DOI: 10.2507/37th.daaam.proceedings.xxx

DESIGNING EFFECTIVE POLYGRAPH TEST QUESTIONS AND PROCEDURES

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Working Paper of 37th DAAAM Symposium

This Publication has to be referred as: Burgetová, L[ucie] (2026). Designing Effective Polygraph Test Questions and Procedures, Proceedings of the 37th DAAAM International Symposium, pp.xxxx-xxxx, B. Katalinic (Ed.), Published by DAAAM International, ISBN 978-3-902734-xx-x, ISSN 1726-9679, Vienna, Austria
DOI: 10.2507/37th.daaam.proceedings.xxx

Abstract

Since its inception, polygraph examination has undergone significant development in both instrumentation and methodological procedures. The quality of its results depends not only on the proper design of the test, but also on its administration and the appropriate interpretation of the recorded physiological responses. This paper focuses on the principles and procedures that should be applied in the design and administration of polygraph tests to ensure their effective implementation. In particular, it addresses the selection of appropriate testing formats and question construction, as well as adherence to the principles of proper examination practice and the factors influencing testing quality and the interpretation of the results obtained.

Keywords: Polygraph examination; Examination procedures; Question formulation; Factors affecting polygraph tests

1. Introduction

Polygraph examination involves the recording and analysis of an examinee's physiological responses while answering a series of predetermined questions. The parameters typically monitored include cardiovascular activity, respiration, and electrodermal activity. Modern instruments can also detect subtle body movements. Since the emergence of polygraph examination in the 1930s and 1940s, the field has undergone significant development in measurement instrumentation, the design of testing protocols, and methods for evaluating physiological recordings. Various testing formats, systematic procedures for assessing physiological responses, and software tools supporting the analysis and interpretation of recorded data have been developed.

The overall quality of a polygraph examination depends not only on the selection of an appropriate testing format, adherence to its rules, and proper question formulation, but also on compliance with the principles of proper examination practice and the appropriate evaluation of recorded physiological responses. This evaluation should take into account both the general principles for interpreting changes in physiological signals and the individual characteristics of the examinee's responses and their variations throughout the examination. Attention should also be paid to psychological and situational factors that may influence the examination process and the physiological responses obtained.

2. Methodological Principles for the Design and Conduct of Polygraph Examinations

The quality of a polygraph examination depends on adherence to methodological principles throughout the entire examination process, from initial preparation to the evaluation of the recorded physiological responses. These principles encompass all stages of the examination, including the selection of an appropriate testing format, the proper formulation of questions, the conduct of the examination, and the appropriate evaluation and interpretation of the recorded responses.

2.1. Timing of Polygraph Examinations

The timing of a polygraph examination is an important consideration. Although there are documented cases in which polygraph testing has helped uncover information contributing to the resolution of a case even years after the event, such cases appear to be exceptional. Polygraph examinations may be most effective during the early stages of an investigation, before details of the event have been widely disclosed and when the likelihood of the suspect having learned relevant information from other sources is lower. Such sources may include the media, acquaintances, previous interviews or interrogations, and investigators involved in the case. Information obtained through these channels may affect the examination results, as it can be difficult to distinguish knowledge acquired through direct experience from knowledge obtained indirectly.

2.2. Case Preparation

Before designing the test, the examiner must develop a thorough understanding of the case through consultations with investigators and a review of the available documentation. It is also essential to assess the examinee's knowledge of the case and the possible sources of that knowledge. This is particularly important when the examination is conducted long after the event, as information about the case may have become more widely available. If the origin of the examinee's knowledge cannot be reliably established, the interpretation of their physiological responses may be more difficult.

2.3. Test Question Formulation

Following a detailed case analysis, the next step is to select an appropriate testing format or combination of formats and develop the corresponding question sequences. An examination may comprise several sequences constructed according to a single testing format or sequences based on different formats. Their development requires careful consideration not only of the content of individual questions, but also of their clarity, simplicity, unambiguity, and order within the selected format. Question construction and sequencing must follow the principles of the respective testing format, which are informed by psychological research and established professional practice.

Each testing protocol has a specific format that determines not only the types of questions used, but also their prescribed order and sequence. Although the theory underlying question formulation and the construction of question sequences is extensive, polygraph testing techniques can be broadly classified according to two distinct criteria.

First, based on their underlying approach, testing techniques can be divided into recognition tests, which assess whether an examinee recognizes or possesses specific information, and deception tests, which focus on evaluating physiological responses to questions concerning the event under investigation.

Second, based on the use of comparison questions, testing techniques can be divided into Comparison Question Tests (CQTs) and non-comparison tests. CQTs incorporate three main types of questions:

- Relevant Questions (R) directly concern the event under investigation. Example: "Did you take that missing deposit?"
- Irrelevant Questions (I) are unrelated to the event under investigation and primarily serve as neutral questions within the test. Example: "Is your first name Jan?"
- Comparison Questions (C) generally concern a broader period or more general behavior and are used to compare physiological responses with those elicited by relevant questions. Example: "In your entire life, did you ever steal?"

One example of a CQT format is the Reid General Question Technique, which illustrates the use of relevant, irrelevant, and comparison questions. This format may also include a knowledge question (K), which may be considered a specific type of relevant question, as it focuses on the examinee's knowledge of the event or perpetrator rather than their direct involvement in the act. An example of a question sequence is presented below:

1. *I – Is your first name John?*
2. *I – Where you born in UK?*
3. *R – Did you leave this store with any of that missing deposit money?*

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4. *I – Were you born in June?*
5. *R – Did you take that missing deposit?*
6. *C – In your entire life, did you ever steal?*
7. *I – Right now are you sitting down?*
8. *R – Were those your fingers on that safe?*
9. *K – Do you know for sure who took that missing deposit?*
10. *Have you ever broken the trust of a friend?*

In contrast, non-comparison tests do not use comparison questions in the CQT sense. Examples include the Relevant–Irrelevant (R/I) technique, which uses relevant and irrelevant questions, and recognition-based tests such as the Peak of Tension (POT), Guilty Knowledge Test (GKT), and Concealed Information Test (CIT). An example of a question series used in the POT is presented below:

Regarding the item stolen from the administration office last week, do you know which of the following items was taken?

1. *Desktop computer*
2. *Digital camera*
3. *External hard drive*
4. *Notebook*
5. *Deposit*
6. *Laser printer*
7. *Tablet*
8. *Mobile phone*

The POT, GKT, and CIT rely on the examinee's physiological responses to information related to the event under investigation. Critical details, known to investigators but presumed to be unknown to an examinee without relevant knowledge of the case, are presented among plausible non-critical alternatives (distractors). The critical item must never occupy the first position in a test series and is typically placed near the middle of the sequence. In practice, examinees commonly respond to each presented item with 'yes' or 'no,' although other response formats are sometimes used. Physiological responses to the critical item are evaluated in comparison with those elicited by the alternative items.

Although these tests share the same underlying principle, they differ in their administration. In the POT, the examinee typically knows the sequence of alternatives and anticipates the critical item, potentially producing a characteristic peak in physiological responses. In the GKT, multiple test series are administered, with the critical item appearing in different positions across presentations. In the CIT, multiple test series are also administered, each addressing a different detail of the investigated crime, such as the identity of a stolen item, the location from which it was taken, or the method of entry.

Within a single investigation, different testing formats may be combined, and individual question series may be repeated once or multiple times.

2.4. Conduct of the Examination

At the beginning of the examination, the examinee provides written informed consent to participate voluntarily and is informed of their right to terminate the examination at any time without adverse consequences. The examiner explains the principles, purpose, and procedure of the examination, including the test questions, allowing the examinee to clarify ambiguities and ensuring that the questions are properly understood. The examinee is also asked about their health status and any current conditions that could affect physiological responses or the interpretability of the recorded data.

Establishing rapport between the examiner and the examinee may contribute to a more effective examination from a psychological perspective. Empathetic communication and a respectful, non-judgmental manner can help reduce anxiety and create an atmosphere in which the examinee feels more comfortable communicating openly. This is particularly important because disclosing past misconduct to an unfamiliar person may be difficult, especially when the examinee fears social disapproval or damage to their reputation. By fostering trust and reducing interpersonal barriers, the examiner may facilitate the gathering of accurate and relevant information.

In some testing formats, a stimulation test is administered during the pretest phase. The examinee selects a playing card or a number from a given range and then denies having selected it while connected to the polygraph. The examiner subsequently identifies the selected item, with the aim of strengthening the examinee's expectation that the polygraph can

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distinguish truthful from deceptive responses. This expectation may intensify physiological reactions during subsequent testing.

The examination should take place in a quiet, neutral environment free from distractions, allowing the examinee sufficient time to acclimatize. The examination itself typically lasts no longer than 150–180 minutes. At the end, the examinee signs the recorded charts again, thereby acknowledging the recorded data and confirming the date and time of completion.

2.5 Evaluation of Results and Formulation of Conclusions

Following the polygraph examination, the examiner manually evaluates the recorded physiological tracings, assessing response patterns across questions and charts to identify potentially significant reactions. The evaluation follows established scoring procedures.

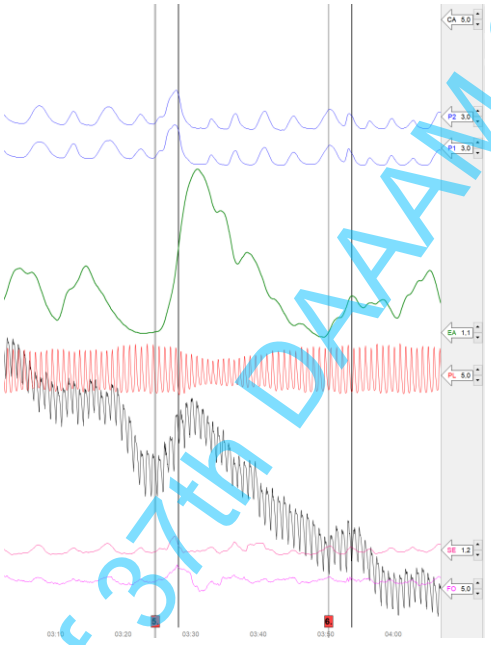

Fig. 1. Physiological tracings showing pronounced changes across various sensors in response to question 5.

As shown in Fig.1, question 5 is accompanied by pronounced changes in the four physiological recordings: electrodermal activity (green line), plethysmograph (red curve), blood pressure (black curve), and respiration (blue curve). The two lower traces represent movement sensors placed beneath the examinee's buttocks and the soles of their feet. These changes illustrate variations in the recorded physiological signals following the presentation of a test question; however, their significance must be assessed in the context of the test format and the overall pattern of responses.

Polygraph LXSoftware provides additional scoring and visualization tools to support the examiner's interpretation of the recorded data. It assigns scores to individual test questions on a scale from 1 to 10, with a score of 1 (green) corresponding to a truthful response and a score of 10 (red) corresponding to a deceptive response within the software's scoring system. The software also identifies physiological artifacts that may affect data interpretation.

The evaluation method depends on the test format used. In comparison question tests, physiological responses to relevant and comparison questions are commonly evaluated using structured numerical scoring systems, including the 3-position and 7-position scoring systems. The latter allows for more differentiated scoring of physiological responses. In the Relevant–Irrelevant (R/I) technique, a more global approach has traditionally been used to assess whether responses to relevant questions are generally more pronounced than those to irrelevant questions. In recognition-based tests, such as the Concealed Information Test (CIT), evaluation focuses on differences in physiological responses to critical and non-critical items and may involve numerical scoring or statistical methods. Therefore, polygraph results should be evaluated according to the established procedures specific to the test format used.

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3. Factors Affecting Examination Course

Before testing, the examiner assesses the examinee's health status and any circumstances that could affect physiological responses or the reliability of the recorded data. Particular attention should be paid to the following factors:

- Mental health and psychological state (e.g., mental disorders, extreme nervousness, or other significant psychological difficulties): The examinee should be able to understand the questions and the meaning of the answers and to maintain sufficient concentration throughout the examination.
- Cognitive abilities: Cognitive limitations may affect the examinee's understanding of the questions and the examination process (e.g., low intellectual ability, memory impairment, or symptoms of dementia).
- Current health status, pain, and medication: Illness, acute pain, and certain medications may affect physiological responses and reduce the interpretability of the recorded data (e.g., analgesics or medications affecting blood pressure). If their effects cannot be safely mitigated, postponement or cancellation of the examination should be considered.
- Alcohol and psychoactive substances: Their current effects may influence physiological responses; therefore, the examination should generally be postponed until these effects have subsided.
- Dependence and withdrawal symptoms: Withdrawal symptoms may significantly affect physiological responses. The health risks associated with discontinuing the use of addictive substances or medication must also be taken into account.
- Fatigue, exhaustion, and emotional distress: These conditions may impair concentration and alter physiological reactivity (e.g., sleep deprivation, severe stress, or psychologically distressing events). Where necessary, the examination should be postponed.
- Other individual factors: Results may also be influenced by personality characteristics and an individual's attitude toward truth and deception, particularly when the examinee is unaware that their answer is untrue, a phenomenon sometimes discussed in relation to habitual lying.

Certain circumstances related to the investigated event may also affect physiological responses and the interpretability of the recorded data:

- Impaired perception or memory at the time of the event: Alcohol, medication, or other psychoactive substances may have impaired the examinee's perception and memory, limiting their ability to recall relevant details.
- Multiple similar or related offenses: Similar incidents may be difficult for the examinee to distinguish, potentially leading to overlapping memories of individual events.
- Exposure to case-related information: Information obtained through the media, social contacts, or other sources may make it difficult to distinguish knowledge acquired indirectly from knowledge gained through direct involvement in the event.
- A prolonged interval since the event: The passage of time may impair recall of specific details or lead to emotional habituation through repeated recollection of the event, resulting in reduced physiological responses to it.

The factors listed above should not be regarded as absolute contraindications in every case. Their significance must be assessed individually, as a relevant and interpretable recording may sometimes be obtained despite the presence of factors that could adversely affect the examination.

4. Conclusion

The effectiveness of polygraph examinations depends on thorough case preparation, appropriate test question formulation, standardized examination procedures, and systematic evaluation of physiological data. Selecting a suitable test format and adhering to its established testing and scoring procedures are essential for ensuring methodological consistency and supporting the appropriate interpretation of results. When designing test formats, careful consideration must be given to the selection of relevant details and, particularly in recognition-based tests, to information known to investigators but presumed to be unknown to individuals without relevant knowledge of the event. Furthermore, individual differences in physiological response patterns should be taken into account, and recorded data should be evaluated consistently across test charts and question series to identify response patterns that may be relevant to the interpretation of the examination. By consistently applying established procedures throughout the examination and evaluation process, examiners can improve the methodological quality and interpretability of polygraph results.

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