THE IMPLEMENTAT ON AND STUDY OF NEW TECHNOLOGIES IN THE DETECTION AND PREVENTION OF CRIME.

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Polygraphy and other lie-detection technologies in the world of crime Tashkent International University Faculty of Law, 2nd-year student

Abstract: *The rapid development of modern technologies has significantly influenced many areas of society, including the field of criminal justice. In recent years, new technological tools have been introduced to assist in the detection, investigation, and prevention of criminal activities. Among these innovations, polygraph systems and other lie-detection technologies have gained particular attention due to their potential role in identifying deceptive behavior during investigations. These technologies rely on various physiological, psychological, and behavioral indicators such as facial muscle movements, brain activity, eye movements, and voice patterns. This article highlights the importance of these technologies, their role in the modern world, and presents various experiments related to their application.*

Key words: *crime detection, lie detection technology, polygraph, criminal investigation, facial analysis, MRI brain scanning, eye-tracking technology, law enforcement technology*

INTRODUCTION

A polygraph, often incorrectly referred to as a lie detector test, is a pseudoscientific[4][5][6] device or procedure that measures and records several physiological indicators such as blood pressure, pulse, respiration, and skin conductivity while a person is asked and answers a series of questions. The belief underpinning the use of the polygraph is that deceptive answers will produce physiological responses that can be differentiated from those associated with non-deceptive answers; however, there are no specific physiological reactions associated with lying, making it difficult to identify factors that separate those who are lying from those who are telling the truth.

In some countries, polygraphs are used as an interrogation tool with criminal suspects or candidates for sensitive public or private sector employment. Some United States law enforcement and federal government agencies, as well as many police departments, use polygraph examinations to interrogate suspects and screen new employees. Within the US federal government, a polygraph examination is also referred to as a psychophysiological detection of deception examination.

Assessments of polygraphy by scientific and government bodies generally suggest that polygraphs are highly inaccurate, may easily be defeated by countermeasures, and are an imperfect or invalid means of assessing truthfulness. A comprehensive 2003 review by the National Academy of Sciences of existing research concluded that there was "little basis for the expectation that a polygraph test could have extremely high accuracy", While the American Psychological Association has stated that "most psychologists agree that there is little evidence that polygraph tests can accurately detect lies." For this reason, the use of polygraphs to detect lies is considered a form of either pseudoscience or junk science

Body 1

Emerging Technologies for Lie Detection and Their Applications in Law

In recent years, technological advances have introduced several novel methods for detecting deception, many of which are being explored for potential use in legal contexts. These approaches range from brain activity monitoring to AI-driven analysis of speech and behavior, offering a more nuanced understanding of how deception manifests physiologically and cognitively.

1. Functional Near-Infrared Spectroscopy (fNIRS).

Developed in the mid-2000s and reaching technological maturity in the 2010s, fNIRS is a portable brain imaging method that measures blood oxygenation in the cortex. Unlike fMRI, it is cost-effective and practical for use outside research labs. By monitoring the prefrontal cortex — the region linked to executive control and decision-making — fNIRS can detect increased metabolic activity associated with deceptive responses.

Legal applications: While largely experimental, fNIRS has been tested in investigative settings to support interrogations. However, it is not yet widely admissible in court.

Usage: Participants wear a sensor cap, respond to questions, and researchers compare brain activity patterns during truthful and deceptive answers.

2. Brain Fingerprinting.

Brain fingerprinting, developed in the 1990s by Dr. Lawrence Farwell (Neurotechnologies Inc.), uses EEG to identify recognition of crime-related information in the brain. It measures P300 responses, which occur when a person recognizes information they should not normally know.

Legal applications: Brain fingerprinting has been used to support investigations but is not legally binding on its own. Admissibility varies by jurisdiction.

Usage: Subjects are presented with stimuli related to a crime, EEG responses are recorded, and recognition patterns indicate prior knowledge consistent with involvement.

3. Eye Tracking and Pupillometry.

Eye-tracking technologies, researched since the 1970s and applied to deception since the early 2000s, monitor pupil dilation, blink rate, and fixation patterns. Deceptive responses often increase cognitive load, which produces measurable ocular changes.

Legal applications: Eye tracking is primarily a supportive tool in interviews and interrogations, not a standalone method for detecting lies.

Usage: Analysts track eye movements during questioning and compare results to baseline readings.

4. Thermal Imaging (Infrared Facial Thermography).

From the 2000s onward, thermal imaging has been explored for detecting deception by analyzing facial temperature changes, particularly around the eyes and nose. Stress and lying can increase facial blood flow, producing detectable heat patterns.

Legal applications: Thermal imaging has been used for airport screenings and pre-interview assessments. It is often more reliable than polygraphs in certain contexts but remains largely inadmissible in mainstream courts.

Usage: Infrared cameras capture facial temperature changes during questioning, helping analysts identify stress-related cues.

5. AI-Driven Statement Analysis (NLP + Machine Learning).

Since the 2010s, AI and natural language processing have enabled the analysis of speech and text for patterns indicative of deception, including linguistic inconsistencies, pauses, and cognitive load indicators.

Legal applications: Frequently applied in law enforcement and corporate investigations, these tools serve as analytical aids, not definitive evidence.

Usage: Transcripts of interviews or written statements are processed through NLP algorithms to highlight suspicious patterns for investigators.

6. Voice Stress Analysis (VSA) Using AI.

Next-generation VSA technologies, developed from the early 2010s, measure microtremors in voice frequency, modulation patterns, and emotional markers. AI algorithms enhance the detection of stress associated with deception.

Legal applications: VSA is used in interviews and call center monitoring but is rarely accepted as independent proof in court.

Usage: Voice recordings are analyzed over time to detect stress patterns linked to potentially deceptive responses.

7. Polygraph Evolution with AI Assistance.

The traditional polygraph, originating in the 1920s, has evolved with AI integration since the 2010s. It still measures heart rate, respiratory rate, and skin conductance, but AI helps reduce false positives by analyzing physiological data more comprehensively.

Legal applications: Polygraphs remain controversial and are not admissible in many jurisdictions. They are primarily used as investigative support rather than definitive evidence.

8. Multi-Modal Fusion Systems.

Emerging in the late 2010s–2020s, multi-modal fusion systems combine multiple signals, such as thermal imaging, eye tracking, voice analysis, and NLP outputs, to improve the reliability of lie detection. AI algorithms integrate these diverse inputs to generate a probability of deception.

Legal applications: These systems are mostly in research or pilot phases, with some use in national security screening.

Usage: Collect physiological, cognitive, and behavioral data, feed it into an AI classifier, and generate a likelihood score for deception.

9. Emerging Ethical and Legal Considerations.

Despite rapid technological advances, most lie detection methods are not yet admissible as standalone evidence in court due to scientific limitations. For example, fMRI-based deception tests have been rejected in some legal cases, and EEG-based methods remain largely supportive rather than definitive.

The more recently developed physiological measures considered to have potential for lie detection are Electroencephalography (EEG) and Functional Magnetic Resonance

Imaging (fMRI). Both are established medical technologies developed and widely used for the assessment of brain activity.

Body 2

31 January 2022 BBC presented information about new technologies for detecting lies and the experiments conducted. We will now learn about these experiments through the insights of Natalie Lisbon.

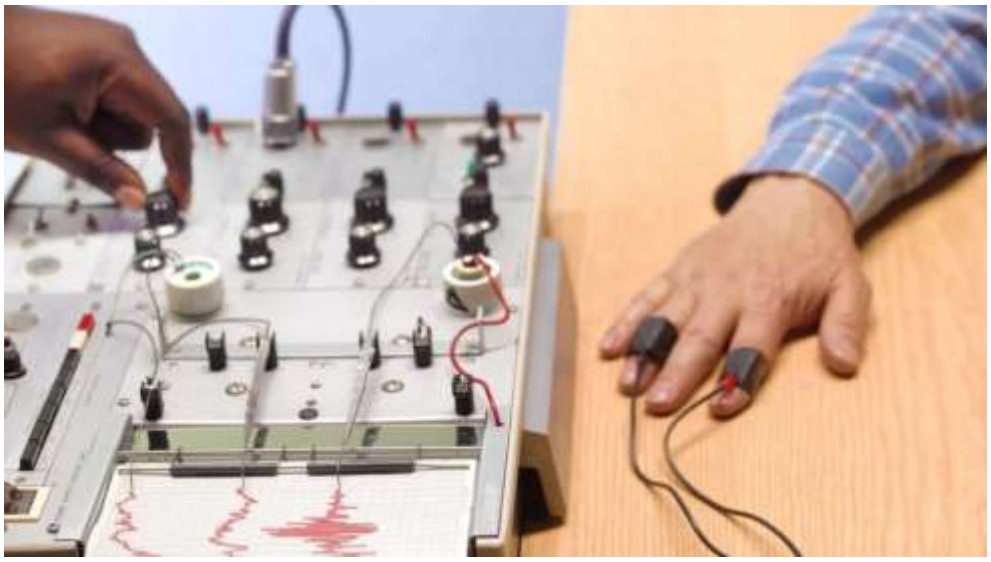
Prof Yael Hanein prepares reporter Natalie Lisbona for her lie detection test:

Prof Yael Hanein sticks a number of electrodes to the left side of my face."Move your eyes, blink, smile. Now try to relax," she says. "We will see if you are a good or bad liar shortly.".

Prof Hanein and colleague Prof Dino Levy lead a team at Israel's Tel Aviv University that have developed a new method of lie detection.

They say they have identified two types of liars - those who involuntarily move their eyebrows when they tell a fib, and those that cannot control a very slight lip movement where their lips meet their cheeks. Their software and its algorithm can now detect 73% of lies and they intend to improve that as they develop the system. "When you try to conceal a lie, one of the things you try to avoid is any sort of body reaction," she says.

In another experiments, we can also see that they all requires physical contact with the sucject. Prof Levy adds: "But it's very, very hard for you to conceal a lie with this technology."



This is most people's idea of a lie detection machine - the analogue polygraph

Methods of lie detection have probably been around for as long as tall tales have been told. One of the first documented examples comes from 1000BC in China, where a suspect would have to fill his or her mouth with dry rice.

After a period of time the grains would be checked, and if they remained dry then the person was determined to be guilty. The theory was that if the individual had indeed lied he or she would be fearful or nervous, and therefore have a dry mouth.

The early 20th Century saw the invention of the first lie detection machines or polygraphs. The most well-known of these is the "analogue polygraph", which typically has three or four ink-filled needles that dance round on a strip of moving paper.

The suspect has sensors attached to their fingers, arms and body and the machine then measures breathing rate, pulse, blood pressure and perspiration as they answer a series of questions.

Yet there are continuing concerns about the accuracy of these machines and whether it is possible to fool them. So researchers and technology firms around the world are working to develop more high-tech polygraph systems.

Dr Sebastian Speer says that using MRI scans he can tell if a person is lying by looking at their brain

At Erasmus University in Rotterdam, Netherlands, Dr Sebastian Speer and his team are using an MRI (magnetic resonance imaging) machine to spot if someone is lying or cheating. They do this by looking out for colour changes in brain scans in response to questions.

"Essentially we see [different] areas [of the brain] that are more strongly activated [light up on the scans] when someone decides to cheat or to be honest," says Dr Speer.

One high-tech lie detection system already in use is EyeDetect from Utah-based firm Converus. This focuses on involuntary eye movements to detect lies.

A subject is asked to answer a number of true or false, or yes and no, questions. As they do so, eye tracking software watches and studies their responses. The result is then provided within five minutes, and it claims to be 86-88% accurate.

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EyeDetect's software is able to work via a laptop camera

Converus (the word is Latin for "with truth") says EyeDetect is now used by more than 600 customers in 50 countries, including over 65 US law enforcement agencies and nearly 100 worldwide.

Chief executive Todd Mickelsen says the test is being utilised by authorities and firms to screen for numerous things: "These could include prior crimes, drug use past or present, unreported disciplinary action, lying on a job application, terrorist ties."

Meanwhile police detectives can use EyeDetect to ask specific questions regarding a crime.

It is important to stress, however, that the legality of lie detectors varies greatly from country to country.

In the UK, polygraphs have been used by the probation service "in the management of people convicted of sexual offences" since 2014. And they are now being trialled regarding

domestic abuse offenders. But the results of polygraph tests cannot be used in criminal cases in the UK's three separate legal systems - England and Wales, Scotland and Northern Ireland. At the same time, UK employers are allowed to offer a lie detection test to staff, but this has to be optional.

In the US, the rules differ from state to state, with the further complication of US-wide federal law on top.For instance, California allows lie detection test evidence in state-level criminal court cases if both sides agree, yet in New York state it is not allowed under any circumstances. And US police forces cannot require that a suspect or arrested person undergoes a test. Meanwhile, The Federal Employee Polygraph Protection Act prevents firms from putting job applications through a test.

Christopher Burgess cautions that lie detection machines are not fool-proof.

Former CIA officer Christopher Burgess cautions that lie detectors should not be been seen as the be-all and end-all for proving the guilt or innocence of criminals - or spies.

"It's one tool used during the interrogation phase of an investigation," he says. "Evidence is how liars, scoundrels, cheats and fabricators are sussed out." Mr Burgess, who is now a security analyst, adds that the devices are not completely accurate, and says that he himself was once wrongly implicated by a false test result back in the mid 1990s. As more high-tech lie detection systems enter use, he says there remain "ethical and moral questions".

Back at Tel Aviv University, the researchers hope that the electrodes will eventually be replaced by video cameras and software able to spot a liar from a distance or even via an internet link, based on facial muscle movements.

Reporter Natalie Lisbona with electrodes - researchers hope to eventually replace these with video cameras and software.

"In the bank, in police interrogations, at the airport or online job interviews, high-resolution cameras trained to identify movements of facial muscles will be able to tell truthful statements from lies," Prof Levy predicts. After my interrogation I ask if I have passed. "You're not a very good liar," the two professors jest.

Conclusion

In conclusion, the rapid development of modern lie detection technologies demonstrates how science and innovation can assist humans in solving complex problems, particularly in the field of criminal investigation. The studies and experiments discussed in this research show that technologies such as facial muscle analysis, MRI brain scans, eye-tracking systems, and advanced polygraph methods are gradually improving the ability to identify deceptive behavior. These tools are designed not only to support investigators but also to make investigative processes more efficient and accurate.

Many of the recent experiments have produced promising results, showing relatively high levels of accuracy in detecting deception. As technology continues to evolve, these systems are expected to become even more reliable and accessible in various fields, including law enforcement, security screening, and employment verification. In this way, technological innovation contributes to preventing crimes and strengthening public safety.

However, it is important to note that lie detection technologies are not considered perfectly reliable. Specialists and investigators do not rely solely on the results produced by these systems. Instead, the outcomes are carefully examined and compared with other evidence before any conclusions are drawn. Legal professionals understand that technological indicators must be supported by thorough investigation and factual proof.

Although these technologies may not provide absolute answers to every case or solve all investigative challenges, they still represent a valuable and effective tool for reducing risks, detecting suspicious behavior, and preventing harmful actions.

Ultimately, the goal of these innovations is to serve society by supporting justice, improving investigative methods, and helping authorities respond more effectively to potential threats.

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