomoto, 1982, pp. 234-238). Instead, it has opted for the Concealed Information Test (CIT), which is considered to be more reliable and accurate in lie detection and is used in the investigation of crimes (Yamamura & Miyata, 1990, pp. 221-231). This decision reflects the concern for the use of a more scientifically valid and precise paradigm in the investigative processv (Nakayama, 2022, pp. 49-86). Referring to the position of Japanese researchers, according to studies conducted by Yamamura, Miyata and Fukomoto, we believe that this method is very effective at the stage of applying the polygraph to establish and/or verify the circumstances of the commission of the crime in the criminal prosecution phase. In special investigative work, however, we recommend the application of the CQT method.

2.1. General Aspects

The investigation of crimes is an extremely complex process, with particularly significant implications in terms of identifying the perpetrators of criminal acts. Criminal prosecution bodies are engaged in a determined effort to identify and gather relevant evidence, while respecting legal and ethical standards.

Criminal activity is characterized by a significant psychological load, determined by the decision to commit the act and the mobilization of the necessary internal resources. This activity is marked by the intensification of the senses and concentration of attention, which contributes to the precise recording of events in long-term memory in the form of structured information. These data constitute the essence of the criminal process and require a careful and specialized approach in the investigation.

In this regard, psychophysiology has provided a valuable tool in the investigation of crimes using the polygraph technique. The introduction of this method into investigative practice represents a significant step towards the modernization of investigative efforts. The use of the polygraph technique is consistent with the fundamental principles of human rights (Grama, 2019) and complements traditional

investigative methods, contributing to obtaining more complete and accurate results. The results obtained through this scientific method are evaluated and correlated with other available means of evidence, thus ensuring the integrity and relevance of the investigative process and having the force of reasonable credibility.

2.2. Approach

The polygraph technique is based on the analysis and interpretation of psychophysiological changes that occur in the human body, an activity reflected/influenced by the activity of the autonomic nervous system, including its sympathetic and parasympathetic components. As a result of the thinking operations induced by the auditory stimuli associated with the polygraph test, representations are formed and updates of the memory of the examined subject take place. These psychological phenomena are governed by the law of free will, the subject being free to carry out any cognitive operations with the information associated with the test. The reverse of this freedom is the impossibility of controlling the physiological alert reactions that occur upon receiving stimuli with negative potential (for example: information related to the involvement of the tested subject in a criminal act). It is precisely these psychophysiological changes consecutive to a well-individualized stimulus (question from the polygraph questionnaire) that denote the subject's involvement/non-involvement in a certain activity with criminal relevance.

The testing procedure is non-intrusive, with the sensors used by the polygraph device recording the psychophysiological parameters of the human body at the level of the epidermis (Krapohl & Shaw, 2015).

Based on the principles of the polygraph technique, the laboratory is configured to perform the tests in a controlled and standardized environment. This environment is important for obtaining accurate and reliable results, as it allows for the adequate monitoring and recording of the psychophysiological parameters of the subjects during the tests. Thus, the laboratory represents an important element in the application of the polygraph method, ensuring that the procedure is carried out in accordance with scientific and ethical standards, with the minimization of any disturbing factors that could influence the test results.

The polygraph examination must be performed in a soundproof room. Extraneous internal or external noises (the ringing of a telephone, the conversation of people outside the examination room, the presence of other people: criminal investigation officers, lawyers, relatives of the person being examined, etc.) can induce collateral stimulation, parasites, overstimulation or distractions of attention, which can distort the physiological records of the subject of the examination.

The examination room must be sober in terms of furniture and the entire environment. It should not contain any ornaments, paintings or other objects that could distract the person being examined.

The room will be furnished with a desk and two chairs: an examiner's chair placed to the side of an examination chair with arms where the sensors will be positioned.

Stan B. Walters, an expert in behavioral interrogation and testing techniques, emphasizes in his work *Principles of Kinesic Interview and Interrogation* that incorrect positioning of furniture in the interview room can generate psychological discomfort and reduce the effectiveness of the examiner's visual control over the subject (Walters, 2002). We believe that placing the chair behind the examinee may generate psychological discomfort, and the examiner may have difficulty maintaining adequate visual control over the subject.

To increase the efficiency of communication and reduce the anxiety level of the person being tested, the American author Nathan J. Gordon recommends, in his work *The Enhanced Polygraph Technique*, the arrangement of an adequate space from a psychological and physical point of view. In this context, it is recommended to use a separate room for the pre-test and post-test stages, equipped with comfortable armchairs, which will facilitate the creation of a relaxing environment and favorable for building a relationship of trust between the examiner and the subject (Gordon, 2006).

The laboratory will be equipped with computing equipment (computer, printer, video camera) that will allow the recording and storage of data obtained from the examination.

In accordance with the recommendations set out in the *Organization of Activities in Polygraph Laboratories of the Romanian Police*, developed by the National Institute of Forensic Science of the General Inspectorate of the Romanian Police (National Institute of Forensic Science, 03.08.2015), it is recommended to install a panic button with manual or „pedal" operation to ensure the examiner's safety in case of risk situations.

Also, a sanitary facility should be provided near the polygraph laboratory, allowing hand hygiene before testing. This measure is important for maintaining hygiene standards and for creating an appropriate environment during the testing procedure.

It is also recommended to install a light signaling system outside the access door to the laboratory, to warn personnel that a polygraph examination is being conducted. The implementation of this system contributes to maintaining peace and confidentiality around the laboratory, essential aspects for obtaining valid and accurate results.

These facilitation and security measures are important for the efficient and ethical conduct of polygraph tests, ensuring an optimal environment for all parties involved in the investigation process.

The lighting, ventilation and air conditioning systems must be adequate to support the activities carried out in the polygraph laboratory. Lighting should provide clear visibility of the subject's facial and postural features, to facilitate the observation and interpretation of nonverbal signals.

The ventilation and air conditioning system should ensure an optimal temperature between 18-22°C in summer and 22-25°C in winter. Maintaining a constant temperature within this range contributes to the subject's comfort and the stability of polygraph recordings. Temperatures that are too low or too high can cause thermal discomfort in the subject and can affect the quality and reliability of the results obtained during testing. Therefore, ensuring a comfortable and constant temperature is important for the proper conduct of the polygraph procedure.

Polygraph tests must meet and respect specific conditions regarding instrumentation. Examinations with homemade or non-validated instrumentation cannot be admitted. It is imperative that the equipment used is of high quality, calibrated and validated according to industry standards and recommendations. This is important for eliminating errors and ensuring accuracy in the measurements made during the test. Strict adherence to the standards regarding the instrumentation is essential for the integrity and reliability of the polygraph testing procedure and the results obtained.

The equipment, regardless of its type (analog or computerized), must be produced by companies specialized in the field that allow their calibration.

The laboratories in the Republic of Moldova are equipped with state-of-the-art computer systems of the Lafayette LX6 model, which integrate the signal from the sensors into the data acquisition system (DAS) and digitally display the resulting diagrams.

Lafayette LX6 (Lafayette Instrument Company, 2020) is a computerized polygraph system, used in the activity of the Ministry of Internal Affairs, with a complex construction, which simultaneously records, through nine channels (distinct instruments), the physiological reactions of the subject of the examination and is composed of the following components (sensors):

- P2-Pneumograph – pneumatic – chest;
- P1-Pneumograph – pneumatic – abdomen;
- CUFF – blood pressure cuff – for measuring changes in blood pressure and heart rate;

- BULB – blood pressure cuff inflation pump;
- EDA – sensor that measures electrodermal response;
- PPG – optical photoplethysmograph;
- FEET – sensor for detecting movements in the legs;
- SEET – sensor for muscle activity in the buttocks;
- ARMS – sensor for detecting movements in the arms.

The LX6 system combines the processes of a conventional polygraph with the performance of a computer at the highest level. During the design phase of the LX6 polygraph, specialists from the Lafayette Instrument manufacturing company paid more attention to the EDA channel (the one that takes data from the sensor that measures electrodermal activity). They improved this channel to collect as much as possible data about electrodermal activity, considering studies from the last two decades that have highlighted the major importance of electrodermal reactivity patterns in identifying insincere subjects.

3. Prioritizing Polygraph Examinations

In the process of planning and conducting polygraph examinations, it is advisable to pay increased attention to certain categories of cases, depending on their procedural and social impact. Thus, it is suggested to prioritize the following situations:

- cases in which persons are under arrest;
- cases involving the investigation of crimes against the life and integrity of the person;
- cases presenting a high level of harm compared to others;
- cases influenced by the operational situation, social or media impact.

This approach is supported by scientific literature in the field. Donald Krapohl and Pam Shaw emphasize the need to adapt the planning of polygraph examinations depending on the severity of the crime and the associated procedural risk, highlighting the importance of a contextual assessment of each case (Krapohl & Shaw, 2015, pp. 45-47).

In all cases, the planning of the examination must be carried out in accordance with the principle of opportunity, and the establishment of priorities is based on the criterion of necessity and sufficient. These principles are applied to determine the relevance of the examination to both the subject and the cause, in order to achieve

an efficient and pertinent investigative process. In this regard, James Allan Matte insists on a pragmatic assessment of the potential impact of testing on the criminal record, advocating for prioritizing cases with high evidentiary stakes (Matte, 1996, pp. 112-115).

3.1. Conditions for examined persons (National Institute of Forensic Science, 03.08.2015)

Persons to be subjected to polygraph testing must meet the following conditions:

- have previously benefited from normal rest;
- be in a normal psychomedical state;
- not be subjected to prolonged interrogations, and if they have taken place, they must be interrupted at least three days before the test;
- not be subjected to threats, coercion, promises or inducements that could influence the behavior or attitude towards the examination.

3.2. Peculiarities of the polygraph examination (National Institute of Forensic Science, 03.08.2015)

- In the event that the subject being examined states that he/she does not know Romanian or is unable to express himself/herself due to disabilities, the court or the criminal investigation body will appoint an authorized translator according to the law to facilitate the polygraph examination.

- We recommend audio and video recording of the examination with an interpreter. The recordings will be kept in format at the institution's headquarters, respecting the archiving rules in force.
- The examination of victims or injured parties, regardless of the type of crime, will be carried out only if there are relevant elements that suggest the insincere nature of their statements.
- In the case of murder and suspicious death crimes, first-degree relatives or persons in emotional relationships with the victim will not be subjected to the polygraph examination until after a reasonable interval that includes the funeral.
- Polygraph examinations are not performed for persons who admit to committing criminal acts before the start of the polygraph test. In these cases, the criminal investigation body is informed and a report is drawn up signed by the psychologist, the criminal investigation body and the person

examined. Subjects who admit to committing criminal acts in the pre-test interview will have their new position recorded in a report. The aspects that the subject continues not to admit can be further examined, only if these are main elements in the file or are a priority for the subject.

- The admission of criminal acts can be audio and video recorded after obtaining the verbal consent of the subject at the beginning of the recording.
- If the subject admits to committing the act in the post-test discussion, this will be mentioned in a report drawn up in the presence of the criminal investigation body or at the end of the polygraph examiner's report/opinion.

The analysis of the diagrams and the interpretation of the results will be carried out in accordance with the Unified Methodological Norms for Conducting Polygraph Testing.

In the context of technological progress applied to polygram analysis, different perspectives are emerging regarding the use of artificial intelligence (AI) in their interpretation. On the one hand, researchers explore the potential of AI to automate the analytical process, but on the other hand, numerous specialists draw attention to the current limitations of these systems in capturing the emotional subtleties and complex motivations that underline human behavior.

Thus, while some authors, such as Wang, Shi and Liu, explore the possibility of using neural networks for polygraph analysis (Wang & Wang, 2025), other experts, such as Giansiracusa, Sánchez-Monedero, Dencik, Oravec, Brouwer, Elkins, Gupte and Cameron, highlight concerns about the accuracy and reliability of these systems (Giansiracusa, N. et al., 2024). The latter argue that AI is not yet advanced enough to correctly interpret the complexity of human emotions and the motivations behind behavior, essential aspects in assessing truthfulness.

Once the analysis and evaluation of the results are completed, the polygraph examiner prepares a research report on the simulated behavior. This report includes the results of the test, as well as information relevant to the initiator of the test, such as the margin of error and other significant aspects identified in the examination process (Decision of the State Commission for Polygraph Testing No. 3/2016 on the approval of the single methodological norms for conducting polygraph testing , 2016).

4. Conclusion

The use of artificial intelligence in the technical analysis of data from polygraph testing can be a valuable support for the investigator, but it cannot replace human input in the complex interpretation of simulated behavior. The absence of the ability to assess the emotional context and individual circumstances of the tested person significantly reduces the relevance of conclusions generated exclusively by algorithms, which requires the polygraph specialist to maintain decision-making responsibility.

Performing polygraph testing in the investigation of simulated behavior requires an integrative approach, in which physiological data obtained by technical means must be correlated with behavioral analysis, criminal profiling and legal contextualization of the case. The examiner's activity involves identifying patterns of deviant behavior, correlating the recorded reactions with the formulated forensic versions and elucidating the circumstances of the commission of the illicit act. From this perspective, the training of the polygraph specialist must be multidisciplinary, including in-depth knowledge in forensics, criminal law and criminology.

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