Introduction

Forensic Psychophysiology

- Classification of individuals as either deceptive (guilty) or truthful (innocent) on the basis of differential autonomic responses to crime-related and comparison questions.

Detection of Deception: Test for Espionage and Sabotage (TES)

1. Relevant Questions (RQs): directly address the crime under investigation (e.g. “Have you provided secret information to an unauthorised person?”).
2. Directed Lie Comparison Questions (DLCQs): Require the negation of behaviors that everyone has done in their life (e.g. “Have you ever told a lie?”).
3. Irrelevant Questions: neutral (e.g., “Is your name ...?”).

Assumptions

- Guilty: stronger responses to RQs than to CQs (RQs > DLCQs).
- Innocent: stronger responses to CQs than to RQs (DLCQs > RQs).

Problem

- Emotional significance of DLCQs is doubtful: Can DLCQs reliably produce larger responses in innocent subjects?

Detection of Concealed Information: Guilty Knowledge Test (GKT)

- Multiple-choice questions: asking crime-specific details of the investigation (e.g. “The murder took place in ...”).
1. Relevant Items (RIs): crime-related (e.g. “a hotel?”).
2. Irrelevant Items (IIs): similar and plausible, but not crime-related alternatives (e.g. “a service station”, a store, a house, etc.).

Assumptions

- Subjects who possess “guilty knowledge”: recognise crime-relevant information and react more strongly to RIs than to IIs.
- Subjects without “guilty knowledge”: no differential reactions to RIs or IIs.

Advantage

- Low risk for innocents (without “guilty knowledge”) to react systematically more strongly to relevant item and to misclassified as “guilty”.

Standard Parameters of the GKT

- Skin conductance responses (SCR): Overall, SCR-magnitudes are larger to RIs than to IIs for guilty subjects; This difference has been replicated by many studies (cf. MacLaren, 2001).
- Respiration: Respiration Line Length (RLL) tends to be smaller to RIs than to IIs for guilty subjects.

Typical Application of the GKT (e.g. in Japan and Israel)

- Crimes like theft or violence against persons.

Aims of this Study

- Examination of the utility of the GKT in a mock espionage crime scenario.
- Comparison between laboratory equipment measuring skin conductance responses (SCRs) and Stoelting Computerized Polygraph System (CPS) measuring SCRs as well as thoracic and abdominal respiration.

Method

Participants

- N = 56 students (31 female; age: M = 23.5, SD = 3.42) were randomly assigned to one of the following groups:
1. Guilty subjects (n = 28)
   - In order to make the mock espionage ecologically valid for the students, they had to gather information about an examination paper from a professor’s office.
   - Guilty subjects were instructed to: go to the professor’s office, take the key no. 8 out of a leather jacket pocket, unlock and open a desk drawer that was covered by an executive case, open a yellow file inside the drawer, read aloud and record the examination questions with a dictation machine.
2. Innocent subjects (n = 28)
   - Carried out a specific instruction in the same building, but obvious to the relevant details of the mock espionage scene.

Guilty Knowledge Test (GKT)

- 6 multiple choice questions seeking knowledge of: last name of professor, key number, kind of jacket, colour of the file, dictation machine and executive case (cf. Table 1).
- 1 buffer item (the first in each sequence), 1 relevant item (RI) and 5 irrelevant items (II).
- Stimuli were presented as pre-recorded audio samples, the inter-stimulus-interval was 22 s.
- Subjects were instructed to deny any knowledge of the items.

Table 1. Example of a GKT question

<table>
<thead>
<tr>
<th>What is the professor’s last name?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Kressel</td>
</tr>
</tbody>
</table>

Measurement

1. Laboratory equipment:
   - SCR: Amplitude of highest SCR (in µS) within a latency window of 1-10 s following question onset.
2. Stoelting Computerized Polygraph System:
   - SCR: Difference between the lowest and the highest value (in µS) within a time window of 0.5-15 s following question onset.
   - Respiration: Respiration line length for thoracic and abdominal respiration within a time window of 0-10 s following question onset.

Results

Table 2. Lykken-Scoring (cf. MacLaren, 2001) to classify each subject as guilty or innocent

<table>
<thead>
<tr>
<th>2 Pts.</th>
<th>3 Pts.</th>
</tr>
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<tbody>
<tr>
<td>Response to the RI is the largest in the inspected multiple-choice block.</td>
<td>Response to the RI is the second largest in the inspected multiple-choice block.</td>
</tr>
<tr>
<td>At least two of the responses to the IIs are higher than the response to the RI</td>
<td></td>
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SCR: Optimised scoring algorithm

- Research indicated, that the diagnostic value of the Lykken-Scoring is limited due to the neglect of the absolute differences in the physiological responses. Therefore an optimised scoring algorithm using the response differences between RIs and IIs was implemented.
- Several analyses of discrimination were computed to estimate the contribution of every psychophysiological parameters to the diagnosis (see Table 4).

CPS: Optimised scoring algorithm

- Overall, SCR and total RLL (mean of thoracic and abdominal RLL) discriminated best between guilty and innocent subjects.
- Cross validation of this discriminant function (leave one out method) yielded an overall hit rate of 91.1% (sensitivity: 89.3%, specificity: 92.9%).

Discussion

- Both, SCR and CPS, showed a significant differentiation between guilty and innocent subjects.
- Even the simple technique of the Lykken-Scoring on the SCRs achieved an overall hit rate above 80%.
- An optimised scoring algorithm based on differences in the raw scores of SCR and RLL yielded an impressive overall hit rate above 90%.
- Results confirm the status of the GKT as useful diagnostic tool in different situations. The findings support the utility of the GKT for identifying espionage suspects.

Tasks of future research

- Cross validation of the computed discriminant function.
- Field studies in espionage crime scenarios using the GKT.

Reference