University of Twente
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Detection of Deception
The Application of the Concealed Information Test within a Mock Crime Paradigm

Bachelor thesis

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Abstract

The purpose of this study was to investigate in a laboratory setting whether the Concealed Information Test (CIT) can detect guilty people on the basis of electro-dermal measures. Participants were randomly assigned to one of two groups, where they either had to take an active part in a mock crime or watch a video with crime relevant information as an informed innocent bystander. For our experiment, we chose a 2x2x2 mixed subjects design, which consisted of two stages. Participants were tested either immediately or five days after the experiment on crime relevant and irrelevant trials. Results could demonstrate a significant effect for a different responsiveness on guilty and innocent trials. Yet, there was no main effect found for the factors condition or time. Also, an interaction effect between trial type and time could be shown in the group informed innocents. These findings suggest that the CIT is a valid tool to test for guilty feelings.

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Introduction

Since the beginning of the twentieth century, the study of psychophysiological detection of deception has attracted a great deal of interest among researchers as well as practitioners and has become an important area of applied psychology. The polygraph, commonly known as lie detector, is widely applied in US law enforcement agencies, even though it is still criticized for its inaccuracy. The Concealed Information Test [CIT], formerly known as Guilty Knowledge Test [GKT] is an alternative approach to detect concealed information. Despite fruitful findings and scientific advocacy in previous research, the CIT is implemented exclusively for crime investigations in Japan and has also been used as admissible evidence in Japanese criminal courts (Verschuere, Ben-Shakhar, Meijer, 2011).

The purpose of my study is to emphasize the importance of the CIT as a reliable investigation tool for the detection of deception. The electro-dermal activity [EDA] serves as the physiological indicator. The EDA is the change of electro-conductivity measured between the index- and ring finger of the participants. The current study tries to determine the amplitude of so called skin conductance responses [SCR], which form the peak of EDA's. Studies suggest that the CIT has a strong validity (Verschuere et al, 2011). Furthermore, the usability of the CIT will be demonstrated in a mock crime experiment in order to investigate its theoretical foundations. Supported by a Meta-Analysis concerning all previous research on the field of CIT, the mock crime scenario turns out as the most reliable test procedure to investigate the validity of detection of deception tests compared to card-paradigms or biographical paradigms (Ben-Shakhar & Elaad, 2003). In a mock crime the participants not only have to memorize specific items; they are independently simulating criminal events. Even though the participants are situated in an artificial surrounding such as a laboratory, they generally tend to feel uncomfortable during the task. This artificial setting has many methodological advantages. First of all, more specific crime centered questions in the CIT can be used. Bradley and Warfield (1984) demonstrated that a larger number of crime relevant items are associated with a higher probability of correct classifications of guilty people. In this context Ben-Shakhar and Elaad (2003) recommend to formulate at least five different CIT questions. Secondly, researchers (Ambach, Lueer & Vaitl, 2011) found out that dealing with specific items during a mock crime is likely to produce deeper encoding of the critical information in the mind of the participant. This account is consistent with extensive literature on the memory generation effect (de Winstanley and Bjork, 2004), demonstrating that

individuals tend to remember crime relevant information better when they take an active part in it.

In addition, this research will focus not only on guilty people who are committing the mock crime but also on informed innocent bystanders. In real life, there might be a situation where some bystander is accidently witnessing a crime related event. In the worst case scenario the bystander can mistakenly be suspected as the criminal himself. A direct comparison can find out, whether the memorization of crime relevant items differs between guilty mock crime offenders and informed innocent bystanders. Gamer (2010) found that the performance on the CIT immediately after the mock crime was no different between informed innocent bystanders and the guilty participants. In real investigations a suspect is also more likely to be tested after a few days or months after the crime is committed (Winograd & Rosenfeld; 2011). On this account it is interesting whether time does affect memory and, consequently, lead to different responses. Will a greater decline of accuracy be shown as time goes by between informed innocent bystanders than among the guilty? Previous research demonstrated that after 14 days guilty participants mainly forgot about the crime irrelevant items, whereas the informed innocent bystanders forgot almost all crime relevant items (Nahari & Ben-Shakhar; 2010). Other researchers suggest (Zvi, Nachson & Elaad, 2012) that the weak physiological responses to the crime relevant items have to do with a passive attitude, which the informed innocent bystanders tend to adopt. The passive attitude towards the crime goes along with less motivation, less focused attention and a lack of inhibition attempts. Therefore we have chosen to compare between a directly administered CIT and a CIT which will be administered after a certain delay. The setup is based on a mock crime paradigm (Nahari & Ben-Shakhar, 2011).

The rising of physiological measuring devices such as the polygraph in the early twentieth century had a huge impact in the emerging field of crime investigations (Verschuere, et al., 2011). The CIT was introduced in an experimental study as a new type of lie detector test by Lykken in 1959. Lykken's main principle was to create a test, which is purely based on incriminating knowledge. The CIT uses knowledge to which only the police investigating the crime or the guilty perpetuator of the crime could have. The CIT is designed to identify only the guilty subject with a positive response and to reduce the false-positive rate to a minimum. From a neurophysiological point of view the CIT is based on the orienting reflex (Sokolov, 1990). An orienting reflex [OR] occurs when someone is confronted with a personally significant stimulus. Orienting reflexes become noticeable in physiological responses, such as an increase in electro-dermal activity (Lykken, 1991). On the other hand, a constant repetition

of the same stimulus would lead to a decline in physiological response and a habituation would occur. Sokolov (1990) argues that the repeated stimuli result in internal representations. These representations can be described as neuronal models, which contain all parameters of the stimulus. All input information is compared with the existing neuronal models and a mismatch between stimulus input and the models results in an OR. If the input matches with the existing model, the OR will be inhibited – this process is what we call habituation. Nevertheless Lynn (1966) found out that personally significant stimuli are resistant to habituation and even evoke enhanced OR's. In the context of this study this means that only the guilty subject will recognize the relevant item and involuntarily evoke a strong OR. For the innocent subject, the crime relevant item will not evoke a strong OR, because all items have an equivalent personal value to the person. However, there is no guarantee that a criminal remembers the crime relevant details that are contained in the questions of the CIT. Therefore an OR could fail to appear. Honts (2004) argues that there is no scientific approach to predict which elements of a crime scene criminals are likely to remember. Especially serial offenders, who have committed many crimes, may have forgotten what exactly happened during one particular crime (Nakayama, 2002). On this account designers of the CIT have the difficult task to formulate appropriate questions.

Additionally, research on eye witness testimonials (Wickens, Lee, Liu & Becker, 2004) proves that people's memory can also be distorted over time, because they generally have problems with remembering the details of a crime scene. The so called episodic memory is comprised of autobiographic events. Unfortunately, episodic memory is amenable for biases, personal beliefs and other processes, which can lead to bad storage or incorrect retrieval of stored, crime relevant information. Another important implication of memory distortions is that retrieval is often based on reconstruction instead of a reproduction of the event. Especially when delay between encoding and retrieval increases the ability of remembering the information correctly declines. This can result in failed attempts to retrieve the information, because new representations compete with older ones (Smith & Kosslyn, 2009). There is no general decay theory, which can give us an exact prediction about the relation of memory and time. Forgetting is a complex interaction of many factors, such as individual beliefs, attention given to the event and the salience of the items, which have an impact on retrieval of stored information for the CIT.

The CIT itself contains a series of multiple choice questions, each with the salient item and crime-relevant alternatives. A possible CIT question could be: "Do you know if the victim

was ___" On completion the irrelevant and relevant items such as stabbed, strangled, shot and struck will be enumerated to the subject of interest (Ben-Shakhar & Elaad, 2003). The physiological response for the relevant item is typically larger as for the irrelevant items. Vrij (2000) summarized several reviews that the CIT correctly detects between 94% and 99% of guilty people. The correct rejection rate of innocent people was lower (between 78% and 86%). However it's important to mention that a CIT can only be administered if some central information exists about the crime (Gamer et al., 2010; Nahari and Ben-Shakhar, 2011). Verschuere et al. (2011) compared the CIT as an analogue to fingerprint evidence. If the felon left fingerprints at the crime scene it is possible to compare all the fingerprints of all suspects to those found at the crime scene. However, sometimes there is almost no relevant information available about the crime. Therefore the lack of relevant information can produce a high false-negative rate, which should be considered in when designing such a test (Ben-Shakhar and Elaad, 2003). Summarizing, examinations of the CIT cannot be conducted in criminal events where relevant information is lacking. It is also impracticable to use the CIT if crime relevant information is – intentionally or unintentionally – publicly available. The available information could lead to representations in the otherwise innocent suspects and to OR during a CIT. The logical consequence would be that innocent people could have the same crime relevant information and thus the same OR during a CIT as the person who committed the crime.

In matters of the most feasible psychophysiological measure device Horneman and O'Gorman (1985) label electro-dermal activity as an efficient method for detecting reactions to relevant information and for differentiating between individuals with guilty knowledge and those who do not have that knowledge. An extensive review (Mac Laren, 2001) summarized that the electro-dermal activity has higher validity if the participants performed in a simulated mock crime before. Even though the high validity of electro-dermal measures for the detection of concealed knowledge has been supported; a systematical combination of physiological measuring devices could increase the accuracy. Ben-Shakhar and Elaad (2003) successfully showed that respiratory and cardiovascular measures have an added value. Similar results have been reported by other researchers (Gamer, Goedert, Keth, Rill & Vossert, 2008b), who give some possible explanations for the higher accuracy. One plausible reason might be that multiple physiological measures cover slightly different aspects of psychological processes, which lead to a more complete view. Although the CIT is the focus of our research, the standard method for testing criminal suspects to date is the Control Question Test (CQT). In

order to create a more global understanding of physiological measuring devices, the CQT should not remain unmentioned.

While the CIT is designed to detect concealed information, the attempt hereby is to detect deception through physiological responses to direct questions (Carmel, Dayan, Naveh, Raveh & Ben-Shakhar, 2003). Several sets of comparison questions are posed to the suspect, including one crime relevant question ("Did you steal the wallet from X?") and one control question ("Have you ever lied to get out of an awkward situation?"). The control questions are also known as probability lie questions. Supporters of the CQT expect that the physiological response of a guilty suspect will be higher for the relevant question, because it elicits a personally important lie. Consequently, they also expect that innocent people show a stronger response to the comparison question, which evokes a probability lie. But the truth is that the CQT is controversial and widely criticized for its usage. Iacano (2000) enumerates three reasons. First of all, most scientists do not agree about the theoretical foundation of the CQT. There is no rule which says that innocent people will show the strongest response to the control question. The possibility that an innocent subject responds more strongly to the relevant question than the criminal cannot be ruled out completely. The interrogation setting and the sight of the measurement device can generate a high amount of stress for the subject, which might have an effect on the physiological responses, even on the relevant questions. Second, there's a huge gap between science and practice. In other words, polygraph professionals often work outside the scientific environment and therefore they are not excluded from having false assumptions, either. This can lead to the third point of criticism, that a polygraph can have profound consequences for individuals subjected to them. Patrick and Iacono (1991) reported a high false-positive rate of over 40% when highly trained police polygraph examiners blindly rescored confession-verified CQTs. In the light of this criticism the substitution of the CQT by the CIT seems to be the logical consequence, because the CIT improves upon the points that the CQT lacks. The CIT is not susceptible to stress, but knowledge alone is the relevant contributor for the outcome of crime relevant trials. Moreover, the choice between quantities of crime irrelevant items reduces the chance of false positive rates as discussed above.

Taken together, with attentive consideration of the design, the CIT seems to be a viable alternative to the CQT. First the applicability of the test can be increased by formulating questions which only the guilty suspect might have knowledge about. Second, the false

positive rate has to be lowered. This deserves an extended study of the crime scene and the people involved in the crime. A solid design frame is the key to enlarge the accuracy of the CIT.

Therefore the research question is whether the psychophysiological response of the measured SCR differs between a guilty person and an innocent person, guilty trials and innocent trials, or the delay between the crime event and the questioning. In consideration of the research question, the following three hypotheses will be tested. First, the mock crime condition shows significant stronger SCR-amplitudes on guilty- vs innocent trials in comparison with the informed innocents. Secondly, there is a significant difference in SCR-amplitude towards the guilty- or innocent trials between no time delay testing group and the time delay testing group. Thirdly, we hypothesize that there will be a three way interaction between condition (mock crime vs informed innocents), time (time delay vs no time delay) and trial type (guilty trials vs innocent trials) in relation to the dependent variable.

Method

Participants

In this experiment 101 University of Twente students (41 males/ 29 females) participated voluntarily. We recruited the participants by approaching them directly in study rooms of the Cubicus. When the experiment was over, the volunteers received surprisingly chocolate bars as a reward. In addition we designed posters and spread flyers all across the university in order to get the students' attention and make them willing to contact us. The mean age of the students was 22,86 years (SD= 3.59). The experiment was confirmed by the ethic committee of behavior science of the University of Twente. All students had to fill in an informed consent form, which included the right to anonymity and the protection of their privacy.

Apparatus

The experiment was divided in two stages. For the first stage, we refashioned an unused office into a secretary room. The interior fitting consisted of a bureau, a computer and a closet for archival storage. In order to create a realistic scenario we placed a plant on the window bench, put some documents on the desk and distributed some personal needs throughout the room (photos, tea mug). The second stage of the experiment took place in a quiet 7m² laboratory

setting. Skin conductance (EDA) was measured via a sensor (SC-Flex/Pro). The sensor consists of two finger bands to which the electrodes are attached. A voltage isolator device was installed in order to provide medical grade electrical isolation between the patient connected sensors and the computer. The stimuli were visually displayed on the computer screen and via headphones. The auditory stimuli were recorded in advance with a small voice recorder and synchronized with the test (E-Prime). We also used a laptop to record the EDA via biofeedback software (BioGraph Infiniti).

Design

A 3 x 2 in between subjects design was used, with the following two orthogonal factors. The type of mock crime (guilty vs informed innocents vs uninformed innocents) and time of test (no time delay vs time delay). 97 participants were randomly assigned into the different groups created by this design. Technical issues made the data of 27 participants useless, which means that we disregarded the group of uninformed innocents with no time delay. Altogether 70 participants were distributed in the different group as follows: First 17 Participants were tested immediately after they committed the mock crime (NTD) and 16 were tested five days after they committed the crime (TD). In the informed innocent group, 16 participants were tested immediately (NTD) and 15 after the duration of five days (TD). The uninformed innocent group consisted of the remaining six persons (TD).

Procedure

In the beginning all participants had to fill in the informed consent form. They received an instruction sheet according to their grouping. Between the mock crime groups and the innocents, there was a different instruction sheet and therefore a different task which had to be executed. However, during the execution of the tasks the instruction sheet had to remain in possession of the participant, so that the chronological steps were not forgotten. In the first stage of the experiment the participant was confronted with all test relevant stimuli. In the mock crime procedure, the participants were instructed to find the secretary room anonymously (office) and avoid any kind of conversation. The participants should check if someone was inside the room, if not, they were instructed to enter the room. In the following, the participants were instructed to watch out for an envelope (blue), which they had to bring us in the end. The envelope was located next to the computer (desk). The participants were instructed to take anything valuable and put the object into their pocket (a bank note of 50€). After the guilty act was committed, the participants were instructed to put the money in one of

the lockers next to the entrance. Equipped with the stolen item the participants made their way through the corridors and stairway of the building until they finally reached their destination. Usually the entrance was quite crowded with staff members and students. The participants extracted the number of the locker (#11) and the key combination from the instruction sheet and should hide the money in there, before they went back to the researchers in order to deliver the envelope. Participants in the informed innocent condition were instructed to find the secretary room anonymously and avoid any kind of conversation. The next order was to sit on a chair behind the desk and turn towards the laptop. All they had to do was to start a video clip and watch it attentively. In this short clip we re-enacted a burglary, which took place in the exact same office. The video was split into two scenes and was recorded from a 3rd perspective. The video clip contained all the test relevant stimuli like in the mock crime condition. The first scene captured the sequence where a student sneaked into the office room and walked carefully behind the desk. After the student kept an eye on his surroundings and made sure he was not monitored, he took the banknote and left the room. The second sequence shows with a close angle how the student stores the money inside the locker. After five minutes a researcher picked them up and brought them back to the laboratory. Participants in the uninformed innocent condition got the same instructions like the informed innocents. The only difference was the content of the video clip they got to see. The video clip was about some aerial video recordings from the University of Twente, which included no test relevant stimuli. After five minutes they were also picked up by a researcher.

In the second stage of the experiment, the CIT was administered to all participants. Participants in the delayed condition (TD) returned for the test after five days, whereas participants in the direct condition (NTD) were tested immediately after the first stage of the experiment. The participant was connected to the skin conductance device and put on the headphone. He received a brief instruction about the test procedure, in which he was advised to rest in a comfortable position until the test ends automatically. The questions were presented on the computer for six seconds. There were five multiple choice items following each question for three seconds. The order of the one relevant item and the four irrelevant were randomized and intercepted by a ten seconds interstimulus interval (white screen). In order to understand the task completely the participant was administered to a test round ("In which city are we at the moment?"). Every multiple choice item should be answered loud and clearly with "No". When the participant was confident about the task execution, the researcher left the room. After the test was completed the researcher returned to the room for

a compensation and debriefing. Even though this research was under our direction, four former students from the Psychology department have also taken responsibility. After we coached and briefed them in detail, the students were able to manage this research independently.

Preliminary analysis

The data from all participants was transformed from Matlab into SPSS in order to test our hypotheses. First calculations with general linear models showed poor results. It turned out that the uninformed innocents had a negative influence on the main effect. In other words, if we consider the uninformed innocents in the statistical evaluation, the probability of a main effect would decrease drastically. This might have to do with the fact, that the uninformed innocents only consisted of six participants, which is, in comparison to the other groups, not enough to draw any reliable conclusions. On this account we had changed our 3x2x2 design into a 2x2x2 mixed subjects design (guilty trial vs innocent trial, mock crime vs informed innocents, time delay vs no time delay). After removing the uninformed innocents, the dependent variables (guilty trials and innocent trials) were computed under logarithmic transformations to achieve a more normal distribution. Nevertheless, for ease of interpretation, we used raw data for data displacement of the descriptive. First, the descriptive data of SCR-amplitude and on innocent and guilty trials was generated in order to get a global overview of the average scores. The descriptive data included frequency, mean values, and standard deviations of the relevant variables. To make sure that our trials were unbiased, the uninformed innocents were briefly considered in order to look how strong they respond on guilty and innocent items. For the statistical data ascertainment, the measurement processes with the SCR-amplitudes, we used repeated measures in order to explore any main- or interaction effects. The output showed a significant main effect on trial-type (guilty-trials vs innocent trials). Next to that, SPSS successfully reported an interaction effect. It had to be found out in which condition the interaction effect exactly took place. By means of the SPSS function split file, the participants from the mock crime group and the informed innocents could be regarded separately. Next to that, an analysis of variance (ANOVA) was executed to probe for the interaction effect between the mock crime condition and the informed innocents. A closing descriptive of the one way ANOVA considered the influence of the orthogonal factors on the guilty- and innocent trials, which proved nothing more than the determination of the interaction effect.

Results

We computed the mean standardized response of each participant across the two presentations of the innocent- and guilty trials within each question. These means, which were averaged across participants within each condition, are displayed in table 1. We conducted a 2x2x2 mixed model analysis of variance (ANOVA) with the between-subject factors condition (mock crime vs informed innocents) and time (time delay vs no time delay) and the within-subjects factor trial type (guilty trials vs innocent trials).

SCR-amplitude

The descriptive comparison between the mock crime condition and the informed innocent condition shows that both conditions responded on average weaker in SCR-amplitude, when they were confronted with the innocent trials than when confronted with guilty trials. The data clearly reports the total strength of the average response of the innocent trials (M= 0.05, SD=0.08, n=64) was outperformed by the average response of the guilty trials (M=0.07, SD=0.10, n=64). The data also revealed that the average strength in SCR-amplitude for innocent trials was stronger in the NTD condition (M=0.06, SD=0.04, n=33) than in the TD condition (M=0.04, SD=0.05, n=31). The same occurred after the analysis of the guilty trials. Guilty trials were experienced stronger in the NTD groups (M=0.8, SD=0.5, n=33) than in the TD (M=0.06, SD=0.09, n=31) groups. In addition to total data, it is interesting to take a deeper look at the responsiveness between the different conditions in relation to the variable time. The results show that participants, who belonged to the informed innocents (NTD), were more responsive to innocent trials (M=0.07, SD=0.08, n=16) than guilty trials (M=0.03, SD=0.05, n=15). It is quite striking to note that the opposite effect can be shown for the TD group. The responsiveness on guilty trials (M=0.08, SD=0.11, n=31) was quite higher in comparison to the innocent trials (M=0.05, SD=0.07, n=31). Comparably, the executers of the mock crime were generally more responsive to guilty trials (M=0.07, SD=0.09, n=16), when they were tested five days after committing the crime. On the other hand, there was no difference in the SCR-amplitude between innocent- and guilty trials in the NTD group (M=0.06, SD=0.09, n=17).

		Innocent trials			Guilty Trials		
		M	**SD**	**N**	**M**	**SD**	**N**
Mock Crime	NTD	0.06	0.01	17	0.06	0.09	17
	TD	0.05	0.05	16	0.07	0.09	16
	Total	0.06	0.09	33	0.07	0.09	33
Informed Innocents	NTD	0.07	0.08	16	0.09	0.09	16
	TD	0.03	0.05	15	0.06	0.08	15
	Total	0.05	0.07	31	0.08	0.11	31
Total	NTD	0.06	0.04	33	0.08	0.05	33
	TD	0.04	0.05	31	0.06	0.09	31
	Total	0.05	0.08	64	0.07	0.10	64

Table 1. Means and standard deviations of SCR-amplitude on innocent and guilty trials

The results of multivariate tests reveal a statistically significant effect on the different trials $F_{(1,43)=}11.63$, p=0,01, ηp^2=0.213. Figure one clearly pointed out that guilty trials produced significantly stronger SCR's. On the other hand, participants with no information about the crime provided were more responsive on innocent items. A statistically significant difference in SCR-amplitude related to guilty or innocent trials between the groups could not be found $F_{(1,\ 43)=}1.56$, p=2.2. Neither the variable time evoked a main effect in reference to the guilty- and innocent trials $F_{(1,43)=}980$, p=3.28. However, if the variables time and conditions were taken together, an interaction effect occurred with marginally statistical significance $F_{(1,43)}$=3.96, p=0.53, ηp^2=0,84. Further analysis of the component interaction will show, in which condition the variable time has a strong impact on the SCR-amplitude on innocent or guilty trials. A 2x2x2 analyses of variance (ANOVA) with two orthogonal factors condition (mock crime vs informed innocents), time (time delay vs no time delay) and the dependent factor trial (guilty vs innocent) neither revealed statistically significant interaction effect of the mock crime group. Neither was an interaction effect found on the guilty trials $F_{(1,43)=}10.29$, p=0.28, nor on the innocent trials $F_{(1,43)=}1.40$, p=0.64. However, the results showed that a statistical significant effect, which is displayed in the figure below, occurred in the informed innocents group in matters of innocent trials $F_{(1,43)=}2.12$, p=0.53. Analysis of this interaction revealed that the informed innocents from the NTD group (M=-1.34) had a much lower SCR-amplitude in comparison to the participants from the TD group (M=-1.92).

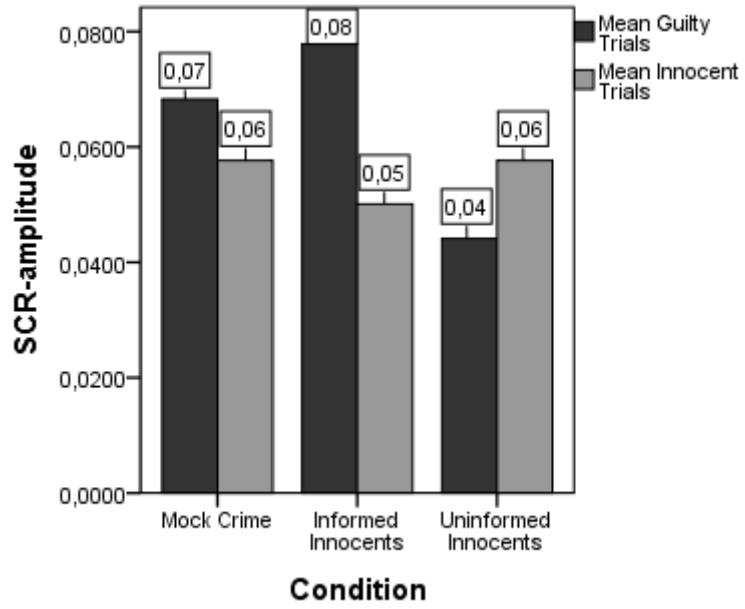

Figure 1. Main effect: Mock Crime offenders and informed innocents show higher SCR-amplitudes on guilty trials

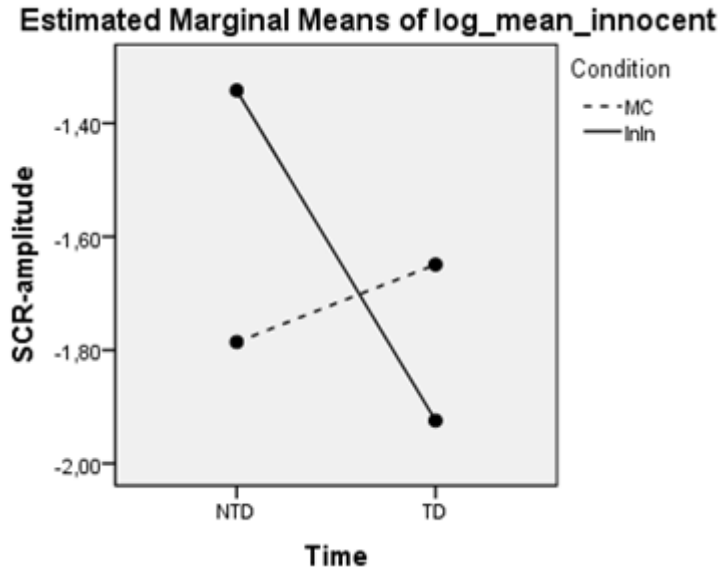

Figure 2. Interaction effect: Informed innocents show higher SCR-amplitudes on innocent trials within the NTD-condition and lower SCR-amplitudes on innocent trials within the TD-condition.

Discussion

This study investigated whether time would have an influence on participant`s SCR-amplitude in relationship to crime relevant items (guilty trials) and crime irrelevant items (innocent trials) on the CIT. Therefore we tested three hypotheses, which would shed light on the validity of the CIT in a laboratory design. Before the CIT was administered, we hypothesized that people who committed a mock crime show stronger responses in SCR-amplitude in relation to guilty- or innocent trials compared to informed innocents (Hypothesis 1). Unfortunately we could not find a statistic significant main effect, which confirms this claim. We also did not find any difference in SCR-amplitude, when the participants were placed in different groups in consideration with time as a factor (Hypothesis 2). However, we could indicate a three way interaction between condition (mock crime vs informed innocents), time (time delay vs no time delay) and trial type (guilty trials vs innocent trials) in relation to the dependent variable (Hypothesis 3).

Taking these findings into account, previous studies showed that the CIT is a reliable tool in crime investigation. Our findings partially agree with the results of Nahari and Ben-Shakhar (2011), on whose setup our experiment was based on. One important aspect was the discrimination between guilty- and innocent trials in the two conditions. Even though the guilty-trials produced generally stronger SCR detection efficiency, they were not significant. This does not necessarily contradict the theoretical background. In the original study, no distinction could be found between participants who committed the mock crime immediately and participants who were just exposed to the guilty trials in a neutral context. Similar results were found by Gamer et al. (2010), who argued that the CIT would be equally effective in differentiating between knowledgeable and unknowledgeable individuals, but equally ineffective in differentiating between guilty and informed innocents. In this context, the finding of a significant main effect between the trials fits in well. The effect is in accordance with previous findings on the CIT (Ben Shakhar & Elaad, 2003). For the purpose of building a psychophysiological measuring device, which in its application clearly distinguishes crime relevant items from crime irrelevant items, we successfully explained the validity in this study. The effect size, we could find was remarkably high and revealed that physiological response for the relevant items are typically larger than for the irrelevant items. However, this is only true for participants who were exposed to the crime relevant items. Uninformed innocents logically did not show a significant stronger SCR-amplitude on guilty trials,

because they had no information about the crime at all. A contrary result from the original study was that no main effect could be found, when the participants were separated in TD- and NTD groups. Participants who immediately took the test showed more responsiveness in SCR-amplitude in matters of guilty trials, but were less responsive towards innocent trials. In addition, participants who took the test after a delay from five days were also more responsive towards guilty trials. It was quite surprising for us, because the results were also contrary to our expectations from the reports we received from the participants. Several of the informed innocents reported that they could not remember any of the guilty trials they were exposed to during watching the video of the mock crime. This finding is consistent with the literature. Carmel et al. (2003) explain that the memory for central details (guilty trials) would decline over time, but remained equally stable for the guilty participants. Based on this assumption, the memory of guilty trials should decline strongly in the group of informed innocents. In realistic circumstances, the practical questioning of the CIT would also occur after an indefinite time delay. The main criticism on the CQT included that uninformed people still have a high probability to be considered guilty, a so-called false-positive. This seems quite obvious when in that case the factor stress is considered as the only legitimate indication device in order to detect the guilty. While implementing the CIT, we tried to make a contribution to protect uninformed people from the target of possibly false accusations by exposing their knowledge in relation to crime relevant events. In consideration of the above-mentioned results it seems that the ambitions are well fulfilled in this test design. However, after five days the group of informed innocents showed comparably strong SCR-amplitude in comparison to the mock crime condition on the guilty trials which in reverse cannot guarantee that they did not participated in the crime. As predicted in the original study, the guilty trials produced more efficient SCR detection, when the test is delayed. The people who committed the mock crime showed a somehow stronger SCR-amplitude after five days on innocent trials. But in case of the informed innocents we could find an interaction effect, which can be linked to our third hypothesis. While no significant difference was found of SCR-amplitude between the informed innocents in the different time groups in relation to guilty trials, a strong difference related to innocent trials was found. This account is enumerated in the literature (De Winstanley and Bjork, 2004) and refers to the so called generation effect. Hereby the difference between TD group and NTD group does not affect their immediate responses but only becomes visible after a certain delay. This has to do with a decline in memory for the crime relevant event within the group of informed innocents. As a reason, the researchers argue that individuals are likely to remember crime relevant information, if they take an active

part in producing it. In the case of the informed innocents, they were merely exposed to the crime relevant stimuli in a neutral context. But the guilty participants actually experienced the event. They enacted the mock crime independently and had a direct contact with the crime relevant items. All in all the people who committed the mock crime were more involved in the task and were likely to remember the crime relevant items better than informed innocents. The generation effect suggests that time delay may diminish the danger of accusing informed innocents and therefore increase the probability of detecting the guilty. This would also go along with the verbal reports we received from the informed innocent group, who were tested after five days. In this case, we can conclude, the generation effect was confirmed for the mock crime condition. Also in accordance to the literature, the informed innocents show weaker responses on guilty trials after the delay than the guilty, but this interaction effect was only significant in relation to innocent trials. The same effect was supported in the article of Gamer et al. (2010), where informed innocents became aware of the critical details by reading a newspaper article.

What theoretical consequences can we conclude from our results? Is the usage of the CIT really beneficial in terms of enhancing the detection of deception in the field of law enforcement or does the evidence not yet suffices? In either case, the distribution of participants across all three conditions, which was based on the study on Ben-Shakhar and Nahari (2001) had to be reorganized. Because of time- and technical issues, we have lost 27 participants, which is with regard to the complexity of the experiment disadvantageous for its validity. As in the original study, we were planning to have at least 15 participants for each condition. Ultimately, the uninformed innocents had to be removed. We also have to be aware of the fact that almost all experiments in this field took place in a laboratory setting. And even, if the mock crime paradigm turned out to be the most realistic setting, it cannot fully reflect a real life crime. In other words, the external validity of the CIT is still low.

In the current study, we tried to produce an OR in order to create a valid instrument for physiological response measurement. Consequently, liars can remain undetected, if an OR does not occur. It is an open question what physiological responses are to be expected from a multiple offender, who might have problems remembering the relevant details from one specific crime. Another possibility would be that the offender, through his frequent operations, is already habituated to the crime relevant stimuli to the extent that the physiological response to the guilty trial will not differ from that to the innocent trials. Another important challenge is the identification of crime relevant items for the test. In order

to create a valid framework, we formulated a total amount of six questions. But in the realistic context, it can be challenging for crime investigators to collect enough information, which is needed for designing a CIT. Preferably, the questions should be designed so that innocent people are capable of figuring out the correct answers. This leads us to the biggest challenge of lie detectors in general; namely to reduce the risk of false-positive rate. In our study, we were able to guarantee that only participants, who are exposed to crime relevant information, exhibit a stronger physiological reaction on guilty trials in comparison to uninformed innocents. But nevertheless, a sharp distinction between informed innocents and mock crime offenders could not be guaranteed.

With regard to this issue, I have examined limitations and suggestions, which should be taken into account for future research. At first, the length of the time interval, which was recorded during the SCR should be analyzed. In the current study, we have worked with a time interval of five seconds starting with the presentation of the test trials. These extractions of physiological responses are considered as relevant data we examined for analyses purposes. The extension of the time interval to 10 seconds did possibly affect the results. Eventually, the electro-dermal reaction pattern differs from individual to individual. Gruzelier et al. (1981) mention that physiological responsiveness across data channels might vary to such a degree as there might be non-responders among the participants. Secondly, the performance of the first stage of the experiment should have been monitored in the group informed innocents. The possibility that one participant watched the mock crime video repeatedly, while another one briefly took attention to it, could have affected the results of this study negatively. On this account, the participants should be advised explicitly to watch the video once. Thirdly, we cannot be sure that all participants really answered every test trial with "No". If it happened occasionally, again the testing results would be affected negatively. A conscious deception is associated with a cognitive dissonance, which can be achieved by saying "No" out loud. Primarily, in the mock crime group the cognitive dissonance results generally in a stronger SCR. The installation of a (hidden) video camera will enable the researchers to monitor the testing procedure. Finally, after the successful demonstration that the SCR-amplitudes on guilty and innocent trials become generally weaker in respect to time, consideration of more time delay groups could lead to a better understanding in whether the variable time has an impact on memory. Thereby the pursuit of a sharper distinction between informed innocents and mock crime offenders with respect to crime relevant items could approve the validity of the CIT.

Taking these recommendations into account, research on this field might deliver more insight into the usability of the CIT. Finally, it should be pointed out once again that this research indicates an incidental encoding of crime relevant items as a sufficient way to generate a stable memory representation. This is helpful for identifying guilty examinees on the basis of their physiological response pattern in the CIT. This study did approve the CIT as a valid instrument for differentiating the innocent from the guilty in an artificial crime setting.

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Appendix

Informed consent, Dutch

Toestemmingsverklaring

Titel van het onderzoek: Detection of Deception

Verantwoordelijke onderzoekers: Matthijs Noordzij, Lisa Goller, Elias Waziri

In te vullen door participant

Ik begrijp dat mijn deelname op vrijwillige basis plaatsvindt. Ik heb het recht mijn toestemming op ieder moment weer in te trekken zonder dat ik daarvoor een reden behoef op te geven. Ik ben mij van het feit bewust, dat de onderzoekers mijn privacy zullen beschermen. Alle data die verzameld worden door de onderzoekers zullen volledig anoniem zijn.

Naam participant: …….

Datum: …….

Handtekening: …….

In te vullen door onderzoeker

Ik zal zowel mondelinge als schriftelijke instructies geven aan de participant. Ik zal gestelde vragen met betrekking tot het onderzoek, tot op zekere hoogte beantwoorden, zodat deze niet de uitkomst van het onderzoek kunnen beïnvloeden. Ik zal overige vragen met betrekking tot het onderzoek beantwoorden in de vorm van een debriefing, welke de participant aan het eind van het onderzoek zal ontvangen. Er zullen geen negatieve consequenties zijn voor de participant, wanneer hij/zij op elk moment tijdens het onderzoek wil stoppen.

Naam onderzoeker: …….

Datum: …….

Handtekening: …….

Informed consent, German

Einverständniserklärung

Name der Studie: Detection of Deception

Verantwortliche Forscher: Matthijs Noordzij, Lisa Goller, Elias Waziri

Vom Teilnehmer auszufüllen

Ich erkläre mich hiermit einverstanden, an dieser Studie mitzuwirken. Meine Teilnahme erfolgt freiwillig. Ich bin mir bewusst, dass ich die Möglichkeit habe, meine Teilnahme an dieser Studie jederzeit abzubrechen. Ich bin mir außerdem darüber bewusst, dass die Forscher meine Privatsphäre schützen und meine Daten anonym verarbeitet werden.

Name des Teilnehmers: ……..

Datum: ……..

Unterschrift: ……..

Vom Forscher auszufüllen

Ich habe dem Teilnehmer sowohl mündliche als auch schriftliche Anweisungen gegeben. Eventuelle Fragen des Teilnehmers über den Ablauf der Studie werde ich so beantworten, dass sie die Ergebnisse auf keine Weise beeinflussen. Alle übrigen Fragen werden in Form einer Nachbesprechung beantwortet, die am Ende der Studie erfolgt. Sollte der Teilnehmer seine Teilnahme während der Studie abbrechen, entstehen ihm hierdurch keine Nachteile.

Name des Forschers: ……..

Datum: ……..

Unterschrift: ……..

Demographic data, Dutch

Demografische gegevens

Code participant (invullen door onderzoeker):

Nationaliteit:

Leeftijd:

Geslacht:

Beroep/faculteit:

Demographic data, German

Demografische Angaben

Teilnehmercode (vom Forscher auszufüllen):

Nationalität:

Alter:

Geschlecht:

Beruf/Ausbildung:

Instructions mock crime, Dutch

Bedankt voor deelname aan het onderzoek "Detection of Deception".

De instructies die je worden gegeven, zullen exact moeten worden gevolgd. Probeer tijdens het uitvoeren van de instructies **niet** met iemand te praten. Mocht dit niet te vermijden zijn, probeer dan de interactie minimaal te houden.

Voel je je ongemakkelijk bij het uitvoeren van de stappen, dan ben je vrij om op elk moment het experiment af te breken.

Code voor de kluis: 5435

Je loopt naar kantoor C239a en klopt op de deur om te zien of iemand in het kantoor aanwezig is

Wanneer je niemand in het kantoor ziet, kijk je om je heen of iemand je ziet

Je opent de deur en loopt het kantoor binnen

Binnen in het kantoor vind je een envelop op het bureau

Naast de envelop ligt een bepaalde hoeveel geld

Neem de situatie waar en stop het geld in je zak (broek etc.) zodat dit niet door andere mensen gezien kan worden

Tevens neem je de envelop mee (andere mensen mogen dit zien) welke je later inlevert bij de instructeur

Neem de trap naar beneden naar de rode kluisjes, welke naast de receptie is gelegen. Wees voorzichtig, zodat je niet teveel aandacht trekt!!!

Zoek naar kluis met nummer 23

Heb je de kluis gevonden, type dan het button "C" en vervolgens de code. Druk dan de "sleutel" button om de kluis te openen

Leg alleen het geld in de kluis

Sluit de kluis, door dezelfde volgorde van buttons te gebruiken dan tijdens het openen

Ga terug via de trap naar B219 en lever de envelop in bij de instructeur

Einde experiment

Instructions mock crime, German

Herzlichen Dank, dass du an unserer Untersuchung „Detection of Deception" teilnimmst!

Die Anleitung, die du bekommst, muss genau befolgt werden. Bitte sprich während du die Aufgabe ausführst mit niemandem. Falls dies nicht zu vermeiden ist, reduziere die Interaktion auf ein Minimum.

Solltest du dich bei einem der auszuführenden Schritte unwohl fühlen, kannst du natürlich jederzeit mit dem Experiment stoppen.

Zahlenkombination für das Schließfach: 5435

Du läufst zu Büro C239a und klopfst an der Tür, um zu sehen ob jemand im Büro ist

Falls du niemanden im Büro sehen kannst, siehst du dich außerdem um, um zu schauen, ob dich jemand bemerkt

Du öffnest die Bürotür und betrittst den Raum

Im Büro findest du auf dem Schreibtisch einen Umschlag

Neben dem Umschlag findest du eine bestimmte Menge Geld

Bitte nutze die Situation aus und stecke das Geld in deine Hosentasche, sodass es für andere Personen nicht mehr sichtbar ist

Du nimmst außerdem den Umschlag mit (dieser darf von Anderen gesehen werden), um ihn später deinem Begleiter zu geben

Gehe die Treppe runter zu den roten Schließfächern, neben der Rezeption. Sei vorsichtig, sodass du nicht zu viel Aufmerksamkeit auf dich lenkst!!!

Suche nach dem Schließfach mit der Nummer 23

Wenn du das Schließfach gefunden hast, drücke die "C-Taste" und gebe den Code ein. Dann drückst du die "Schlüssel-Taste", um das Fach zu öffnen

Hinterlege nur das Geld im Schließfach

Schließe das Schließfach, indem du erneut die gleiche Prozedur ausführst wie beim Öffnen des Schließfaches

Gehe über die Treppen wieder nach oben zu Raum B219 und gib den Umschlag deinem Begleiter

Ende der Testprozedur

Instructions informed and uninformed innocents, Dutch

Bedankt voor deelname aan het onderzoek "Detection of Deception"

De instructies die je worden gegeven, zullen exact moeten worden gevolgd. Probeer tijdens het uitvoeren van de instructies niet met iemand te praten. Mocht dit niet te vermijden zijn, probeer dan de interactie minimaal te houden.

Voel je je ongemakkelijk bij het uitvoeren van de stappen, dan ben je vrij om op elk moment het experiment af te breken.

Ga naar kantoor C239a

Open de deur en loop het kantoor binnen

Ga op de stoel zitten achter het bureau en maak het jezelf comfortabel

Kijk rond in het kantoor

Voor je staat een laptop, waarop je een video te zien krijgt

Je zult 5 minuten naar deze video kijken

Druk op de startknop om de video af te spelen

Kijk aandachtig naar de video

Wanneer de video is afgelopen blijf je in het kantoor

De instructeur zal je ophalen wanneer de tijd om is

Instructions informed and uninformed innocents, German

Herzlichen Dank, dass du an unserer Untersuchung „Detection of Deception" teilnimmst!

Die Anleitung, die du bekommst, muss genau befolgt werden. Bitte sprich während du die Aufgabe ausführst mit niemandem. Falls dies nicht zu vermeiden ist, reduziere die Interaktion auf ein Minimum.

Solltest du dich bei einem der auszuführenden Schritte unwohl fühlen, kannst du natürlich jederzeit mit dem Experiment stoppen.

Gehe zu Büro C239a

Öffne die Tür und gehe in das Büro hinein

Setze dich auf den Stuhl hinter dem Schreibtisch und mach es dir bequem

Schaue dir das Büro genau an

Vor dir siehst du einen Laptop, auf dem du ein Video sehen wirst

Du hast 5 Minuten Zeit um dir das Video anzuschauen

Drücke die Start Taste um das Video abzuspielen

Schau es dir aufmerksam an

Nachdem du das Video gesehen hast, bleibst du im Büro

Du wirst von einem Begleiter abgeholt wenn die Zeit vorbei ist

Multiple-choice questions GKT, Dutch

Items voor de GKT

Waar vond het misdrijf plaats?

a. WC
b. Buiten
c. Kantoor
d. Cafeteria
e. IT-zaal

Welke kleur had de envelop, welke door de verdachte/door jou werd meegenomen?

a. Groen
b. Bruin
c. Rood
d. Blauw
e. Geel

Waar lag de envelop voordat hij door de verdachte/door jou werd meegenomen?

a. Stoel
b. Plank
c. Vensterbank
d. Buiten het kantoor
e. Bureau

Wat werd er precies gestolen op de plaats van het misdrijf?

a. I-pad
b. Geld
c. Juwelen
d. Sleutel
e. Telefoon

Wat was het nummer van de kluis, waar het item werd ingelegd door de verdachte/door jou?

a. 11
b. 43
c. X
d. 32
e. 46

Wat was de hoeveelheid geld wat is gestolen op de plaats van het misdrijf?

a. 100 Euro
b. 50 Euro
c. 200 Euro
d. 18 Euro
e. 400 Euro

Multiple-choice questions GKT, German

GKT-Items

Wo fand das Verbrechen statt?

a. Auf der Toilette
b. Draußen
c. Im Büro
d. In der Cafeteria
e. Im Computerraum

Welche Farbe hatte der Umschlag, der entwendet wurde?

a. Grün
b. Braun
c. Rot
d. Blau
e. Gelb

Wo war der Umschlag platziert, bevor er entwendet wurde?

a. Auf einem Stuhl
b. In einem Regal
c. Auf einer Fensterbank
d. Außerhalb des Raums
e. Auf einem Tisch

Was genau wurde vom Tatort entwendet?

a. Ein iPad
b. Geld
c. Schmuck
d. Ein Schlüssel
e. Ein Handy

Welche Nummer hatte das Schließfach, in das der Gegenstand gelegt wurde?

a. 11
b. 43
c. X
d. 32
e. 46

Welche Geldsumme wurde vom Tatort entwendet?

a. 100 Euro
b. 50 Euro
c. 200 Euro
d. 18 Euro
e. 400 Euro


NO LIE CAN LIVE FOREVER
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