BOOK CHAPTER | *"Hidden Yet in View"*

Forensic Detection through the Identification and Collection of Data for Analysis

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ABSTRACT

Forensic detection – identifying and collecting data for analysis detailed the key contribution forensic science is making in the discharge and or adjudication of criminal justice. The scope of forensic science was reviewed and the associated data collection techniques for analysis were discussed. Existing literature on the subject matter was reviewed and conclusions drawn. Some recommendations for policy and practices were made. Forensic science is often driven by specific issues and scandals (such as a miscarriage of justice), and resources are specifically deployed to address them (3). This means that forensic science is often reactive to "symptoms" that arise (4, 5), rather than engaging in continuous and systematic proactive examination, research, and self-reflection as routine practice. In addition, forensic science frequently works within the framework that "every case is different," which creates a fundamental tension between research seeking to develop generalizable theories and approaches, and professional practices in crime reconstruction. Therefore, taking a longer term view of the possibilities and potentially desirable directions of the future of forensic science is an important undertaking. [4]

Keywords: Data, Forensic Detection, Analysis, Reconstruction, Adjudication, Criminal Justice

BOOK Chapter | Research Nexus in IT, Law, Cyber Security & Forensics. Open Access. Distributed Free

Citation: Joshua Wemegah (2022). Forensic Detection through the Identification and Collection of Data for Analysis. SMART-IEEE-Creative Research Publications Book Chapter Series on Research Nexus in IT, Law, Cyber Security & Forensics. Pp 1-6. www.isteams.net/ITlawbookchapter2022. dx.doi.org/10.22624/AIMS/CRP-BK3-P1

1. INTRODUCTION

Forensic detection involves the application of science to those criminal and civil laws that are enforced by law enforcement agencies (Police) in a criminal justice system. Forensic identification expertise encompasses fingerprint, handwriting, and firearms ("ballistics"), and toolmark comparisons, all of which are used by crime laboratories to associate or dissociate a suspect with a crime.

The scope of forensics includes but not limited to forensic biology/DNA, forensic odontology, controlled substances, forensic toxicology, forensic anthropology, forensic pathology, impression and pattern evidence, cyber forensics and digital forensics.

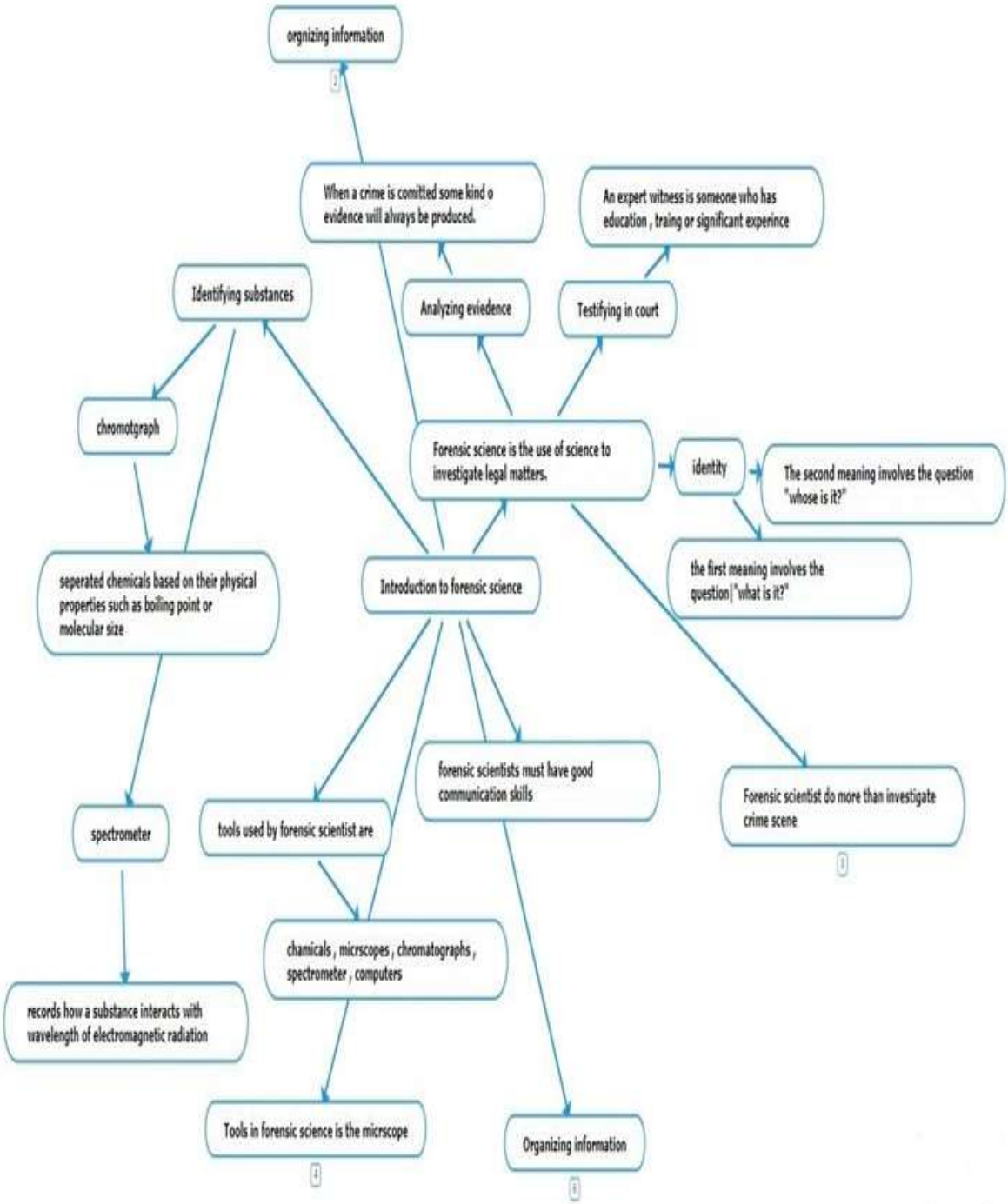

Fig. 1: Introduction to Forensic Science (AlShehhi 2020)

Forensic identification is the application of forensic science, or "forensics", and technology to identify specific objects from the trace evidence they leave, often at a crime scene or the scene of an accident. Forensic means "for the courts". Identifying and collecting forensic data for analysis is therefore very crucial for adjudication of justice.

2. DISCUSSIONS

This paper discusses “Forensic Detection – Identifying and Collecting Data for Analysis”. The paper critically looks at the scope of forensic science, the type of data/evidence collected for analysis relative to the scope of forensic sciences, methods of data/evidence collection, the tools deployed in forensic data collection, analysis of forensic evidence and challenges/limitations associated with the analysis. Some key terminologies used in forensic detection will as well be looked at and parallels will be drawn between/among them.

Fig 2: Forensic Data Analysis in Progress
Source: https://www.wasteforceproject.eu/forensic-data-analysis-for-waste-trafficking/

2.1 The Scope of Forensic Science

The scope of forensic science is very broad. However, we’ll take our time to discuss some of the fields relevant to our study.

1. Forensic Biology DNA: In addition to fingerprint analysis which is widely used, DNA profiling is another commonly used forensic technique in criminal investigations. No two individuals have the same DNA just like it is in the case of fingerprints. Even twins, triplets or quadruplets are uniquely identified by their DNA/fingerprint. DNA/fingerprint professionals identify an unidentified person or eliminate suspects from a list of accused. The biological data/evidence most commonly used for DNA profiling include

blood, saliva, semen, skin, urine, and hair. Forensic examiners collect items that could have been touched or worn by persons involved in a crime. Items such as masks, hats, clothing, tools, weapons etc. may contain DNA materials. The best evidence occurs when a person's DNA is found where it is not supposed to be. For example, consider a burglary that occurred in a residential area. Near the point of forced entry, a hat was found which the homeowners confirm was not theirs. Several head hairs were recovered from the inside, one of which had a root with tissue attached, which made it possible to obtain a DNA profile. The DNA profile was used to identify the perpetrator. Some limitations of this technique include; DNA evidence is only found in a small fraction of crime scenes, Criminals can plant DNA evidence to frame an innocent person for the crime, also known as "crime framing". It must be noted however that DNA/fingerprints are usually never used as the single piece of evidence in the court of law. [6]

2. Forensic Odontology: Forensic odontology helps in the identification of victims when the body is left in an unrecognizable state. This is achieved through an examination of their teeth, the alignment, and overall structure of the mouth. Forensic dentists or odontologists aid in the comparative identification of a person by examining the development and anatomy of the teeth including any restorative dental corrections such as filling. It is often applied to criminal investigations for bite mark analysis.

3. Forensic Toxicology: Forensic Toxicology involves analysis of biological samples to check for the presence of toxins and drugs. This branch of forensic science is of prime importance in road accidents, poisoning, sexual violence etc. The toxicology reports furnish key information about the nature of substances present in an individual pertaining to an incidence. It also determines whether the quantity of substances are normal as per a therapeutic dosage or exceed the permissible level. Since newer variants of drugs are developed each day, this branch of forensic science is ever-evolving and demands up-to-date approach.

4. Forensic Anthropology is the study of human remains or bones to identify their age, gender, and ancestry. It also aids in determining the time since death by detecting and inspecting any injuries that may have occurred. Investigators can use these studies to help identify victims, especially if the bodies are beyond recognition.

5. Medicolegal Death Investigation and Forensic Pathology: Forensic pathology is a discipline of pathology that examines a body to identify the cause of death. As a result, forensic medicine entails the collecting and examination of medical samples in order to derive facts that can be used in court. Identification of wound patterns, for example, can aid in determining the weapon used to inflict the wound. In fatalities involving the use of weapons or other projectiles, forensic pathologists can evaluate exit and entrance wounds. As a result, a forensic pathologist can make important assumptions about whether the death was natural, criminal, or accidental.

6. Trace Evidence: The term *trace evidence* is a generic one, referring to minute physical evidence that may be transferred from a criminal to a victim or crime scene, or vice versa [1]. Evidence such as fibers, soil, hair, gunshot residue, wood, and pollen are some of the many examples of trace evidence. It derives its name from its tendency to be easily transferrable between objects, people or the environment during a crime.

Trace evidence often plays a pivotal role in establishing a prime link between a suspect and the victim. For instance, a soil sample obtained from the shoes of a victim can give critical clues on the location of the crime and thus help in tracing the perpetrator. Common collection methods include individual fiber collection using tweezers or vacuuming an area and sorting the materials at the laboratory. Trace evidence can also be gathered by tape lifting, however, this is not ideal due to the destructive nature of adhesives. Most laboratories have trace evidence sections where analysts conduct analysis on evidence so gathered.

7. **Ballistics**: Ballistics is a specialized forensic science that deals with the motion, behavior, dynamics, angular movement and effects of projectiles, such as bullets, rockets, missiles, bombs etc. The use of ballistics in forensics is mainly in criminal investigations. For instance, the examination of the bullet found at a crime scene can reveal what type of gun was used to fire it and whether it is associated with any other crime in the past. In fact, ballistic details are documented in a large database that is accessible by law enforcement agencies across the globe. [6]

8. **Cyber/Digital Forensics**: The study of evidence found in computers and digital storage media such as pen drives, hard disks, tape drives and other devices including cloud infrastructure is known as cyber forensics. Its primary goal is to detect, preserve, retrieve, analyze, and convey facts and views concerning digital material that is admissible in a court of law.

   Although it is most commonly utilized in cybercrime investigations, it is also regularly used in civil cases. [6]. Computer documents, emails, text and instant messages, transactions, images and Internet histories are examples of data that can be gathered from electronic devices and used very effectively as evidence. For example, mobile devices use online-based backup systems, also known as the “cloud”, that provide forensic investigators with access to text messages and pictures taken from a particular phone. These systems keep an average of 1,000–1,500 or more of the last text messages sent to and received from that phone. Once the digital evidence is sent to the laboratory, the analyst as part of his job take steps to prevent contamination, isolate wireless devices, install write-blocking software, select extraction method, Submit device or original media for traditional evidence examination and proceed with the investigation.

3. RELATED WORKS

Joel, John (1999), corroborated with McCarthy (2006) that fingerprints have played important roles in modern crime detection. For example, after a Mannlicher-Carcano riffle was recovered following the assassination of President John F. Kennedy, the Dallas Police crime lab found underneath the stock a latent palmprint that belongs to Lee Harvey Oswald. In 1968, latent fingerprints on a riffle led to the arrest of James Earl Ray for the assassination of Dr. Martin Luther King Jr. It is established that forensic detection plays a critical role in the criminal and civil justice system.

4. RESEARCH GAPS/FINDINGS

A review of the policy-related aspects of forensic science shows gaps in legislation, governance, service provision, quality assurance and accreditation, education and research. Resolutions to the policy issues identified in this review will ensure a more robust application of forensic science in delivering safe justice and enhancing public security. [5]

5. RECOMMENDATION FOR POLICY AND PRACTICES

An important recommendation to improve forensic science in general and forensic detection in particular in Ghana is the creation of a "national policy strategy", a blueprint informed by relevant stakeholders, best practice from other countries and the status of the field. [5]. Cybercrime incidents continue to plague economic development in the African region. Prior research indicates that millions of dollars are lost annually due to this menace.

The prospects of Digital Forensics Investigation (DFI) as evident in developed countries provide hope for defeating cybercriminals. Existing legislations are scattered and cumbersome whereas mandated institutions lack the requisite capacity. There is a need to streamline existing laws into a comprehensively harmonized legal framework. Furthermore, heavy investments must be deployed to boost the capacities of relevant institutions. [7]

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