

## A Review on the Suspect Detection System – A Forensic Screening Tool

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### ABSTRACT

The fascination for understanding and deciphering human nature is not a new found fad. From witnessing the adoption of primitive methods to detect deceitful behaviour to the evolution of technology used for it, the human race has come a long way. This paper describes one such technological advancement in the field of deception detection called the Suspect Detection System (SDS) that uses the Cogito technology, henceforth called the Cogito SDS. This forensic investigative tool applies the Electrodermal Activity (EDA), also known as the Galvanic Skin Response (GSR) – a psychophysiological measurement of the sympathetic nervous to detect deception. This forensic tool applies the process and technique of questioning called the Guilty Knowledge Test (GKT), now known as the Concealed Information Test (CIT). The application of the CIT implies that the examination focuses on eliciting any concealed information that an individual taking the test may possess but may assumably be suppressing the awareness of that knowledge. This hidden knowledge is related to the cause or case for which the individual is examined and could include facts about any person, place, or incident in question. The focus of the technology is on detecting hostile or malicious intent as opposed to detecting the means. Thus, it provides a kind of predictive analysis of an individual's behaviour. This makes the Cogito SDS technology useful in cases of terrorism, human and drug trafficking, illegal immigration, homicide and fraud, effective. Notwithstanding, the use of the Cogito SDS presents its challenges in the detection of deception and forensic investigations.

**Keywords:** *Cogito Suspect Detection System, Screening, Hostile Intent, Psychophysiology, Electrodermal Activity, Concealed Information Test, Forensic*

If there is one piece of information considered most valuable to the forensic and investigative community, it is concealed information. Its importance however, is inversely proportionate to its accessibility (Twyman, et al., 2017). In fact, success in

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concealing information provides an individual with the impetus to carry out unlawful acts such as fraud and terrorism. Concealed information is a problem of deception which can be carried out by a deceiver through “misdirection, omission, fabrication, or another deception tactic” (p. 4). In such cases, the observation of physiological changes plays a significant role in detecting probable deceptive behaviour or hostile intent (Davis, et al., 2013). Through their study on the two biosignals of blood volume pulse and electrodermal activity, Alves et al. (2013) surmised that changes in skin conductance (mostly perspiration) can be considered as an effective index of arousal or stimulation. This is because they are directly related to changes in emotions, and therefore more likely to be associated with an untruth. The overview on the EDA by Dawson, Schell, and Filion, (2000) reiterated the psychological importance of the electrodermal activity that was seen in its connections with “emotion, arousal, and attention” (p. 201). The Cogito SDS has its roots in polygraph testing and security related interrogation techniques. The fundamental principle on which the polygraph works to detect deception is the psychophysiological construct. Therefore, the different techniques of the polygraph generally depend on the psychological parameters that are generated out of the physiological changes. Examples of the psychological constructs include the “fear of detection, enhanced attention, information processing, orienting reflexes, conflict and arousal” (Raskin and Kircher, 2014 citing Podlesny, Raskin, 1977 and Raskin, 1979).

The origin of the Suspect Detection System (SDS) dates back to 2004 Israel when Suspect Detection Systems Ltd. having compiled years of voluminous data and intelligence in airport security created a system that focused on preventing crimes and terrorism by detecting hostile motives. The Cogito SDS technology as an interrogation and screening system has the ability to identify and establish a “potential suspect” who may harbour an intention of committing a crime or has already committed it (PRNewswire, 2013). The detection of deceptive individuals, or ‘suspects’ is determined by placing the hand in a sensor that reads the physiological activity to measure the knowledge of any hidden information (Vaya, Wagh, & Kumar, 2010).

### ***System Components***

The Cogito SDS includes a suitcase that holds a laptop (with an in-built web camera), headphones, fingerprint recorder and a palm sensor cradle that detects the psychophysiological reaction. The left hand is placed securely in the ergonomic palm sensor which provides the biofeedback. The power panel is located on the bottom right side of the system (Suspect Detection System, 2021). The software components of the system include the in-built software that is responsible for the analysis of the skin conductance and the generation of the results of the test. Questions are presented to an examinee in both audio and visual format in the screen. The Cogito technology is an automated decision making system where in it “does not require any other external device or tool for analysis” (Vaya, et al., 2010, p. 106). It collects and analyses the psychophysiological signal, cross-references these markers with additional objective information and finally identifies and isolates those that it detects as suspects (having malicious intent). Another version of the Cogito SDS is kiosk based. The kiosk contains two industrial personal computers, a touch screen display, a noise cancellation headset, a microphone, a bar-code reader, a galvanic skin response sensor built into an ergonomic palm case, a video camera, and a seat for the examinee. It has an administration station that is used to monitor the kiosk.

## **WORKING PRINCIPLE AND PROCEDURE**

### ***Psychophysiological Detection of Deception***

The Cogito SDS functions on the principle of psychophysiology. The technology uses the concept of stimulated psychophysical reaction (SPRR) which is based on stimulating examinees with specific crime-related triggers. When an individual perceives and experiences danger, there is an intrinsic bodily need to respond; this how the body gets “ready” (Spierer, Griffiths, and Sterland, 2010) and this forms the basis of the Cogito SDS. An individual who is made to take the examination on the Cogito SDS is assumedly suspected of perfidious intentions, and if it is so, then it is expected that the individual will experience certain emotions particularly when faced with trigger “crime-related triggers”. The system posits that these crime-related triggers expressed through specific words or questions will elicit a SPRR in a guilty individual. This reaction will be distinctly different from that of an innocent individual (Suspect Detection System, 2021). The focus of the Cogito System is thus on preventive forensics. It preempts and prevents the execution of an adverse act or event by detecting the intention in an individual to commit such an act.

### ***Electrodermal Activity (EDA)***

The Electrodermal Activity (EDA) is considered as an effective parameter of psychophysiology to determine the difference between truth tellers and deceivers while they answer test questions (Widacki, 2015). In fact, Slowik and Buckley (1975) and Widacki (1977) (as cited by Widacki, 2015) affirmed that the galvanic skin response does indeed play a significant role in the detection of deception as seen in studies and experiments involving mock crime scenes enacted by students in laboratory settings. The EDA is characterized by its distinct sensitivity to any matter subject to an individual. This feature makes the EDA work as “physiological windows of brain activity” (Sequeira, Deren, and Maitte, 2021, p. 407).

### ***Intent versus Means***

The Cogito SDS technology concentrates on looking for antagonistic motives in individuals. It does not focus on discovering the physical means or tools (weapons or explosives) on a person who might have an intention to cause harm. In other words, the Cogito SDS is concerned with whether an individual has any pernicious design so that it can avert the actualization of such a plan. What means are being used to achieve this is secondary that can be, and is, established later during probing and further questioning. The concept of ‘Intent versus Means’ in the Cogito SDS was highlighted in several terror attacks. Not every criminal or terrorist will move about with weapons on their person but they can certainly harbour criminal thoughts and intent (Suspect Detection System, 2021). When there is an intention in the mind of an individual to carry out a task, it will guide the individual to achieve that goal (Malle & Knobe, 1997, Gollwitzer, 1999 cited in Djeriouat, et. al., 2021). Intent is what guides and determines the different behaviour detection programs at various airports because the objective of such programs is to prevent all kinds of terror attacks or felonious acts. This is achieved by identifying the different markers that indicate anticipated “pre-attack or pre-assault”. (Djeriouat, et. al., 2021 citing the National Commission on Terrorist Attacks Upon the United States, 2004). These indicators emphasize the significance of the concept of intention.

### ***Test and Questionnaire Structure***

A study by the Transportation Security Administration in an airport in Tennessee, USA (Warren and Graham, 2006) involved two groups of participants – one group comprised of 126 ‘innocent’ non-travelling visitors to the airport and the other comprised of 33 ‘guilty’

## A Review on the Suspect Detection System – A Forensic Screening Tool

law enforcement personnel (off-duty) as the participants. The aim was to detect the knowledge of the malicious intent that the guilty group possessed. The latter group was given incorrect information about testing activities and was required to complete an act that could make them appear “suspicious”. This involved the confidential task of bringing in IED components through the security checkpoints of the airport, leaving it behind at a pre-decided location and exiting the premises. The plan was changed midway and they did not need to follow through. The seed of malicious intent was thus planted. The two groups without any prior familiarity with the Cogito Suspect Detection System underwent the test. The examinees verbally answered the questions that visually appeared on the screen before them and via the headphones with a ‘Yes’ or ‘No’. While the system identified 66.7% of the guilty suspects as ‘guilty’, 24.6% innocent examinees were also identified as guilty. On the other hand, 75.4% innocent examinees were ascertained as innocent and 33.3% of the guilty suspects were recognized as innocent. Today the system produces as low as 4% false-positive results (Suspect Detection System, 2021). In their simulated experiments using the SDS, Wagh and Vaya (2009) (as cited in Vaya, et al., 2010) saw about 95% accuracy rate in detecting ‘suspects’ and ‘non-suspects’.

There are six sets of questionnaires used in the Cogito SDS for each screening test although only four sets are initially administered. Each set comprises of six questions. There is only one relevant stimulus in every set. The rest of the questions are non-relevant (or control questions) and do not expect to elicit a strong psychophysiological reaction. The non-relevant questions are intended to create a baseline for the examinee’s responses. The sensors of the palm case monitor the SPRR responses to the questions asked. Of particular focus is to follow the difference in the responses to the ‘relevant’ and ‘non-relevant’ questions. However, the Cogito SDS does not solely depend on verbal responses so even when a suspect does not answer a question the system reads a response through the GSR (Vaya et al., 2010). The system adopts two kinds of questionnaires that fulfill two different aims – first is the screening questionnaire that aims to screen and identify a “suspect” from a pool of examinees; second is the investigation questionnaire that is used for probing and in-depth examination of a “Suspect” in relation to the case being investigated. If the initial test identifies the examinee as a ‘suspect’, the system automatically continues with another two sets that follow the same pattern of one relevant and five non-relevant questions. If not, the test concludes after the first four sets of questions declaring the examinee as “Non-suspect”. In the event that an examinee’s result depicts ‘Suspect’ in both the questionnaires, the system will confirm the status as “Suspect”. The test is completed within five to six minutes (Suspect Detection System, 2021).

### ***Basis of questioning technique - the Guilty Knowledge Test***

The Cogito SDS uses the concept of the Guilty Knowledge Test in its questioning technique to detect deception or more precisely, to detect ‘guilty knowledge’. More recently called the Concealed Information Test (CIT) by Verschuere, Ben-Shakhar, and Meijer (2011), it is a part of the technique that is used in the psychophysiological detection of deception (PDD) (Krapohl et al, 2009) for polygraph examinations. The Guilty Knowledge Test (GKT) comprises of a series of questions, the response of which elicits a measure of “some involuntary physiological response (e.g., GSR) to stimuli” that is connected to the memory of the details of an individual’s crime (Lykken, 1959, p. 385; 1960). In the early twentieth century, when the Polygraph was introduced as an instrument that detects deception it was based on the proposition that a person who is deceptive will have physiological responses (Vrij, 2008 as cited by Denault and Jupe, n.d.). These responses work as the ‘give-aways’. These ‘give-aways’ through the electrodermal activity of the Cogito SDS help detect the

## **A Review on the Suspect Detection System – A Forensic Screening Tool**

presence of concealed ill-intentions in suspects. The CIT works on the assumption that it can identify the difference between suspects who have knowledge and those who do not, based on the absence of information regarding a critical incident or experience (Geven, Ben-Shakhar, Kindt, and Verschuere, 2019). The crime details, it will be recalled are those that are known only to the perpetrator and the police and to any innocent suspect (Meijer, Verschuere, & Merckelbach, 2010). The key item must have the quality of exclusivity to the perpetrator, be something that he/she might have paid attention to, and be easily recalled by the perpetrator. In the case of an innocent suspect the credibility of the control items must be similar to that of the key item. In the arrangement of items, the control items are always the first items in a sequence followed by the relevant item placed in any arbitrary position of the sequence.

### ***Result analysis***

It will be recalled that the Cogito SDS has its roots in the polygraph. The system analyzes the EDA output using algorithms similar to how a polygraph expert analyzes the polygraph graphs. There are four basic algorithms that analyze 14 different parameters. The final decision given by the system is based on analyzing and weighing the strongest reactions to the stimulus (relevant questions), the validity of each reaction and comparing all the reactions of all the stimuli. The final judgment is then given as ‘Suspect’ or ‘Non-Suspect’.

### ***The Cogito SDS as A Forensic Screening Tool – Its Applications and Limitations***

The Cogito SDS was developed after the September 2001 terrorist attacks. The central idea behind this creation was to prevent terrorist activities by detecting the intention of committing the act.

### ***The applications of the Cogito SDS***

The use of the Cogito SDS technology is seen extensively in “homeland security, military intelligence and law enforcement” (Suspect Detection Systems, Inc. SDSS, 2021, para.1). Given that this technology works on the concept of preemption, its application in “counter terrorism and crime prevention behavior pattern recognition technologies” (AI driven insider threat detection, n.d., para. 1) and therefore, in the detection of suspicious or malicious intent particularly at borders, checkpoints and crimes scenes makes it a useful forensic screening tool. The technology of the Cogito SDS has been adopted by law enforcement agencies and others in more than a dozen countries mostly in the prevention of crime and detection of terrorist activities. Its applicability has also been seen in ascertaining “insider threat” and “loss prevention mitigation” when conducting this test in the pre-employment and post-employment stages (AI driven insider threat detection, n.d., para. 1).

In their experimental study, Vaya et al. found a 95% accuracy rate in the detection of hostile intent. They also highlighted the time-saving element of the tool as the test is completed within 4 – 6 minutes (Warren and Graham, 2006).

Notwithstanding, the Cogito SDS technology presents a few challenges in its use and applicability. Research studies on the use of the technology are not many and that is one of the major limitations. The other challenges are discussed in the following section.

### ***The limitations of the Cogito SDS***

The Cogito SDS is solely dependent on one psychophysiological measurement to detect deceptive thought and behaviour – the EDA. As such it narrows the interpretation of the responses. This was also stated by the Transportation Security Administration team of the

## A Review on the Suspect Detection System – A Forensic Screening Tool

aforementioned study as a consideration (Warren and Graham, 2006). Another concern involves the lack of studies that corroborate the assumption that a terrorist will manifest a heightened emotion (here, anxiousness) as compared to an innocent traveler. On the contrary, law enforcement agencies at Israel found that for a typical suicide bomber, stress and nervousness is not easily detected as they are extremely focused in their missions and are almost impassive (AI driven insider threat detection, n.d.).

Another consideration is in the use of the CIT or the GKT in the PDD. In their paper Matsuda et al. (2012) suggested that one of the ways to improve the “probative force of the CIT in court” was to add on novel measures to the existing field of CIT to “increase its accuracy” (p.3). They lay emphasis on the combination of new measures of psychophysiology with the conventional autonomic systems. While this sounds plausible, it might defeat the essence of what the Cogito SDS actually stands for. Ben-Shakhar (2012) while highlighting the importance of the CIT brought to the forefront the constraints of the CIT in its application in investigative tools. One of the biggest challenges faced by the Cogito SDS is “dealing with countermeasures” (p. 8). Mental countermeasures are considered to be the most harmful because even examiners fail to detect them.

Leakage of information is typically seen in the CIT. Leakage is a problematic phenomenon whereby innocent individuals questioned as suspects have access to crucial information about a case under investigation (Sergiou, 2016). The availability of such information is usually made possible through media sources, exposure to certain information while being questioned, and even hearsay (Geven, et al. 2021). This might lead to a resultant false – positive conclusion as an innocent suspect may thus have knowledge of a ‘guilty’ act or event even without being involved in it any way. One of the ways to counteract the effects of leakage might be to probe for details and exemplar-level information (Osugi, 2011 as cited in Geven, et al., 2021). Ben-Shakhar, Gronau, and Elaad (1999) also suggested verifying suspects’ justification of the awareness of such knowledge as a means to counter the issue. Unfortunately, it may not always be possible for a suspect to provide an explanation of the awareness of critical intelligence if the information is provided to the suspect by the interviewing or interrogating personnel during the course of the investigation.

Experimental studies in laboratories prefer to use the non-dominant hand for EDA measurements. This could be attributed to the observation that the non-dominant hand is comparatively less prone to injuries such as cuts or hardening of skin due to frequent use. Additionally, it also ensures that the dominant hand is free and available to carry out any task (Dawson, Schell, and Filion, 2000). The palm sensor cradle of Cogito SDS machine requires the left hand of an individual to be placed in it. It therefore assumes that the left hand is the non-dominant hand which may be true for most people. However, for individuals whose dominant hand is the left, the arrangement could appear inconvenient.

### ***Legal implications of the use of the Cogito SDS– the scenario in India***

Legally, the current status of the admissibility of lie detection test results in the courts of India is only as circumstantial or corroborative evidence (Goswami and Goswami, 2021) and this includes the Cogito SDS as well. Iyengar (2011) in his *Limits to Privacy* highlighted the legal sanctions of lie detector tests in the courts of India. The Cogito SDS is non-invasive in nature and its risk for impinging on human rights. However, the Supreme Court stated that even if a test may be non-invasive the “consequences for the individuals” that undergo the tests must be taken into consideration. The mental health and “mental privacy”

## A Review on the Suspect Detection System – A Forensic Screening Tool

of an individual (familiar with the details of crime) may be negatively affected by the conclusions drawn after a test (p. 28).

In India, a few forensic science laboratories and law enforcement agencies use the Cogito SDS for investigative purposes. Presently the use of the technology in the country is limited and research on it is sparse. It is also mostly used in collaboration with the other forensic tools like the Polygraph.

### ***Concluding remark – recommendations and implications for the future***

The use of technology in the field of forensics and the criminal justice system has helped improve our understanding of criminal behaviour and the varied nature of crime. The Cogito SDS is one such technology that works on detecting the intentions of committing a crime before it can take place. This process of first identifying hostile intent and then probing further for details of the crime (like weapons) has helped numerous agencies in preventing terror attacks. The Cogito SDS already works on detecting insider threat from employees within an organization. As a screening tool to detect any ill-intention, it can be utilized by recruitment agencies and employers to screen candidates for any mala fide motives of joining the workplace. Post-employment checks can be made for any threat that the organization might encounter in the form of (data/information) theft and loss.

The limited research done on this technology prevents its application in many instances. To fully comprehend and make use of its advantages would require more studies focusing on both its strengths and limitations. Experimenting with different questioning techniques can be explored. Would the effect of tone of voice, rate of speech and accent in the audibly presented questions affect the outcome of the test? Would the use of visual images, not just the written questions on the screen impact the test results? Would occupational type make a difference in the final decision given by the system? These are some probable topics that can be explored and researched into.

The Cogito SDS technology might appear to be in its nascent stage now as far as awareness about its applicability and credibility is concerned. More research and future studies may encourage its usage and practice in the field of forensics and investigation.

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### **Conflict of Interest**

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