SUMMARY

Improving Forensic Methodologies across Europe (IFMAE)

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Project Coordinator	European Network of Forensic Science Institutes (ENFSI)
Project Partners	• Bavarian State Bureau of Investigation Forensic Science Institute (BLKA-Munich) DE • Central Forensic Laboratory of the Polish Police (CFLP-Warsaw) PL • Centre for Applied Science and Technology (CAST-Sandridge) UK • Criminalistic Service of the Civil Guard (CSCG-Madrid) ES • Criminalistic Services Cyprus Police (CSCP-Nicosia) CY • Eolaiocht Fhoireinseach Eireann (EFE-Dublin) IE • Estonian Forensic Science Institute (EFSI-Tallinn) EE • Forensic Science Institute (BKA-Wiesbaden) DE • Forensic Science Institute (LKA-Wiesbaden) DE • Institute of Criminalistics Prague (ICP-Prague) CZ • Landeskriminalamt Berlin, Forensic Science Institute (LKA-Berlin) DE • Landeskriminalamt Hamburg LKA3/ Department of Forensic Science (LKA-Hamburg) DE • Metropolitan Police Service (MPS-London) UK • National Bureau of Investigation Forensic Laboratory (NBIFL-Vantaa) FI • National Institute of Criminalistics and Criminology (INCC-Brussels) BE • National Laboratory of Forensic Science (SKL - Linkoping) SE • Netherlands Forensic Institute (NFI - The Hague) NL • Scottish Police Services Authority Forensic Services (SPSAFS - Glasgow) UK • State Criminal Police Office Northrhine-Westfalia - Department of Forensic Science (LKA - Dusseldorf) DE • University of Strathclyde, Glasgow UK
Associate Partners	• Canada Border Services Agency (CBSA-Canada) CANADA • Forensic Science Institute (FSI-Zurich) SWITZERLAND • Swiss Federal Institute of Technology (EPFL-Lausanne) SWITZERLAND

Project Description and Context

The IFMAE project was designed to seek improvements in the methodology used for forensic examinations across Europe, focused on specific areas that have not previously been subject to detailed study and/or development. Improvements in forensic methodology play a significant part in fostering international cooperation in fighting crime and facilitating justice. The investigation and prosecution of crime has come to rely very heavily on forensic science. Furthermore, the rise in serious international criminality (e.g. people trafficking, organized crime, terrorism) requires increasing cooperation between countries to conduct effective investigations and, in the longer term, to secure rightful prosecutions. When forensic science plays a central part in this work it is important that each country can rely on the forensic methods being used in all other countries.

Forensic science is not a single discipline but involves the wide ranging application of science to the investigation and prosecution of crime. With continuous advances in different scientific areas there are corresponding opportunities to advance forensic science. At the same time changes in crime patterns or the experiences gained through specific cases can highlight a need to re-evaluate existing methods. Furthermore, the forensic examination of some materials recovered at crime scenes can pose particular problems with existing methods. Thus, forensic science is not a static discipline and forensic methods need to be continuously reviewed, revised and improved. All forensic institutes regularly review the wide ranging methods used within their laboratories. Nevertheless, many problems in forensic methodology are very hard to solve and these difficult forensic challenges are best resolved through a concerted effort from several forensic institutes, working together to use their combined resources, knowledge and experience.

The results from the IFMAE project will serve many different target groups across Europe in addition to the forensic scientists who will make direct use of the new forensic methods and procedures that have been developed. Improved forensic methods will be of benefit to police forces engaged in criminal investigations whilst, at a later stage, the results from the methods may be used in the courts. Thus, the benefits of the IFMAE project will filter through to police officers, judges and prosecutors in the course of their work ensuring that justice is available to all the people in the EU Member States.

Activities and Achievements

The IFMAE project has delivered results across four different forensic areas:

1. Detailed studies into the dating of ballpoint ink marks in questioned documents. The examination of questioned documents is a well-established field in forensic science, but still has problematic issues, one being the methods used

for dating ink marks. This is an area where there are currently no best methods widely accepted by the international forensic community. Two separate studies have been conducted:

- The first study involved a systematic comparison of the current methods used for ink dating in forensic document examination based on the ballpoint ink solvent (phenoxyethanol). Such methods are generally applicable over relatively short time periods (up to 6 months). The work has involved a group of forensic institutes, known for their particular expertise in this area, with the personnel achieving hands-on experience of the methods used in each other's laboratories. Methods have been tested and validated using a common set of samples to provide objective assessments of method performance. Alongside the study report, a common general procedure for ink dating has been agreed based on the experience gained. This has been presented as a set of flow-charts to act as a guide to such examinations.

- The second study involved basic research to look at the qualitative and quantitative changes to the resins and binders in ballpoint ink marks over time in order to seek effective methods for establishing the age of the marks over a longer time scale than the solvent based methods. The examination of resins and binders is a relatively new area of study in dating inks. The project has established a physical reference collection of these substances for the IFMAE work and for future research needs. Robust analytical methods have been developed (HPLC-MS) with narrow-bore (1mm diameter) HPLC columns. Furthermore, a small scale sample preparation method has been demonstrated, able to analyse ballpoint ink entries on paper with a stroke length of only 3mm, achieving good signal to noise ratios. In addition, the reference collection has been used to create a mass spectroscopic (structural) database of these substances and some of their degradation products. The new HPLC-MS method can differentiate between different ballpoint ink marks (demonstrated by measurements of different black ballpoint ink marks) and has also shown promise for differentiating other ink types (e.g. inkjet printed documents). Ink ageing experiments have demonstrated that each resin/binder does show a characteristic ageing behaviour indicating that the method has long-term potential. However, the wide range of substances involved and the complexity of the ageing processes suggest that it may not be possible to develop a single universal method of data evaluation for dating questioned documents. Each resin/binder will need to be investigated separately to understand its detailed degradation mechanism and the factors influencing its ageing behaviour.

2. An internet accessible Fibre Type Information System (FTIS) has been designed and implemented. The initial work involved the creation of a physical reference collection of 341 different textile fibre samples covering 92 different 'fibre types' / 'fibre sub-classes'. The FITS database has collected together an enormous amount of information for these reference fibres to provide a central resource for forensic scientists across the EU working in this discipline. The information includes microscope pictures, spectroscopic data, refractive indices, melting points and literature references. It can be used to support the identification of a fibre type during a forensic examination in a given case, whilst the clear definition of the sub-classes within some fibre-types will increase the probative value of the associated evidence. Further, FTIS can be used for training new people as fibre examiners. The cross-transfer of textile fibres during criminal activity and the subsequent recovery of such fibres by forensic scientists can provide important evidence for investigations and court procedures. The classification of the recovered fibres is an important first step and forensic fibre examiners are faced with a very large range of different fibre types either originating from natural or man-made sources.

3. Universal methodology has been developed for forensic semi-automatic and automatic speaker recognition (FSASR and FASR, respectively) when used in casework situations. In general, forensic speaker recognition denotes the different ways of discriminating one person from another based on speech, taking into account the limitations of forensic speech material and the specific needs of reporting the results to a court. The role of the forensic scientist is to provide an interpretation of the voice material available to a police investigation or to a law court. The current work has published "Methodological Guidelines for Best Practice in Forensic Semiautomatic and Automatic Speaker Recognition including Guidance on the Conduct of Proficiency Testing and Collaborative Exercises". These methodological guidelines constitute a pioneering result in the domain of forensic speaker recognition. They present a standard approach for forensic semiautomatic and automatic speaker recognition based on scientifically approved methods for calculation and interpretation of speech evidence in the Bayesian interpretation framework and in providing detailed guidance documentation for forensic experts in the field.

4. Important progress has been made to support the methods used by forensic scientists when working to enhance image and video evidence. The images and video recordings provided to forensic investigators are often of low quality and require considerable knowledge and experience with various software tools to achieve good results. Furthermore, it is difficult to keep up to date with recent developments in the relevant software tools (both academic and commercial). This project has conducted a survey of all the methods and procedures currently in use across Europe. Further, it has created an on-line central repository containing diverse recourses including an up-to-date literature review, an overview of the existing state-of-the-art software tools, and a database of images & video sequences that can be used for training, testing, comparing, validating & selecting software tools. In addition, the study has organised two collaborative exercises amongst European forensic institutes. The knowledge and experience gained for the work has been collected into a two-part "Best Practice Manual for Forensic Image and Video Enhancement".

All the results from the IFMAE project will contribute to the overall aim of improving the methodology used for forensic examinations across Europe within these specific areas and thereby will have a significant impact on international cooperation in the area of law enforcement.