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Forensic Technology: The Future of Investigation

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Latest technological advancements have been created to help avert crime and improve police investigative efficiency. These advanced technologies, along with developments in police administrative functions, contributed to the construction of the police department as we understand it today. Computers, communication technologies, the internet, mobile devices, wireless connections, and digital photography are all being used more and more in everyday life throughout the societal structure. These technologies have enormous societal benefits, but they also provide endless opportunities for criminals and potential issues for law enforcement. This article focuses on present scientific and technological advancements that reduce the occurrence and investigation of crime. The article also highlights how forensic science has evolved in the criminal investigation.

Keywords: *forensic science, technology, investigation, dna, odontology.*

INTRODUCTION

It is true that the world is undergoing tremendous technological changes, and as a result of these developments, offenders have refined their strategies while embracing better methods of concealing their identities. In addition, almost everyone has access to mobile phones and internet connections, which contributes to a greater understanding of science and technology in the common person. The internet is a great place to discover about numerous ways to

commit a crime without getting busted. The use of the darknet for illegal purposes is far more concerning because it leaves no record of data.

Crime is now accessible at the tip of one's finger thanks to technological development. But, the very same fingertips could also assist in the investigation of a crime. Forensic Science is a weapon made up of different ideas, including such criminal psychology, DNA profiling, physics, handwriting analysis, computer science, chemistry, fluid analysis, and on and on, that provides improved strategies for better criminal investigation as well as justice administration. *"Crime prevention is a concept that has been applied in a number of different ways to the problem of crime."*¹ As technology touches every facet of life, it's no surprise that crime-solving technology has advanced to nearly future levels.

TECHNOLOGY IN ASSISTING INVESTIGATION OF CRIME

Technological innovations frequently surpass corresponding improvements in law, regulations, policy, civilization, and understanding about successful usage. It is also critical for criminal investigators to be able to securely communicate information, efficiently utilise intelligence-gathering technology, enhance evidence quality, and efficiently handle investigations. *"The police service is increasingly reliant on a wide range of information and communications technology, forensic science and other technologies to carry out its work."*²

Science and technology certainly play a prominent part in the forensic science department in the investigation, interpretation, including examination of evidence, but it has become progressively important to apply it to the criminal investigation. A crime scene is indeed a location or venue that is considered to hold evidence stemming from activities pertaining to a particular crime. Light sources are often used to find latent fingerprints, underground utility radar is used to discover buried corpses and things, sniffer devices detect hydrocarbons and explosive materials in fire situations, and chemical enhancement methods such as luminol are now used to detect and recognize blood.

¹ James Byrne and Gary Marx, 'Technological Innovations in Crime Prevention and Policing: A Review of the Research on Implementation and Impact' [2011] Cahiers Politiestudies 17

² Julie Mennell and Ian Shaw, 'Science and technology at the crime scene' (2005) 38 Centre for Forensic Investigation

Hard technology & soft technology are two major types of advancements in criminal investigative technology. New materials, tools, and instruments that could be used to engage in criminal activity or to prevent and mitigate crime are elements of hard technological advancements. Soft technologies entail the systematic use of information and reduce crime and increase police efficiency. New software programmes, categorisation systems, criminal investigation tools, and data sharing/system integrating procedures are elements of soft technology advancements.

Technology has progressed tremendously, enabling police departments to far more quickly follow, capture, and convict offenders who are violating the law today. Mobile phones, GPS trackers, computers, and facial recognition software are all instruments that assist in the production of a contemporary criminal investigation. Some of the most recent advancements used in criminal investigations nowadays include the use of drone technology by law enforcement to get a birds-eye vision of crime scenes, gunfire sensing devices, which are devices of electronic sensors installed in high-crime areas to help police investigators identify where a certain sound of gunfire show up from, Automatic number plate recognition systems, which use dash cams somewhere within police vehicles that can run automatically every single plate number the camera sees and GPS tracking darts, which are the latest device that enables police to shoot a small sticky stinger comprising mini GPS tracker from the grill of their police vehicle upon an accused's vehicle.

For decades, there has been a tremendous development in science and technological development, including sophisticated forms of scientific evidences for substituting the lack of concrete evidence which may result in the acquittal of a criminal. To obtain information, several tests were recently created. Forensic science plays an important part in crime investigation through procedures of DNA profiling, forensic odontology, pathology and toxicology, cyber forensics and Ballistics, etc. It is considered a weapon used during the enforcement of the law. Forensics is the process of using scientific applications to carry out this study of a crime.

THE EVOLUTION OF FORENSIC SCIENCE: BENEFIT TO CRIME INVESTIGATION

Forensic science assists in the solving of crimes by integrating witnesses, sufferers, and professionals in the court of law. In regards to scope and applicability, forensic science is a relatively wide area. Forensic science may significantly assist in the recovery of missing people, establishing their authentic identities, relating and prosecuting who victimised whom through the development of scientific evidence. *"The technological advances, the forensic techniques, and forensic laboratories are very significant factors/actors in solving crimes."*³

Forensic science follows:

Individuality Principle - According to this core principle, every element, natural or manmade, has a unique identity that cannot be replicated. DNA and fingerprints are two crucial instances of this principle.

Exchange Principle - It was established by Edmond Locard, who stated that "contact exchanges traces." It simply means that every time the crimes have been committed, the offender either drops or collects his traces. Ex. Ballistic fingerprinting.

Progressive Change Principle - It indicates, as the name suggests, everything alters with the passing of time. Time has an effect on almost everything, including the perpetrator and the evidence. Anything that may constitute evidence should indeed be handled with extreme caution.

In recent times, criminologists have sought to narrow the gap between their profession and forensic science in a number of ways, including embracing the renowned criminal career model to analyse pathological offenders. The significance of forensic evidence in the prosecution of criminal offenders is universally acknowledged by the judicial system. This is due to the fact that when scientific procedures and methodologies are utilised, there is very little room for partiality or unfairness. This is also why DNA profiling and some other forms of forensic evidence are unanimously recognized in courts throughout the world.

³ NB Narejo And MA Avais, 'Examining the Role of Forensic Science for the Investigative -Solution of Crimes' (2012) 44 Sindh University Research Journal (Science Series) 251

Due to the obvious development of DNA technology as a contemporary technique of forensic science, investigating police now have a plethora of data that allows them to locate the offender only on the grounds of scientific evidence that he has dropped at the scene of the crime. A few of those forensic methods that are widely accepted in the court of law are:

- **DNA Profiling**

DNA profiling is a cutting-edge technique that can be used to identify individuals tailored to specific genetic compositions. Persons that have similar hair and eye colour, along with matching facial features, do not have similar DNA. As a result, the approach has the potential to assist in a much more efficient way to resolve crimes. Over the last several years, such internet has evolved the criminal justice system, boosting the probability of detecting perpetrators with near-certainty. This not only makes it simpler to detect criminals, but also reduces the probability of innocent civilians being unjustly imprisoned. DNA Profiling is one of the most significant developments in forensic science in recent times. Due to the enormous exposure produced by high-profile cases, TV crime programmes, and films, DNA testing has now become a well-known procedure utilized in criminal and other matters of law.

- **Forensic Odontology**

Forensic Odontology is described as the discipline of forensics that applies dentistry expertise to judicial systems. Forensic Odontology is also described as the examination, evaluation, and successful handling of evidence submitted before the court of law in the pursuit of justice. An odontologist, often known as a Forensic dentist, analyses the teeth and prosthetics to determine the cause of death. This kind of evaluation is typically performed on murder victims and at the situations of disasters to identify the details of victims.

When elements like bite marks as well as age must be evaluated, the aforementioned discipline of forensic science comes in beneficial. *“From the past few years, there has been an alarming rise in incidences of brutal rapes, human trafficking, terrorist attacks, homicides, and natural disasters in*

India.”⁴ There are many case laws that have been primarily solved with the help of forensic dental evidence. For example, In the Nirbhaya case where the bite marks were examined through forensic odontology to provide concrete evidence against the accused.

- **Forensic Superimposition**

*“Forensic facial reconstruction, is the reproduction of the lost or unknown facial features of an individual, for the purposes of recognition and identification.”*⁵ It is widely acknowledged that facial reconstruction is a method that involves restoring and repositioning destroyed or deformed connective tissue onto such a skull, utilising photographic transparencies as well as sketches in an identikit-type method, graphical, digital, or video superimposition, including plastic or three-dimensional reconstructions of a face over such a skull utilizing sculpting clay. The face superimposition method was employed in the Sheena Bora murder investigation in 2016 to establish the identity using skeletal remains, specifically the jawbone and teeth, that were being excavated three years after the murder.

STATUTORY PROVISIONS PROMOTING FORENSIC EVIDENCE IN CRIME INVESTIGATION

There seem to be lingering questions about whether or not forensic evidence infringes Art. 20(3)⁶ of the Indian Constitution. In the *State of Bombay v. Kathi Kalu Oghad & Ors*⁷, the court determined that the accused's finger impression, samples sign, blood, hair, and semen, among many other things, don't really constitute the accused's "to become a witness" within the scope of the aforementioned Article. As a result, the accused has no legal standing to refuse the DNA analysis for the sake of investigation and prosecution.

⁴ Pereira CP and Santos JC, ‘The role of Forensic Dentistry for identification of a criminal sexual assault: A casework report’ (2015) 4 J Civil Legal Sci 138

⁵ WA Aulsebrook, ‘Superimposition and Reconstruction in Forensic Facial Identification: A survey’ [1995] Forensic Sci Int

⁶ Constitution of India, art 20(3)

⁷ *State of Bombay v Kathi Kalu Oghad & Ors* 1961 AIR 1808

In 2005, the Code of Criminal Procedure was amended to accommodate for the extraction of a number of medical samples from offenders following the arrest. According to Section 53⁸ of the Criminal Procedure Code of 1976, a suspected individual may be submitted to a medical assessment after being arrested if there are "sufficient grounds for assuming" because such an examination will produce incriminating evidence. The court has the power under Section 73⁹ of the Indian Evidence Act to order anybody, including an offender, to permit his fingerprints to be collected. The Apex Court also ruled that being required to submit finger impressions does not infringe Art. 20(3) of The Constitution of India.

THE FUTURE OF INVESTIGATION

The innovations in forensic science are the potential of doing remarkable actions in the future. Although today's modern forensic analysis is still not faultless, the future may introduce advanced methods. DNA analysis will have a profound impact on the criminal justice system. And then have a glance at some of the forensic technologies that will be available in the future.

The bacterial residues that humans deposit everywhere, not just on objects we contact, but even in the air we breathe, are now being studied. According to scientific research, humans are home to thousands of germs that seem to be unique to every individual. These bacterial specimens can be extracted from the accused's feces and comparing them to the traces collected from a crime scene.

For a long period of time, fingerprints are often used to identify individuals. However, there have been instances in which they have resulted in erroneous convictions, demonstrating that they are not without flaws. Researchers have reported that the fingers produce a range of components, such as lipids and proteins, that a person takes as part of his food. These technologies may, in the future, be able to determine the individual whose fingerprints are being analysed consumes. Those very comprehensive tools, on the other hand, are not currently being utilized by investigators.

⁸ Code of Criminal Procedures 1976, s 53

⁹ Indian Evidence Act 1872, s 73

DNA Phenotyping technology will be a game-changer in the field of forensics. A picture of such a person may be produced with nothing more than a DNA sample using this technology. Physical characteristics such as skin tone, hair colour, height, facial characteristics, structure, and occasionally even body weight are determined by genes. A DNA sequence comprises innumerable characteristics of a human being as well, as per scientists, can even reveal a human's geographical origin. But, several features of the body are still not carried by DNA. DNA phenotyping is now being studied, but if its accuracy is established, it will constitute a substantial breakthrough in the criminal investigation.

CONCLUSION

During the investigation of a crime, forensic science is a flexible and extremely effective resource. Technological developments have had a significant impact on the legal system. Innovations in forensic science research are enabling us with an exceptional chance to solve crimes and uncover errors made while investigations. It finally assists investigators in getting on the proper path at the appropriate time in an attempt to investigate criminal cases and arrest the accused. As a result, it's more than a need for emerging technology in the field of crime handling that will assist in the earliest and most accurate resolution of cases.

In a criminal investigation, DNA will become the backbone of forensic sciences. Other than DNA, in the future, computers and artificial intelligence could be able to tell anything about a suspicious area or individual depending on the location and some other private information even without an eyewitness. Eventually, in the future, technologies such as artificial intelligence and other forensics fields will be able to effectively identify who should be investigated and who should not.