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LES JEUDIS DE LA SÉCURITÉ



Forensic science: an asset to the justice



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In the shadow of investigators, Police Forensic Science intervene in any event legally classified as a crime to collect and preserve evidence, make observations and search for traces, and to identify victims and suspects. Beyond fuelling fantasies, the profession finds itself at the forefront of political and technological developments, in an increasingly digitised and interconnected world where cooperation is no longer an option.

By Amélie Rives

New missions

Today, forensic science contributes to the fight against petty crime as well as terrorism and organised crime. Its scope of action has broadened in line with changes in crime patterns, *modus operandi* and the skills of the perpetrators, recently including digital crime and environmental offences. « *The missions and activities of forensic police vary from country to country, as they are heavily influenced by politics. As 'Scientific weapons' in the service of the judiciary, they are highly dependent on the direction taken by governments in terms of domestic and security policy,* » comments Christophe Champod, Professor of Criminal Sciences at the University of Lausanne.

« *Since the 2000s, at the request of the public authorities, French forensic science has been democratised and industrialised, and now also deal with everyday crime. Today, we have to combine mass work on an ever-increasing volume of cases with maintaining our technical expertise in the most sensitive cases,* » explains Pierre Pascaud, Chief of Staff of the French National forensic science service. Today, forensic science is an essential link in the judicial chain, from crime scene to court houses. « *In court rooms, juries expect forensic science to be present within any case, even when there is a lot of other evidence. The public have an expectation around science from their experience of TV programs and there is an increasing demand for forensic services.* » explains Fiona Douglas, Director of Forensic Services at the Scottish Police Authority.

Forensic Science in the digital age

Digital transformation is forcing PTSs to adapt their methods and techniques. The art of making sense of digital evidence has thus given rise to digital forensics, the aim of which is « *to extract data from electronic evidence, transform it into usable information and present the results for legal proceedings.* »¹ « *The challenge of any digital investigation today is therefore to 'freeze' the digital scene in order to recover, from the seized devices, uncorrupted information and data, and to be able to ensure the traceability of digital evidence in the same way as for physical seals,* » explains Christophe Champod. The potential of digital technology for forensic science is considerable. « *It will provide answers to one of the major challenges facing forensic science today: bringing the laboratory closer to the crime scene to shorten processing and analysis times. This is made possible, for example, by the automation of biometric transactions for fingerprint analysis* » explains Christophe Champod. The application Crim'In contributes to this, by enabling data collected at a crime scene to be captured on these same tablets, and will soon be reinforced by the capture of fingerprints on the NEO DK tablets used by gendarmes and police officers. Virtualisation and miniaturisation technologies are already in use among forensic services. « *Laser scanning of a crime scene helps to preserve it and carry out more accurate measurements and analyses retrospectively, but it also enables judges and juries to immerse themselves in it and victims to avoid a painful reconstruction...* » notes Pierre Pascaud. « *The capture and the reconstruction of scenes digitally through virtual reality also proven very useful to train our investigators, especially in our fire investigation facility* » confides Fiona Douglas. Or in France for autopsy training.

Artificial intelligence (AI) for analysing video streams or audio data, as well as facial recognition, completes the technological arsenal available to investigators. Facial recognition « *could also help to facilitate the targeting and identification of individuals of interest, but it is essential that it is strictly regulated from a legal and ethical point of view. In particular, it will be necessary to ensure that the data is not collected without the knowledge and consent of the individuals concerned, but as part of a legal procedure, and that it is recorded in a secure database controlled by the police authorities* » warns Christophe Champod. The acceptability of these technologies is a major issue. « *The need for ethical service provision is particularly important for us. As we advance our forensic capabilities, we need to make sure that the public has confidence in the type of science and technology that are using, and that we use scientific excellence technology to make communities safer.* » Fiona Douglas says.

Technological progress and genetic analysis

It is probably in the field of genetic analysis that progress has been the most spectacular. « *DNA analysis techniques are nowadays much more sensitive and their results more accurate. Applied to old seals, they sometimes make it possible to obtain a profile from traces that did not yield one at the time. Y-chromosome analysis, in particular, is being used more and more, with techniques that have been greatly refined. It involves isolating the male fraction of a sample which may contain the DNA of several individuals, and is therefore particularly useful in the case of sexual assaults,* » explains Christophe Champod. Another recent development is DNA phenotyping, which makes it possible to obtain morphological information about a profile, even if the DNA is not on file, in order to draw up more precise photophit picture: skin, eyes and hair colour, facial shape, geographical origin, etc. « *This technique is still far from being a miracle tool. Firstly, because the indications it provides are modest in strength, with a margin of approximation that reduces its operational value. Apart from certain exceptional cases where it can provide new or unexpected information, it is still all too rarely decisive* » regrets the professor of criminal science. Several countries have nonetheless adapted their legislation to allow the use of this technique, as Switzerland did this year.

A changing profession

These political, scientific and technological developments have deeply transformed the forensic science profession. According to Fiona Douglas: « *The fact that most crimes now have a digital component to them has changed radically the role of crime scene investigators. In Scotland, where digital investigation do not sit within the Forensic Services, one of our greatest challenge now will be to make traditional and digital forensic sciences work together efficiently. Also, the unprecedented sensitivity of new investigation techniques, in particular around DNA, has changed the way we operate on the ground. Investigators are much more careful around contamination and protecting the environment, with new methods and processes. Today, there is also a greater understanding of the impact of repeated exposure to trauma on crime scene investigators, and the well being of our staff is at the core of our Strategy.* » France is preparing to create a National School of Forensic Science, which is currently being set up.

International cooperation

At bilateral, regional and international levels, Forensic services exchange, share and act, in particular via the European Network of Forensic Science Institutes (ENFSI), which brings together 72 laboratories from 39 European countries: « *In particular, we are working to harmonise forensic practices, essential in cases involving transnational organised crime and terrorism,* » explains Pierre Pascaud. To facilitate operational cooperation between national police forces, Interpol is developing tools that bring together data supplied by its members: a DNA profile database, another dedicated to identifying missing persons via international DNA kinship matching, an automated fingerprint recognition system, or a facial recognition system that has helped identify nearly 1,500 terrorists, criminals, fugitives or missing persons since 2016.

Europol is strengthening its capabilities, particularly in the fight against drugs, with a system for comparing illicit laboratories, which processes photographic and technical information on synthetic drugs, but also with an arsenal of tools to combat payment card fraud (radio frequency counters, motorised card readers, etc.) and a *Universal Forensic Extraction Device* capable of extracting data from 95% of mobile phones. To facilitate joint action between operational teams, Europol organised in March 2023 a "forensic raid" as part of the « Lotus » Task Force. 15 experts from 8 countries worked together to extract dozens of terabytes from equipment seized in a human trafficking network, reducing the process from months to days.

And Fiona Douglas reminds us: "While forensic science is supported by great technology, instrumentation, tools and techniques, the greatest value that comes into science is the opinions and expertise of our people."

The rise of forensic science in Africa

Significant progress has been made using DNA to identify people or evidence to solve criminal cases. Thanks to the expertise of several dozen scientists at the Institut de Recherche Criminelle (IRCGN) in Pontoise (France), the Mobil'DNA lab has been created. This is a cutting-edge forensic science tool that can be deployed as close as possible to operational requirements.

In particular, it provides African forces with an unprecedented tool for rapid, high-throughput analysis of large quantities of biological samples. « *The laboratory uses the patented GendSAG device, based on the « Sample and Go » concept of rapid analysis. This new-generation swab includes a biological reactor that eliminates the extraction stage. Its microfibres collect biological traces with great precision, minimising their alteration and making the DNA directly available for amplification by PCR and genotyping by a capillary electrophoresis sequencer* », explains David Boisseau, Deputy Managing Director at WIDE INT, a company that offers solutions for providing irrefutable evidence (papillary traces, DNA or even mobile phone geolocation). The samples are then processed in an area of the mobile laboratory that meets the quality standards required for DNA analysis, « *amplified using a thermocycler performing polymerase chain reactions, then the genetic markers are tested by capillary electrophoresis to establish a genetic profile* », explains Didier Sonnois, head of the forensic division at WIDE INT. The digital processing of the results provides the genetic profile in the form of an electropherogram, a particularly useful tool for processing complex crime scenes or during natural disasters. « *This helps to improve the capabilities of local security forces and avoids the costly and time-consuming task of sending data out of the continent,* » emphasises Didier Sonnois, adding: « *2 hours are enough for Mobil'DNA to generate the genetic profiles of the first 21 samples analysed, and then 21 new analysis results are obtained every 30 minutes.* »

A policy of modernisation of the management of crime scenes, with new tools including the 3D scanners, now also enables « *the digitisation of the crime scene or the taking of essential measurements for reconstruction, for example. Artificial intelligence can also be used to model several possible scenarios, providing invaluable assistance to investigators as they explore different leads. They remain in control of the investigation and the key decisions,* » explains David Boisseau.

While African forces are now well equipped with modern forensic resources, training is an area in which they need to invest heavily. « *We are deploying partnership models within our Wide Academy, in which we help security forces to better train their staff in the use of these tools, equipment and software, with certification training provided by experts,* » adds David Boisseau. This training across the entire forensic chain is essential if African countries are to gain independence and establish their sovereignty in terms of justice and security.



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