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Exploring the role of forensic science in modern law enforcement: Challenges and opportunities

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Abstract

The evolving landscape of law enforcement demands a proactive approach to crime investigation, necessitating the integration of modern scientific techniques into traditional practices. This paper explores the intersection of law and technology, focusing on the utilization of forensic science and advanced investigative methods in contemporary policing. Beginning with an overview of the dynamic nature of law and society, it delves into the historical evolution of scientific investigation, highlighting milestones and pivotal moments that shaped its trajectory. Emphasis is placed on modern forensic techniques such as bloodstain pattern analysis, crime scene investigation, digital evidence analysis, and deception detection tests like narco-analysis, polygraph, and brain mapping. Additionally, the paper addresses the legal and ethical implications surrounding the use of these methods, including issues related to privacy, self-incrimination, and international human rights standards. Through a comprehensive examination of both the benefits and challenges associated with the adoption of scientific techniques in criminal investigations, this research aims to inform policymakers, law enforcement agencies, and legal scholars about the potential for enhancing justice delivery in the digital age.

Keywords: Bloodstain pattern analysis, digital evidence, narco-analysis, polygraph, brain mapping

Introduction

We know that law is dynamic and not static. Society is changing according to its necessary. According to by Jeremy Bentham —Law is the instrument of societal change and the judiciary has power to interpreting the law for the greater good. Law gives to society those provisions which are suitable in all situations. Nathuni Yadav v. State of Bihar Supreme Court held that —To combat organised crime, its detection, investigation and prevention method have to be employed synchronously. In the modern era criminals are using modern technology during the commission of crime. If police wants to arrest these criminals, they have to use also modern technology during investigation of crime, otherwise police cannot detect or investigate the crime properly. Krishna Iyyer J. Remarked, —the courts self-criminate themselves if they keep the gates partly open for culprit to flee the justice under the guise of interpretative enlargement of golden rule of criminal jurisprudence.

In the present era scientific technology should be used by Police Officer in the investigation method. Because we know that criminals use very new technology. Traditional crimes almost end. In the welfare States police needs use scientific or new methods in the investigation of crime. Modern methods such as Polygraph, Brain Mapping and narco-analysis test are available.

History of Scientific Investigation

The idea of scientific investigation is certainly not a nascent one. In ancient times medicinal supposition was habitually connected to the prerequisites of the Law. Sir William Herchel was the first advocate who supported the fingerprint in the trial. Argentina was the first court who recognized the proof of finger impression during trial in 1890s. After then English court also considered finger print during trial in 1902. Legal science is very useful in the investigation. Criminology science in this day is a progressed logical method which utilized in criminal examinations. It is fit to respond to essential inquiries and structures as an incorporated piece of criminal justice system. It incorporates all notable systems, for example, finger impression examination, DNA investigation, ballistic, guns or on the other hand unstable culture and so forth. It convicts those blameworthy of wrongdoing as well can excuse the innocent one. In 19th century scientific investigation was used by developed countries.

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But now every country knows about scientific investigation. They prefer for using of scientific investigation to detect the criminals. But in developing countries there was no new technology available therefore they have to go on old methods of investigation.

First we should know that which types of method used by the Police Officer. But we know that our chapter deals with use of modern techniques in investigation. Our studies will emphasis on modern techniques (Forensic science), so we will discuss Forensic techniques in detail and other techniques will discuss in brief.

Some Methods Is Used By Police In The Investigation Procedure

Bloodstain Pattern Analysis

BPA is the interpretation of bloodstains which has collected from the crime scene. In this usually Analyst check about the biology (behavior of blood), Physics (cohesion and velocity of blood) and mathematics (such as distance geometry and angle of blood) of blood. Mainly Analyst find the answer of followings questions:-

1. Where did the blood come from?
2. What caused the wounds?
3. From what direction was the victim wounded?
4. How were the victim(s) and perpetrator(s) positioned?
5. What movements were made after the bloodshed?
6. How many potential perpetrators were present?
7. Does the bloodstain evidence support or refute witness statements?]

Crime Scene Investigation

In this method, Police Officer goes to place where crime was happened. He goes there for collecting physical evidence from a incident place. Generally Police collects blood, hairs, tissues, fingerprints, foot prints, tire track evidence, trace evidence i.e soils vegetation, cell phones and other evidence from the occurrence spot. These evidences help in the investigation of some crime like burglaries, violent crimes, suicides, fires, auto thefts, auto accidents. Police Officer also takes statement from the witnesses which are present on the incident place.

Crime Scene Photography

In this method photographer takes some photo from that place where incident occurred. Photograph of the scene used as a document of physical evidence it helps in some crime like traffic collisions, burglaries, homicides, or any number of crimes against people or property. These photograph helps in the evaluate conditions, also helps for how to commit crime on this place.

Digital Evidence

In this method some equipment comes in this purview that is computer and mobile. Digital devices are everywhere present in the world. In the modern era everybody use these digital devices. Computers, cell phones and the Internet come in this category. Criminals also use these types of devices in the crime. Whatapps messages, online transactions, digital images, emails, text messages and internet histories are come under the ambit of digital evidence. If we see now a day's mostly criminals are traced by mobiles. Mobiles also help to disclose the location of the person. If the location of cell phone is present on the incident place then it is easily for the police officer for getting information from that person whose

mobile was present on the incident place. Lastly we can conclude that this method is also very useful for disclosing the crime, how it happened and who committed this crime.

Footwear and Tire Track Examination

We know that everybody wears the shoes and uses the vehicle. Criminals also use vehicles in the committing of crime. The footwear and tire track impressions are unique. Therefore, analyst knows that every company designs their own symbol. So first analyst want to know of any footwear is related to which company. Then proceed in this way that by whom used this footwear and this vehicle, which is used in the committing crime. The fundamental theory behind footwear and tire track may leave behind either prints (referred to as "imprints") or impressions; these impressions are examined by investigators.

Trace Evidence

When any crime is occurred, accused generally left some things like hairs, as hairs, fibers from clothing or carpeting, or pieces of glass. These hairs, fibers from clothing or carpeting, or pieces of glass, which are very helpful for telling the story of what happened. These are related to as trace evidence. Suppose if any two vehicles collided with other. Paint may transfer from one vehicle to another. Forensic experts assist the I.O in the investigation. Investigation officer collected material from the occurrence place. After collecting material, he makes sample or seals it and send to forensic lab. After consider of results of sample I.O can proceed his investigation in proper way. Microscopy and chemical analysis help in the trace evidence.

Narco-Analysis Test

The term _Narco 'had come from the Greek word _Narkc'. Narkc means _anesthesia or torpor'. These type of drugs is used for anesthesia. Firstly Robert House used scopolamine drug on two prisoners for Narco-analysis. Three grams of Sodium Pentothal or Sodium Amytal dissolved in 3000ml used in Narco analysis test. In this test this mixture administered to accused/ suspected person for getting of state of Hypnotism. The dose of above said mixture is based on the sex, age, health and physical condition of person. Generally this test is conducted to get true information of the case. When the narco drug is administered to the accused, he goes in half sleep condition and answers the questions truthfully. The statements of this test are not admissible in evidence. But it helps proceed in the right way of investigation. In this test consent of accused or suspect person is material. Any person cannot put into this test without his consent. Before 20th century scopolamine together with morphine and chloroform used in this type of test. Such a test is generally conducted on an accused that is not ready to give true information. After administering this substance into the accused he interrogated, the statements made by the accused are recorded in the audio form and video form in the cassettes. Narco-Analysis test firstly had used in the veerappan case in india in 2001. NHRC gave some guidelines for the conducting this test. When accused gives consent for conducting this test then investigation officer start proceedings for Narco-Analysis test. However, these guidelines are not mandatory but only recommendatory in nature. Therefore Enforcement machinery does not bind to follow. But Apex Court held that magistrate or Illaka magistrate cannot give order for conducting this test without consent of accused or suspected person.

Polygraph or Lie Detector Test

The word literally meaning of Polygraph is many writings. This test first attempted by Lombroso in 1895. He used this test to trace the truth or fraud. In this test six sensor are attached with person who is giving the statement under this test. The machine which is used in this test has given many signals from the sensors. These signals are recorded on paper.

1. The breathing rate of the person.
2. The pulses of the person.
3. The blood pressure of the person.
4. The perspiration of the person.
5. Arm and leg movement also recorded.

When this test starts first check the consciousness of the person so examiner first asks on three and four question. Afterwards real question asks from the person who is under this test. While doing this test one expert looks the graph of the machine and also considers the breathing rate of the person, the pulses of the person, the blood pressure of the person, the perspiration of the person and also record things like arm and leg movement in sometimes. After wards the expertise examine the report which is obtained after conducting this test, make a report. The scientist named was keeler further developed the polygraph machine by adding a Psycho-galvanometer to record the electrical resistance of the skin.

Procedure for the Polygraph Test

- First Investigating officer asks to the accused or suspected person for conducting this test.
- If accused or suspected wants for conducting this test. He has to give consent for Polygraph test.
- If accused/suspected person does not give consent, investigation officer of the case inform to his superior officer about the consent of accused/suspected person. we can say that I.O of the case must inform to his superior officer about the consent of accused/suspected person in both condition (either condition has given or not).
- I.O of the case has duty to check the consent of accused/suspected person. Consent must be volunteered without any pressure.
- After getting consent of accused or suspected person investigation officer of the case must write an application to the magistrate about the recording of the consent of accused or suspected person.
- Accused/suspected person has right to access his lawyer during test.
- Public prosecutor should inform about status of the statement to the accused or suspected person.
- After recording consent of accused or suspected person, investigation officer should meet the director or any other senior officer of the State FSL and tell about all the facts of the case.
- After knowing the facts of the case experts prepare the question list for the accused or suspected person.
- During polygraph test doctor or lawyer must be present there.
- During test expert recorded the answers of the accused/suspected person.
- After Polygraph test, Investigation officer must inform about the result of Polygraph test to his superior officer.

Brain Mapping Test or P300 Test

Dr. Lawrence A. Farwell was the director and Chief Scientist

of Brain Wave Science (IWOA). He developed this test and patented this test in 1995. Dr. Lawrence A. Farwell was a famous neurologist. This technique is also called as 'Brain wave finger printing'. Dr. Lawrence A. Farwell said about Brain Mapping test or P300 test that:

—In this technique, the suspect is first interviewed and interrogated to find out whether he is concealing any important information, then sensors are attached to the head and the person is made to sit in front of a computer monitor. He is then shown and made to hear certain images and voice. The sensor attached to head monitors and records electrical activity and P300 waves in the brain, which is produced only if the subject has link with stimulus. The subject is not asked any question. To put it simply, it simply means that brain finger printing matches the information stored in the brain with that of the related crime and crime scene. In case of an innocent person no such P300 waves would get registered during the test.

Actually in this test accused interrogated by the expert and ask some regarding to crime. The sensors are attached with his mind and his body. If he gives false information then the brain waves will be different. It is recorded by also expert. Then the forensic expert analysis's the data which is obtained under examination of this test. Afterwards come into the conclusion this is saying true or not.

This technique is first used by Forensic laboratory of Bangalore in India. The scientist of this laboratory conducted this test properly. They also recorded the statement which was giving under this examination. The report send to the court, court considered this report. But said in one case this statement which is obtained under this test shall not be admissible in evidence. The first case named as Selvi Vs Karnataka which is related to narco-analysis and other similar test. In this case Supreme Court gave some guidelines regarding this matter. Before this high court of this case thought that this test is violated the fundamental rights, against substantive due process of law, and against the self incrimination rule. But Supreme Court disagreed these views and the Supreme Court over ruled these judgments in this case. Lastly Supreme Court said that if without consent of accused, the investigation officer sends to the accused for conducting of this test, it will illegal. The test would not be applied in a case where there are doubt these accused were present or not in the committing of crime. This method useful for collecting the information regarding the crime, from this we can obtained the answer of these questions i.e who committed this crime? who assisted for committing the crime? who abetted for committing the crime?, who gave the arms for committing the crime? Etc. The method can only help to get information from their memory of the accused.

Lastly we can conclude that these tests come into same category named as Deception Detecting Test. Because in all these test accused is in semi conscious situation and we can say that statement takes form accused by fraud.

Self-Incrimination

Self-incrimination is the act of exposing oneself (by an oral, written and electronic statement) "to an accusation or charge of crime; to involve oneself or another person in a criminal prosecution or the danger thereof." It is recognized law doctrine that every person who arrested by police is presumed innocent unless proved guilty and no person can be compelled for making self incriminating statement. So any person which is arrested by Police, Police asks any questions in the

interrogation which directly or indirectly incriminates himself, he has right to refuse to give answer of these questions.

In the case of *Nandini Sathpathy Vs P.L. Dani* Apex Court held that — no one can forcibly extract statements from the accused, who has the right to keep silent during the course of interrogation (investigation). By the administration of these tests, forcible intrusion into one's mind is being restored to, thereby nullifying the validity and legitimacy of the Right to Silence. 3 Judges Bench of C.J.I, K.G. Balakrishnan and other Justices said:

Fingerprints

We know that every person has fingerprint on his hand. These fingerprints developed in the womb of mother. We can say two people have no same fingerprints. Scientist proved this fact that there is one in 64 billion chances that your fingerprint will match with others. Fingerprints are even more unique than DNA profiling. This science is more reliable than DNA technology. We know that fingerprints also uses in the solving of crime. Our courts also permit the admissible of evidence of fingerprints. Our law also permit of taking the fingerprints of accused and suspected person. So investigation agencies take fingerprints of suspected person. Explanation of Section 53 of Criminal Procedure Code 1973 clearly says that investigation Officer has power to get fingerprints of accused. Lastly we come on the conclusion that fingerprints technology more reliable science. Court easily accepts of evidence regarding the fingerprints.

Ballistic Fingerprinting

According to Knight, KeDarius "Ballistic fingerprinting refers to a set of forensic techniques that rely on marks that firearms leave on bullets to match a bullet to the gun it was fired with. It is a subset of forensic ballistics (the application of ballistics to legal questions) and internal ballistics (the study of events between the firing of a gun and the bullet leaving the barrel).

This science is very useful in solving the crime, in which arms is used. When we want to trace this technique then we found some evidence in 15th century. But the first firearms evidence identification can be traced back to England in 1835. In ballistic Fingerprinting the distinct marking left on ammunition as a result of its use in a particular weapon. This science works in two phases. In the first phase expert, see the bullet in which arms this can be used and which company makes this bullet. In the second phase experts check the gun. Because when any gun used then it left some scratches in the gun barrel. By this method, they can easily solve the problem which gun is used in this crime?

Issues related to the methods used by the police

Violation of right to health

In this point we will discuss some international laws by this we can easily understand that these test also violated not our law but these tests also violated the international laws e.g.

1. Article 25 of UDHR.
2. Article 12 of the I.C.E.S.A.C.R. Third point is related our constitution. Because our constitution also provided right of health which is enshrined U/Art. 21 of the Indian Constitution.

Article 25 of the UDHR states that "Everyone has the right to a standard of living adequate for the health, and wellbeing of

himself and his family. The Preamble of the WHO also declares —it is one of the fundamental rights of every human being to enjoy the highest attainable standard of health. used in DDT, if the Doctor's give excess dosages, it causes coma or even death.

Violation of right to privacy

In this point we will discuss some international laws by this we can easily understand that these test also violated not our law but these tests also violated the international laws e.g.

1. Under Article 19 of UDHR.
2. Under Article 17(1) of the I.C.C.P.R.
3. Article 8 of European Convention on Human Rights
4. Under Article 21 of the Constitution.
5. Article 19 of Universal Declaration of Human Rights recognized right to privacy.

According to this Article —Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media and regardless of frontiers. Many jurists explain this right. They said that right to privacy mans living life with minimum degree of interference. The right to privacy is also given in the I.C.C.P.R under Article 17(1) which says, —no one shall be subjected to arbitrary or unlawful interference with his privacy, family, home or correspondence, nor to unlawful attacks on his honour and reputation and everyone has the right to the protection of the law against such interference or attacks.

Article 8 of European Convention on Human Rights states —Everyone has the right to respect for his private and family life, his home and his correspondence; there shall be no interference by a public authority except such as is in accordance with law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the protection of health or morals or for the protection of the rights and freedoms of others. But this right is not guaranteed expressly by the Indian Constitution. But Article 21 of Indian Constitution includes also right to privacy. In *Kharak Singh v State of Uttar Pradesh* was a first case which was related to right to privacy. In this case The Court held that —the Right to Privacy is an integral part of the Right to Life, but without any clear cut laws, it still remains in the grey area. Justice Subha Rao was of the opinion that —privacy was an essential ingredient of personal liberty. In *Govind v State of Madhya Pradesh* the right to privacy was comes in the ambit of right to life which is guaranteed under Article 21 of the Constitution. But we can say it is not given expressly in the Indian Constitution. In *People's Union for Civil Liberties v Union of India* this also known as telephone tapping case, the Apex Court held that —right to life and personal liberty includes telephone conversation in the office or home and thus telephone tapping is violation of Art. 21. In *Smt. Selvi and Ors Vs State of Karnataka* Apex Court held that —the use of Narco analysis, brain-mapping and polygraph tests on accused, suspects and witnesses without their consent, unconstitutional and violation of the 'right to privacy'. When we analyze the catena of judgment of various of High Court and Supreme of Court then we find that the deception detection tests considered to be violation of privacy. If any Police Officer gets personal information under these tests then we can say it is violation of privacy.

Conclusion

In conclusion, the integration of modern scientific techniques into law enforcement practices represents a crucial advancement in crime investigation. The exploration of forensic science, coupled with innovative methods such as bloodstain pattern analysis, crime scene investigation, and digital evidence analysis, has significantly enhanced the ability of law enforcement agencies to solve complex cases and deliver justice effectively. Moreover, deception detection tests like narco-analysis, polygraph, and brain mapping offer valuable insights into the minds of suspects and witnesses, aiding in the pursuit of truth and the resolution of criminal proceedings. However, the adoption of these techniques is not without its challenges. Legal and ethical considerations, including issues related to privacy, self-incrimination, and adherence to international human rights standards, must be carefully navigated to ensure the fair and just application of investigative methods. The evolving nature of technology and its impact on the legal landscape necessitate ongoing dialogue and collaboration between policymakers, law enforcement agencies, legal scholars, and civil society to address emerging concerns and safeguard individual rights. As we move forward, it is imperative to strike a balance between leveraging the benefits of scientific advancements in crime investigation and upholding fundamental principles of justice and human rights. By embracing innovation while remaining vigilant against potential abuses, we can build a more equitable and effective criminal justice system that serves the needs of society while respecting the dignity and rights of all individuals.

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