CSEye
The Chartered Society of Forensic Sciences
January 2016

The home of crime scene science

NEW WET VACUUM TOUCH DNA RECOVERY SYSTEM

M - Vac wet vacuum system improves the search and recovery of touch DNA.

Bob Milne MCSFS FFS takes a look at the wet vacuum DNA technique and results achieved by a number of Police services internationally.

Figure 1 M-Vac system

Traditional swabbing is fine for the recovery of DNA from body fluids or the removal of cells on non-porous surfaces but what about the microscopic traces of body fluids or cells in crevices, in fabrics below the surface? Here swabs can be ineffective and that is why the M-VAC originally designed to recover bacteria from food plants for analysis was utilised in its present form to enable the more effective recovery of DNA.

A two-fold study by the Philadelphia Office of Forensic Science produced empirical data on the effectiveness of the wet vacuum M – Vac system.

In the first part the M-Vac recovered 180 times more than the swabbing of diluted buccal cells from clean cloth swatches.

In the second part of DNA recovery of touch DNA on a variety of substrates the M-Vac recovery was on average 5 times more than swabbing in those scenarios.

Both validations however showed a significant increase in performance. The M-Vac enables the systematic search of clothing, rock, cement or other porous surfaces and even large-surface sampling from human skin. Both casework and research has shown traditional methods are not as effective as the M-Vac on these substrates.

M -Vac has been in use in the United States and other countries for a few years and a considerable number of current and cold solved cases have been published. The cases covered in this article serve to illustrate how effective the proper use of wet vacuum DNA recovery techniques can be.

inside this issue

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How Does the M-Vac Work?

Collection

The M-Vac uses wet-vacuum principles to cause the DNA material to release from the substrates and then captures the cells. DNA free buffer is sprayed directly onto the surface while simultaneously vacuum is applied around the spray pattern to collect the buffer and suspended particles in the collection bottle.

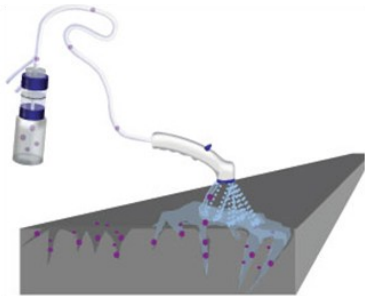


Figure 2

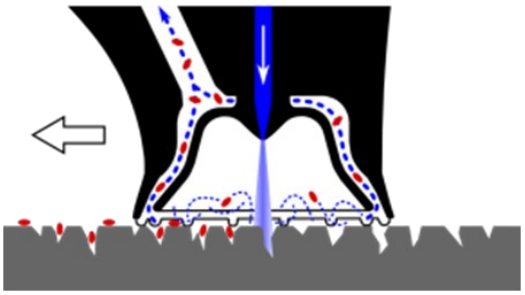


Figure 3

No Elution

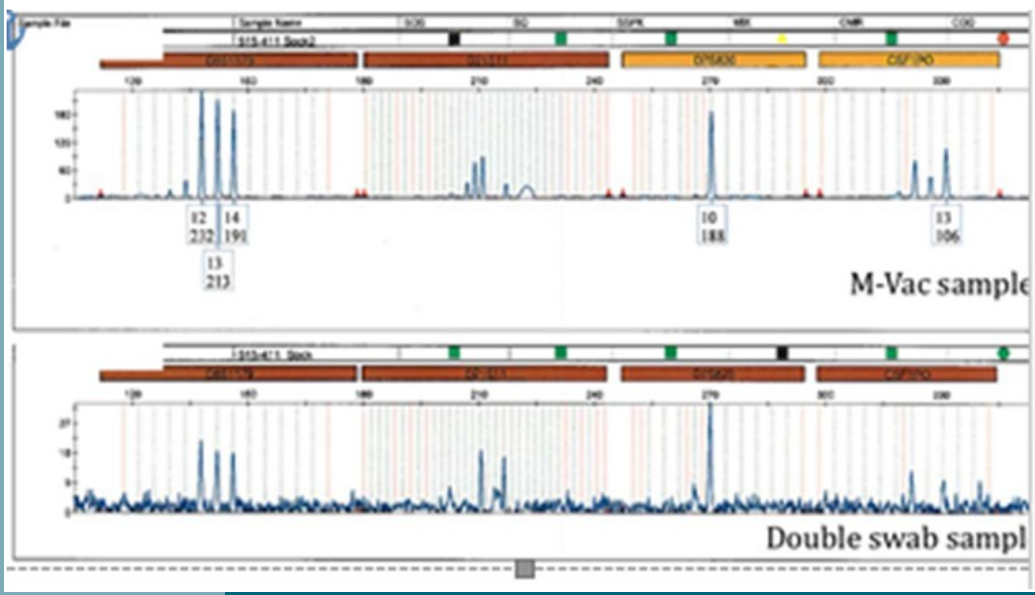
Many sampling methods require elution - removal of the cellular material from the sampling device - which can be problematic if the device is not designed to capture and release. Most sampling devices like swabs are not physically capable of both. The M-Vac sample is contained in a collection bottle ready for concentration or enrichment, eliminating the elution step.

The M-Vac's Patented Collection Method

The M-Vac's patented collection method applies a sterile solution to the surface and simultaneously vacuums up the DNA material from the targeted substrate. The solution and DNA material are then captured in the attached collection bottle, which is then filtered and sent to the lab for further processing. This unique collection method is both scalable and more sensitive so covering larger surface areas and/or collecting minute amounts of DNA are very feasible.

Validations

M – Vac has been validated in many laboratories and police services worldwide. It can be used in the laboratory or taken to crime scene to search and recover touch DNA from immovable objects. For each examination the entire front end collection kit is replaced with a new DNA Free sterile set, the liquid vacuumed into the collection bottle is kept safe and in a sterile safe environment the liquid is decanted into the filter. It is only the filter which is submitted to the DNA laboratory. Used properly there are no contamination issues. Indeed, owing to the improved amount of DNA recovery with the wetvacuum method less amplification is needed and there is less background noise in the profile as shown in figure 4 (left)



Notice that the amount of amplification of the DNA is less with the wet vacuum method and the profile cleaner.

The M-Vac has been extensively tested by MSI, universities, law enforcement agencies, labs and other companies.

UC Davis Sexual Assault Oriented Research: Project 2

Comparing the M-Vac to Standard DNA Collection Methods for Large Surface Areas: Conclusions

In some cases, a sexual assault victim will shower before they seek out a forensic exam. If the victim was unconscious during the assault, it may be hard to indicate where the victim was violated by the assailant. The traditional swab technique is limited to a small surface area, but the M-Vac can sample large regions of the body. In this study, the saliva location was known, potentially giving the swab an over-representation in the results. When the saliva location is unknown, the M-Vac would be more effective.

UC Davis Sexual Assault Oriented Research: Project 3

Comparing the M-Vac to Standard DNA Collection Methods for Large Surface Areas: Conclusions

Touch DNA is typically not visible to the naked eye, even with the use of an ALS (Alternative Light Source). Therefore, using a collection technique that only covers a small area can limit the DNA recovered.

Cuttings are typically restricted to a 1cm square fragment, whereas the M-Vac can collect one sample from a much larger area. Compared to cuttings, the M-Vac collects more touch DNA because it is capable of covering a much larger surface area. In some trials, the cuttings result in little or no DNA; however, the M-Vac is capable of collecting touch DNA. Regardless of the collection method used, more touch DNA is recovered if the contributor has sweaty hands.

Click the link below to view a video by Chris Davis, UC Davis Forensics Programme Director about M-Vac from the University of California at Davis, Forensic Science Graduate Program, Sacramento State University, California Clinical Medical Training Centre.

https://www.youtube.com/watch?v=6dBG9AAuVjA

Boston University Comparative DNA Collection Research

Researchers at Boston University presented impressive M-Vac comparison results at the 2012 North East Association of Forensic Scientists (NEAFS) Conference showing the M-Vac recovered significantly better than the swabbing method on denim.

Filter Apparatus Verification

A verification test was conducted to evaluate the use of a filter apparatus with a 0.45µm PES filter as a viable means for concentrating M-Vac samples. The verification also included a comparison of the double swab and M-Vac sampling methods. The M-Vac collected 39 times more DNA material than the double swab method.

Boston University evaluation

Click the link for access to the Boston University evaluation

http://www.m-vac.com/images/pdfs/2012bostonuniversitystudyexcerpts.pdf

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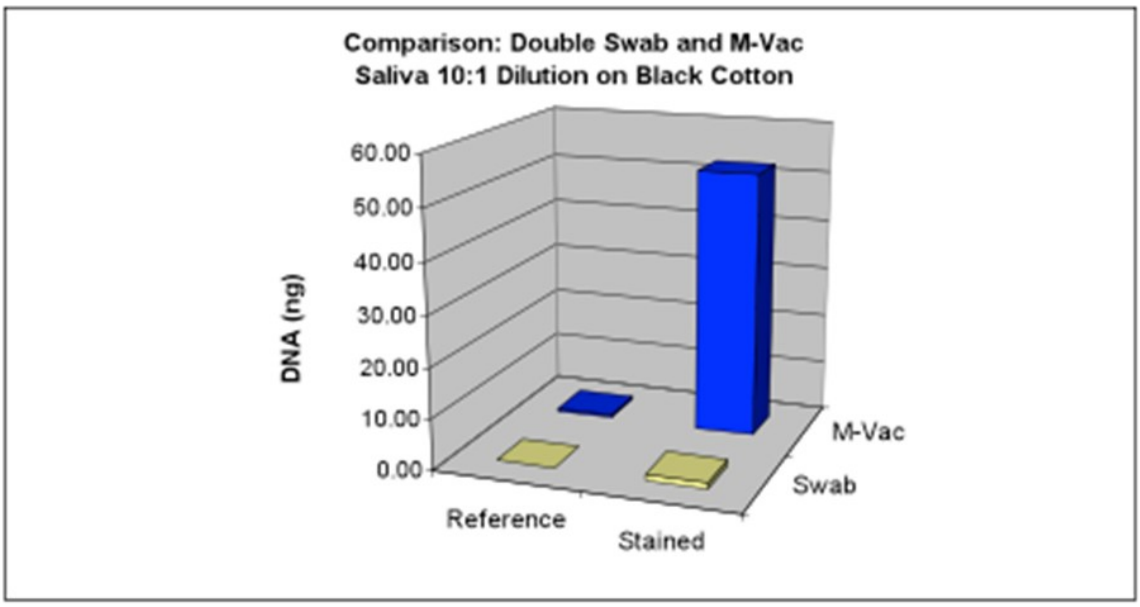


Students at University College Davis California managed to recover touch DNA from the skin of fellow students after 8 minutes showering following simulated assaults.

UC Davis California Sexual Assault case orientated evaluations
http://www.m-vac.com/images/pdfs/aafsposter.jpeg

If You Can't Collect It, You Can't Detect It. Some current and cold cases using M - Vac

First case summary: Case synopsis

Not long ago a good friend, who is also a detective in one of the largest sheriff offices in the US, described the desperate circumstances of one of his cases which was in difficulty and what he had to do in order to move it forward. A young woman had been brutally murdered by a heavy, blunt object and found in her yard along with tools that indicated the person who had killed her also planned on disposing of her body. Most likely the suspect had just run out of time or he would have competed his grisly intentions.

The detective and his team had a suspect under surveillance and based on all the circumstantial evidence they were confident the suspect had committed the heinous crime, but due to a lack of hard evidence, particularly DNA linking the suspect to the murder weapons, they were unable to file charges. To make matters worse, the judge overseeing the investigation had given the investigators a time limit on how long they could keep the suspect under surveillance and that time was quickly running out.

How can touch DNA be effectively collected off of a rough and porous surface? That was the question that had to be answered. The swabbing technique had been ineffective despite multiple tries, and other methods could not penetrate the hard, porous surface. The detectives knew the suspects DNA was likely on the object, but how to actually collect it off of the surface constituted a major problem.

Fortunately, the detective was doggedly determined, information is increasingly abundant and searchable, and even small businesses can have a big presence on the Internet. He was able to find several articles on a new wet-vacuum collection device called the M-Vac System. Almost immediately he knew it was the only possibility for getting that DNA off of the evidence. That's when he arranged to get an M-Vac System to help in the case. Within a relatively short amount of time the M-Vac had collected the touch DNA material off of the murder weapon, the lab had processed it and the suspect's DNA profile was generated.

Due to the hard work of the investigative team, that suspect is now off the streets waiting for trial instead of being out on the streets further terrorizing the community.

Second Case Summary: Case Synopsis

Homicide/possible sexual assault. Female child victim found partially submerged in water (body recovered within 10 hours of the last confirmed contact with victim; thus, victim not in water for an extensive period of time). Victim shows signs of sexual penetration including extensive trauma to vaginal area. Examination by both coroner and subsequent serological testing revealed no sign of semen and/or spermatozoa, limiting potential for probative DNA testing.

Evidence Received: Sorenson Forensics received one pair of panties removed from victim. Panties heavily stained with red/brown staining, theorized to be blood from the victim. Initial testing of panties yielded no probative serology/DNA results. No evidence of spermatozoa nor seminal fluid was obtained from the panties.

Processing: With no potential sperm cells to test, the panties were processed for touch/contact DNA using M-VAC collection system. A large area of the crotch of the panties as well as the side near the hip area was sampled using the M-VAC. Investigators theorized the perpetrator removed or contacted these areas during or previous to the act(s) that caused the significant vaginal trauma. The M-VAC was utilized to ensure collection of the potentially minimal DNA left from the perpetrator (limited contact, submerged in water) as well as allow for collection of a large area of the fabric of the evidence. Both areas were processed using the M-VAC system and the resulting liquid was collected in 50ml Falcon conical tubes. These tubes were centrifuged and the resulting cell pellets transferred to a micro-centrifuge tube for SoPure™ non-differential organic extraction. Quantification was accomplished using the Promega Plexor HY quant system and any potential resulting DNA was amplified with the applied Biosystems YFiler YSTR amplification kit

Result: Quantification data revealed no male DNA in the waist/hip area collection, however, a minimal amount of male DNA was obtained from the crotch area of the panties. Approximately 140pg of male DNA was obtained from the extraction of this area (50ul extract volume, ~.0027ng/ul). Autosomal quant results indicated approximately 850ng of female DNA also within the extract (50ul extract volume, ~17ng/ul) equating to an approximate ratio of 6000:1 female to male. Despite an extreme ratio and limited male DNA, a partial Yfiler profile (9 of 17 loci) from a single male contributor was obtained after consumption and subsequent amplification of the male component. Subsequent testing excluded investigators and crime scene personnel as the source of this profile.

It is Sorenson Forensics' opinion the male DNA profile obtained from the evidence is likely from contact from the perpetrator during the assault. Processing with the M-VAC allowed the minimal amounts of male DNA to be collected despite overwhelming female/victim DNA, exposure to the effects of water and limited amount of cellular material (contact and/or "touch" DNA).

Third case summary: Case from the UAE—Synopsis

Homicide involving spouse (wife) and two male conspirators. Victim injected with insulin to render incapacitated and then his hands and legs were tied up with fabric material. Victim was transported via vehicle and then thrown from a cliff. Cause of death was impact trauma. Initial six (6) DNA collection efforts from the restraint fabric used to tie victim's legs and other areas was completed utilizing the cutting method. Cuttings yielded a full profile of the victim but only a few minor, random peaks otherwise that had inconclusive results.

Challenges: There were a number of challenges in collecting DNA material in the case. One was the fact that very little DNA material was available, especially in areas that were void of victim's blood. Despite individually testing cuttings from six (6) different areas on the restraint material, victim profile overwhelmed and masked minor profiles from other contributors. Compounding the issue, the restraint material had no visible stain other than the victim's blood, was a porous fabric substrate, and then target sampling area was relatively large. The absence of a major or minor contributor other than the victim left the case without conclusive DNA evidence.

Processing: The restraint fabric was processed for touch/contact DNA using the M-Vac wet-vacuum collection system. Approximately 200ml of sterile surface rinse solution was sprayed down and collected from the fabric. The liquid was then concentrated using a 0.45 micrometre Nalgene disposable filter apparatus. The filter was covered, labelled and set aside to dry using standard chain of custody practices.

Laboratory Processing: The evidence filter was removed from the filter apparatus and cut into small sections using a single use sterile scalpel to allow for extraction. This substrate was then processed via modified Chelex extraction and quantitated using the Quantifiler Duo assay. The extracts were amplified with the Life Technologies Amp FℓSTR® Identifiler® Plus PCR Amplification Kit and DNA mixture profiles were obtained.

Results: High quality DNA was recovered from the sample area using the M-Vac System. Subsequent amplification and genetic analysis resulted in positive identification of the spouse and brought into question two other male suspects with peaks of 500 rfu. Suspect profiles generated by the M-Vac System collected DNA material were used to gain confessions from the male suspects and later the spouse, moving the case to a conclusion. Two of the suspects were sentenced to life imprisonment and one received a sentence of capital punishment.

COLD CASE THE PROVO RIVER MURDER CASE 1995

Police solved an 18-year-old cold homicide case by recovering touch DNA from a rock found at the scene

Bluffdale, Utah, Sept 25, 2013 – M-Vac was instrumental in helping solve the 1995 murder of Krystal Lynn Beslanowitch. Utilizing the M-Vac's wet-vacuum approach, investigators collected enough touch DNA from a rock to generate a full profile and move the case forward.

Figure 4.Provo River Midway Utah USA

At the time of the murder 18 years ago, then Detective Todd Bonner was dispatched to the scene and found the body of Beslanowitch, who had been bludgeoned with one of the rocks that lay near her body. Many resources were devoted to solving the crime, but the evidence from the scene would not tell the story. Krystal's case went cold. "It's a case that's haunted me for almost my whole career," said Bonner, now the Wasatch County Sheriff.

On September 17th 2013, Sheriff Bonner was able to close the loop – he tracked the suspect to Florida and personally put the handcuffs on Joseph Michael Simpson. Referring to the process of collecting Simpson's DNA from the rock, Cami Green of Sorenson Forensics stated "In forensics, that's fairly new technology. It is the most sensitive collection method we have at our disposal."

Wasatch County worked closely with other police agencies, crime labs and prosecutors from around the State of Utah and Florida to make the arrest. "There are many officers, analysts and agencies that need to be thanked for their part in solving the Beslanowitch homicide." Sheriff Bonner stated. "Without a doubt, the M-Vac system is the major tool that allowed us to make critical DNA connections in this case."

Wet vacuum DNA recovery the way ahead

At this time in January 2016, there is not one wet vacuum DNA recovery system like M-Vac in use in the UK, and European systems are thin on the ground. M-Vac was demonstrated at the 2015 Forensics Expo at Olympia and information about the system with details of its validations have been available for the past few years. The list of solved cases, particularly difficult cold cases from around the world grows daily. The system does not replace swabbing but has its uses where swabbing is or will most likely prove ineffective. The system is very cost effective as the outlay is usually recovered in solving the first case by saving police and laboratory time.

UKAS has been approached and they see no validation problems when potential users follow the normal validation processes. The UK is falling behind in the use of this technology. South Africa now has three systems in place and there are systems in many countries. The applications of this technology in counter terror casework are obvious.

Without a doubt wet vacuum DNA search and recovery is a game changer in violent and sex crime cases. The results with tests on the recovery of touch DNA from human skin are encouraging. The technique also has good results on rocks, bricks, textiles, skin, rough wood etc. The results on cold cases show the system is cost effective in recovering the outlay for the system on the resolution of the first successful case. The relatively clean profiles produced have offered the chance to resolve DNA mixtures.

How many readers can think of cold cases from earlier in their careers, which could benefit from the use of wet vacuum DNA recovery?

The author wishes to thank Jared Bradley CEO M-Vac Systems for his assistance in producing this article. http://www.m-vac.com/index.jsp

Introducing corporate 'block' membership of CSFS

The Society has been working with universities over the last couple of years to offer group memberships to their students. As a further development of this CSFS have now welcomed two new 'block' group members from the practitioner arena.
Scientific support staff from both British Transport Police and City of London Police have recently been signed up to membership of CSFS by their forces as a complement to their roles.

Recently British Transport Police (BTP) signed up all members of their Scientific Support Unit (SSU) to The Chartered Society of Forensic Science (CSFS). This was to allow all staff to be a member of a recognised professional body to continue their learning and development through the Society's publications and through the conferences and seminars the Society organise.

Belonging to a professional body allows staff to increase their qualifications through CPD; demonstrate competence and experience required and sets standards for professional ethics. It also allows staff to be formally recognised as a professional in their field.

Being a member of the Society also enhances the professional relationship for staff and allows members to support and help one another in reaching their professional goals. The Society organises and sponsors numerous events throughout the year that allow members to connect with peers, increase their knowledge and share ideas. In addition, having access to technical knowledge in the form of online journals and training courses also contributes to the development of staff.

BTP's SSU is all about continuous development and so learning about "best practices" or new ideas and hearing about key achievers in the field are great ways of developing staff and enhancing their skills and knowledge.

Staff within SSU are dedicated to staying connected in their profession and keeping up to date with advances in forensic science so belonging to the CSFS is a great way of doing this.

Farhana Nanji, Scientific Support Manager, British Transport Police

The City of London is very pleased to have full membership of the CSFS. All our staff, including the Chemical Development Laboratory, Scenes of Crime and the High-Tech Crime Unit have now joined the Society. We very much look forward to the exciting opportunities this offers for the coming year.

Tracey Alexander, Director of Forensic Services, City of London Police

The Chartered Society of Forensic Sciences is very pleased to be welcoming FIAG as a new division.

"Coming together is a beginning; keeping together is progress; working together is success"
Henry Ford

FIAG was founded in May 2003 in London by a group of practitioners from diverse backgrounds that had led them into the field of identification of people from imagery. Initially the group was called 'Facial Imagery Analysis Group'. However, it soon transpired that imagery analysis and identification from imagery encompassed more than just faces so the name was changed to 'Forensic Imagery Analysis Group'. This opened the group up to more members and allowed a greater span of knowledge input into the group. The main purpose of the group forming was to come together to discuss methods, terminology and expression of opinions so that we could better understand each other outside of a court room.

Over time, with the number of cases involving imagery analysis, the courts have become more familiar with the nature of the evidence we give and with the development of the Levels of Support Guidelines published by FIAG in 2008 it is now much easier for the courts to determine where experts agree or disagree.

The requirement for further standardisation and development in the field has been around for sometime but it is quickly becoming a necessity with the call for methods to be validated and laboratories to be accredited. The focus of FIAG today and in the future is to become a widely recognised group committed to the development and standardisation of Forensic Imagery Analysis.

Our aims are:

- To provide a forum for the discussion and promotion of subjects of a common interest to members (national and international) of all professions that operate within the domain of Forensic Imagery Analysis.
- To encourage the development of standards that enhance the professional standing of any single or multiple interest parties within FIAG.
- To encourage the professional development of its members by researching and/or providing training in the field of Forensic Imagery Analysis and working with CSFS to incorporate this training into their already established CPD training program.
- To work with CSFS to determine how to assess competency and continuing competence of practitioners in the field – to include all aspects of comparative analysis and imagery interpretation from installation, retrieval, processing, analysis and presentation in courts of law.
- Provide a forum for dispute resolution between members outside of the UK Legal system.

FIAG are very pleased to be joining CSFS and we are looking forward to a very productive future.

Jacqueline Pestell is a Senior Forensic Imagery Investigator at LGC and has been the Chair of FIAG since May 2013.

The utility of Photogrammetry /Photoanthropometry

This article is endorsed by the Forensic Imagery Analysis Group (FIAG). The purpose of this note is to review the utility of Photogrammetry/Photoanthropometry in facial comparison tasks in order to determine whether it remains a viable test to be used in the elimination of a suspect for an offender.

Terminology

This test is referred to as Photogrammetry and also as Photo-anthropology. The definitions of these two terms are as follows:

Photogrammetry is the use of photographic (imagery) records for precise measurement of distances or dimensions (Black, 2007) *(1)*

Photoanthropometry is anthropometry (where the measurements are taken directly from a subjects face) adapted for quantification of surface features from standard photographs. (Farkas, 1994) *(2)*

The members of the FIAG have agreed that these terms do not provide a true representation of the functions of this test and how it is represented in the UK courts of law today. As most practitioners no longer obtain measurements/indices from the images under examination, it is proposed that practitioners adopt the term **'Proportional Alignment'**.

Proportional Alignment

UK practitioners use this test to:

1. Assess the alignment of the camera views available; to determine whether image views are closely matching. The practitioner can then consider the degree of any differences in view and take this into consideration in the morphological examination.
2. Determine whether there are any differences in the proportional alignment of facial features that would cast doubt on the contention that two people are the same person or if possible, eliminate the contention entirely.

Review of Casework

Proportional Alignment, in all its guises, has been used by UK practitioners in facial comparison work for over 20 years. It has been presented in various ways in the UK courts; sometimes using grids, lines and measurements. Further research in the tolerances required for accurate measurements in images, is required. Until such time as such research is available, practitioners use this technique with caution. A review of cases by LGC Forensics *(3)* has shown that out of 54 eliminations made, 30 of them did not allow for a meaningful proportional alignment test so that the elimination relied on morphological examination only, 17 showed differences in both the proportional alignment and morphological examination tests (with 1 case where the differences were more readily observed in the proportional alignment test than in the morphological examination) and 7 showed no significant differences in the proportional alignment but did show differences in the morphological examination. In those 7 cases the quality of the imagery was either limited in detail or the comparative imagery only allowed for a proportional comparison in one plane.

The LGC review indicates that of the two tests, morphological examination has the higher discriminating power; however, it is not to say that proportional alignment is not valuable in certain instances.

It would be premature to discard correctly constituted evidence as inadmissible because some techniques may or have been used inappropriately.

As one of the fundamental aims of all forensic image comparison is to try and eliminate the possibility that two persons being compared are the same, it is appropriate to use all relevant tests at one's disposal. Failure to do so would breach one's obligations to the courts and those who instruct.

Current Guidelines

The members of the FIAG agree that in their position as practicing experts in the field of Forensic Image Analysis, each expert retains the right to choose, in each case, the most appropriate methods in order to conduct their analysis.

The Proportional alignment or 'photo-anthropometry' test remains an accepted form of evidence in the UK courts.

Consensus of the FIAG

FIAG members are instructed by Defence as well as Prosecution. Some concern has been expressed that practitioners are being instructed by a police force (the prosecution) NOT to use a tool that, typically, adds little to the contention that the two persons being compared are the same, but has considerable potential to *exclude* the possibility, a tool useful to the defence. The unanimous decision of the UK Practitioners associated with the FIAG is that they will continue to use the Proportional Alignment test where they opine that the imagery allows for a meaningful test to be conducted and they will continue to present their findings in their reports and in evidence in UK courts who, as the ultimate arbiters, currently accept the technique as useful when utilised under the right conditions.

This article was prepared following a meeting of the FIAG on 20th May 2013.

1 Black, E. b. (2007). Forensic Human Identification An Introduction. Boca Raton: CRC Press.

2 Farkas, L. G. (1994). Anthropometry of the Head and Face (Second Edition). New York: Raven Press.

3 Sample of cases where eliminations were made were reviewed to determine whether proportional alignment had been used and if so whether its use assisted in the elimination of the subjects: [2008] R-v-Thandi, R-v-Gordon, R-v-Gallagher, McDaid, Ramsay, R-v-Richards, R-v-Thompson, R-v-Waszkiewicz, Operation Fathom, R-v-Saenko, Operation Vestige and R-v-Simoes; [2009] R-v-Harrison & English and R-v-Bailey; [2010] R- v- Jama, Operation Cannon, R-v-Cox & Dewe and R-v-Gould; [2011] R-v-Sherwin, Operation Homily, R-v-Redmond, R-v-Savage and R-v-Humphries; [2012] R-v-Kavuala, Operation Homily, R-v-Bozek, R-v-Biggins, McKeown, Raines & Unsworth and DPP-v-Harte.

For the first time ever, never-before-seen objects from the Metropolitan Police's Crime Museum are on public display in this major exhibition at the Museum of London.

Until the **10th of April 2016** the Museum of London hosts more than 600 real exhibits from some of the most high-profile and notorious crimes and criminals in the history of the Metropolitan Police Service. It features exhibits relating to The Krays, Jack the Ripper, the Great Train Robbery and to the attempted Millennium Dome diamond theft. For more information go to www.museumoflondon.org.uk.

WINSTON CHURCHILL MEMORIAL TRUST

SW FORENSICS

Visiting New Zealand and Australia to investigate burglary : A CSI's perspective thanks to the Winston Churchill Memorial Trust.

I am a CSI Supervisor working for Avon and Somerset Police and after breaking my arm and a period of light duties I started to look at how I could improve volume crime performance in Bristol.

Burglary investigation forms part of every Crime Scene Investigator's (CSI) daily workload in the UK. It is a crime that affects thankfully only a few. In recent years burglary has become a national priority and forms part of the Avon and Somerset Constabulary and the Police and Crime Commissioners primary objective, helping the members of our communities to feel safe in their home. It sits under the umbrella of Volume Crime which also includes vehicle crime or any crime that by its sheer volume has a significant impact on the community and the ability of the local police to deal with it.

Over the past ten years volume crime levels have reduced significantly allowing CSI's the ability to spend more time at the scene. This has seen improvements in standards of evidence recovery and recording. It is my wish to push the boundaries of the CSI 'examination' to 'investigation' of the crime scene. This would entail using skills and knowledge gained from training and experience as well as making a professional judgement as to whether there is forensic opportunity at the crime scene.

Each CSI in central Bristol attends on average 130 burglary dwelling crime scenes per year (based on 2013 – 2014 figures). As a result they are experienced in the field of volume crime investigation, enabling them to quickly identify the methods used by offenders to gain access to premises, the reason the property was targeted, identify trends or crime series' and to provide an opinion as to what has happened based on their findings. This is a mind-set that is key to Avon and Somerset's CSI department, led by Forensic Operations Manager Mike Webb, and a vision I have adopted during my seven years under his command. I have established this operationally by creating a Burglary model with my team in Bristol, this pulls together their experiences in burglary investigation and saw the implementation of a tri-department investigation model, working closely with the Intelligence Department and burglary investigators. By the end of the crime year (April 1st 2013 to March 31st 2014) performance had increased by 50%.

As a result of these successes, I was keen to develop the model further and began researching other burglary models, conducting general research around burglary investigation, and looking for other successes in other Police forces in the UK.

I continued to research the available material around burglary investigation, national documents, burglary and performance improvement plans and specifically those in relation to CSI's. I was unable to find any published burglary models relating to CSI or papers specific to CSI and burglary investigation, or indeed CSI's being recognised as an untapped intelligence resource and investigative arm of law enforcement.

This led me to the Australian Institute of Criminology who had conducted various research projects and had publicised work available for me to study. I started to research burglary levels across the globe and learned that the UK and Ireland have one of the highest rates of burglary in the world. New Zealand and Australia are also in the upper sections depending on which model is applied.

It was then that a colleague suggested I apply for a Winston Churchill Fellowship to support my study and travel abroad to see what innovative burglary investigation and CSI models were being used in everyday policing.

I was conscious to take into account population levels so that my research could be put into context. Bristol has an approximate population of 380,000, which is very similar to Christchurch in New Zealand, which sits at approximately 350,000. Perth has a population of approximately 1,800,000 and this is comparable to the Avon and Somerset area population combined. In addition, the number of burglaries in Christchurch is at a very similar level to that of Bristol at approximately 2,500 per year. Perth on the other hand sees incredibly large numbers close to 30,000 burglaries per year.

I wanted to see how much emphasis both countries place on burglary as an offence and the service they provide. In addition New Zealand Police operate as a national body and I hoped that by visiting them I may gain an insight into streamlined procedures and a single operating model that I may be able to bring back working practices that support the new South West Forensics structure and regionalisation process.

New Zealand Police operate as a single policing body across the whole country, divided into twelve district command units. As New Zealand Police are a national force their entire model is based on one plan 'Prevention first', which has been in place since 2011. All departments work to the same goals and strategic plan across the entire nation. All of New Zealand Police work stems from this, and they base their operating model on their five drivers for crime, alcohol, families, youth, road policing and organised crime and gangs.

I visited Police Headquarters and the national DNA provider in Wellington and attended several dwelling burglary scenes during my week in Christchurch. I found that SOCO's focus on DNA and fingerprints as their main evidence types but have no system for recording and using footwear evidence as intelligence. SOCO's spend less time at volume crime scenes and this gives staff the ability to attend a larger number of scenes. This is vastly different from CSI's within Avon and Somerset who collect all available evidence at a crime scene and spend as much time as needed to complete their investigation.

Australia is made of eight states and territories and each state has its own law and enforcement regulations. Each state has its own computer recording and reporting systems and up until recently have not all fed into the National Criminal DNA identification system. This gave a complete contrast to my experiences in New Zealand but does reflect some of the challenges in British Policing (43 separate police forces) even though we do operate in England and Wales under the same legal system. I visited New South Wales Police, Western Australia Police and both the Institute of Criminology in Canberra and The Tasmanian Institute of Law Enforcement. Again I found that SOCO's do not collect all available evidence at crime scenes but was interested to find out that photographing fingerprints was the main method of recovery and offered a fast and efficient service.

On the whole I found that burglary is not set as a high priority in any of the areas I visited, nor is police attendance a regular occurrence. A police officer would only normally attend if an intruder is found on the premises and the responsibility passes to the attending CSI, if in fact they are attending. As a result of this lower level response the priority burglaries are not seen as a priority for CSI attendance and there is little pressure or expectation on outcomes.

The time spent at a burglary scene by CSI is significantly reduced and the examination at the scene does not extend to the same levels conducted within Avon and Somerset, nor does the extent of the evidence collection. Opportunities for detecting these crimes through forensic science are not as readily available to the investigation team but nor is the budget for the submission of items. This is a difficult challenge faced by many of the policing units I visited.

In some areas CSI's are not used as part of the investigation process, and do not see themselves as investigators and there was very limited interaction with other teams. In some areas they were very much a standalone unit when it comes to volume crime investigation. They are however given autonomy and make professional decisions based on the perceived outcome from the offence i.e. whether or not to attend based on this perceived outcome.

Since my return to the UK most of my dissemination has been done via presentations and meetings to a variety of policing audiences. This has included developing a new working model with the lead investigator for burglary within the force, which is still very much ongoing.

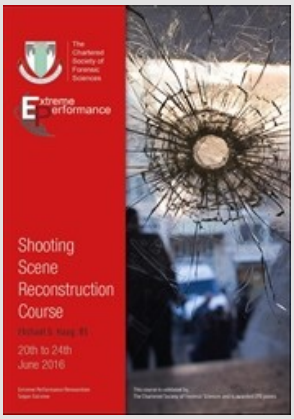
I am also working closely with my Head of Department to bring about these developments into the Scientific Investigation department. I have formed a working group with Volume Crime Scene Investigators (VCSI's) and police investigators who are going to develop key streams of work based on my learning from my Fellowship. We are striving to improve our burglary performance and the service we provide to victims. I have learned that best practice is not always about doing more; it can be about doing what is practical, proportionate and ensuring a positive outcome can be achieved. It is also about identifying when there is an opportunity to recover evidence that can be utilised in bringing the correct person to justice as efficiently as possible. CSI's need to decide when investigating a crime scene what the key items are that need to be seized. Not simply offer a 'cover-all' service attending and seizing everything available without first applying thought as to whether there is scope to recover useable evidence and recording a rationale about the decisions taken so that we are seen to be open in our investigation processes.

To view my full report please visit: -
http://www.wcmt.org.uk/fellows/reports/burglary-crime-scene-investigators-perspective

Alison Williams
Winston Churchill Fellow 2014

Alison Williams is Crime Scene Supervisor with Avon and Somerset Police.

Shooting Incident Reconstruction Course
20-24th June 2016



The Society is organising a
Shooting Incident Reconstruction Course
with Michael G. Haag, Forensic Scientist, Firearm Examiner, Crime Scene Investigator and Reconstructionist

This course has:

- Frequent LIVE-FIRE components to it! You will see how the evidence at shooting scenes is generated.
- Practical, hands on trajectory measurement techniques, and a comparison of known impact angles to measured angles in walls, cars, other objects and materials.
- Training in correct usage of trajectory analysis equipment (rods, lasers, protractors, 3D laser scanners, and more).
- A thorough review of small arms ammunition and projectile design characteristics critical to shooting reconstruction.
- Examination of shooting reconstruction as a well founded aspect of forensic science.
- Review of common questions and issues in shooting incidents. (Case illustrations).
- Instruction in shooting incident investigation and reconstruction procedures, as well as basic crime scene procedures.
- Case investigation approach and philosophy.
- Cover the properties of specific terminal ballistic events (shot sequence, direction of fire, etc).
- Examination of projectile penetration, perforation, and deflection characteristics of; sheet metal, glass, wall materials, wood, tyres, and more!

For further details and to book visit the events pages now.

Visualising a Crime Scene using Novel Crime Scene Documentation Technology

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Abstract

The ability to document crime scene environments in a safe, timely and efficient manner is an integral aspect in the early stages of any criminal investigation. Current methods for documenting crime scenes rely heavily upon digital photography to capture a scene in its original state. In order to meet the demand of technological expectations of juries and law enforcement personnel, forensic investigation findings need to be clearly visualised. Traditional verbal methods of presenting evidence from crime scenes are no longer sufficient and advances in technology have produced systems which allow an entire scene to be documented quickly and efficiently, using spherical photography or 3D laser scanning. This technology allows users to visit a scene without having to be physically present and allows users to view the entire scene as opposed to only the information or evidence deemed relevant at that time. The technology provides a visual presentation tool and allows juries to better understand the evidence they are presented with, providing contextual relevance and conveying spatial relationships within a scene; an aspect that still-digital photography cannot offer.

This paper discusses some of the crime scene visualisation and presentation technologies, which are available to police forces, including the benefits and limitations of this technology and recommendations for future use of technology.

***Keywords**:* Crime Scene Documentation; Digital Imaging Technology; Crime Scene Recording; Panoramic Imaging; Spherical Photography, Laser Scanning.

1.Introduction

There are currently 43 independent Police Services operating within England and Wales, each with their own procedures for documenting crime scenes. Due to the nature of crime scenes and the ephemeral evidence that they present, it is a challenging task for Scenes of Crime Officers (SOCO's) to document (Komar *et al,* 2012). Crime scenes are unstable environments, which are often short lived and present difficult types of data to visualise easily and effectively to other individuals who were not present at a scene, particularly a jury (Gardner, 2008; Howard *et al,* 2000). Many Police Services rely primarily upon laborious manual methods for documenting crime scenes (Stranberg, 2015) including contemporaneous notes, sketches and digital photography (Chan, 2005; Komar *et al*, 2012; Carrier and Spafford, 2003).

Still-digital photography is extensively used for comprehensively recording a crime scene and capturing images of evidence items within a scene (Robinson, 2010) as it provides a visual representation of the scene as it was at the time (Milliet *et al,* 2014). Digital photography is known to be one of the best methods for conveying information to individuals in order for them to retain and understand that

information, more clearly than is possible with verbal descriptions (Tung *et al,* 2015; Schofield, 2009). Complex crime scene information can easily be conveyed through a photograph as 'A picture is worth a thousand words' (Whitney and Greenberg, 2001). However, a still-digital photograph is limited in its ability to present spatial information or relationships of evidence within a scene (Tung *et al,* 2015).

2. Modern Technology Integration

With the continuous development of new technologies, there is the continuing need for more innovative and novel solutions for documenting and managing crime scenes that can improve performance and the quality of service given to the public (Association of Chief Police Officers, 2012). Criminal investigations are a very time consuming and laborious task and Police Services are continually striving to improve and develop the speed of these processes (Baber *et al,* 2006). The basic techniques of crime scene examination have remained in place for many years; however modern technologies are presenting more effective and efficient solutions (Association of Chief Police Officers, 2012).

Traditional verbal methods of presenting evidence from crime scenes are no longer sufficient, and significant advances in technology development over recent years have produced systems, which allow an entire scene to be documented quickly and efficiently, using spherical photography or three dimensional (3D) laser scanning. With a drive to improve efficiency and effectiveness with criminal investigations, the adoption of this type of technology is becoming more popular with police (Chan, 2001) for recording and visualising crime scene environments, and for use as visual presentation tools to assist viewers in understanding the environment layout (Fowle and Schofield, 2013) and conveying the distribution of evidence (Tung *et al* 2015).

There are a range of different digital recording technologies that are being utilised by police including photographic technology, which produces panoramas through stitching many images together using software such as Photosynth, or more recently automated panoramas which eliminate the requirements for stitching, and point cloud 3D laser scanning technology (Cavagnini *et al,* 2009). Panoramas or 3D representations can convey spatial perception and enable perpetration of a scene at anytime, including taking measurements and adding in linked information (Dang *et al,* 2011).

Both panoramic cameras and 3D laser scanning equipment consist of two main components; a hardware component, the actual scanning device, whether this is the laser scanner or the panoramic camera, and a software component. The software component presents the scene allowing navigation through and perpetration of the scene without having to be physically present. In addition to presenting the scene, other evidentially useful information can be added into the scene as 'hotspots' containing data in various formats such as video, audio, text files or PDFs, and image files. Both laser scanning and panoramic photography technology enables a user to gain a 360^{o} by 180^{o} view of a scene but through the production of different outputs (Galvin, 2009). As a result, the two categories of technology should not be confused but can both offer significant benefits to the criminal investigation process.

The technology provides a visual presentation tool and is allowing juries to better understand the evidence they are presented, providing contextual relevance and conveying spatial relationships within a scene, an aspect that still digital photography cannot offer. The visualisation of such complex information and evidence allows for a faster interpretation and comprehension (Fowle and Schofield, 2013).

360° photography

Spherical or 360° photography is a photographic technique that combines a series of photographs taken from a single position around a central point (Tung *et al*, 2015) and creates a highly detailed visual representation of a scene. The stitching of these photographs together using various software applications creates a panorama presenting a 180° by 360° field of view of an entire scene, floor to ceiling (National Institute of Justice Technology Center of Excellence, 2013; Marsh, 2014). Traditional methods involve taking a series of photographs at overlapping intervals and stitching the resultant images together, however technology development has created automated systems which eliminate the need for stitching and produce a spherical panorama in one photograph.

Figure 1: 360° panoramic photograph captured using the Spheron VR SceneCam. JPEG Equirectangular projection.

Figure 1 shows an Equirectangular projection of a scene captured using the Spheron VR SceneCam. This is 3D data, which has been flattened onto a 2D plane and as a result presents distortion. Using the SceneCenter complementary software application, a user is able to stand in the centre of the scene and navigate through the environment left, right up and down and can interact with the scene, taking measurements and zooming.

3-D Laser scanning

Laser scanners, particularly time of flight scanners, operate using the principle of the speed of light and as a result, distances of objects can be calculated easily using the laser. The laser is emitted within an environment and once this reaches an object, it reflects back to a sensor within the laser-scanning device. Using the time it took for the laser to be emitted, reflect off the object and back to the sensor, the distance of that object can be calculated (Sansoni *et al,* 2009). As a result, laser-scanning techniques can quickly capture a scene producing highly detailed point cloud data along with millions of measurements. Laser scanning enables 3D documentation of a scene and the data captured can be used to create digital reconstructions and simulations of events that may have occurred at a scene (Buck *et al,* 2013). This technology has been adopted for more complex crime scenes, such as Road Traffic Collisions (RTCs) where significant numbers of measurements need to be recorded, due to its speed in comparison with manual recording of measurements, which can be slow (Komar *et al,* 2012).

Figure 2: 3D Laser Scan data with colour captured using the FARO Focus 3D X 330 Laser Scanner.

Figure 2 also shows an Equirectangular projection of the scene but using the FARO Focus 3D X 330 Laser scanner. The image shows distortion as it is presenting 3D data on a 2D plane and utilising the complementary software removes the distortion and allows the user to navigate through the 3D environment taking measurements and zooming.

3. Methodology

This paper identified a few specific criteria that should be considered by Forensic Investigators seeking to purchase crime scene documentation technology. These criteria consisted of lens type, image resolution, field of view, minimum capture time, storage format, storage device, whether the camera utilises High Dynamic Range (HDR), battery life, cost, whether additional lighting is available and whether measurements can be taken. To gather information about what forensic personnel consider when adopting a new piece of technology, discussions were conducted with Forensic Investigators from Police Services in the United Kingdom. To obtain information and specifications about the technology described in this paper, manufacturers of the technology were contacted, and where this was not possible, literature searching was conducted to obtain details from manufacturer websites.

The technology discussed in this paper is not an exhaustive list and does not imply that these are the only crime scene documentation technologies available to forensic investigators. The technologies which have been chosen for inclusion in this investigation represent a range of documentation technology which is available to police forces, nor are they the only technology which each company provide. These technologies represent a spectrum of some of the crime scene documentation technology available.

4. Results and Discussion

Police forces have to consider many factors when considering the adoption and integration of technology into their current practices. Some of the main considerations are how much the equipment costs, how often it will be utilised for cases and whether it will provide any probative value to the organisation and the crime scene investigations conducted (Koper *et al.* 2009).

The very nature of the crime scene documentation process requires that any new element within that process needs to be implemented in a risk free manner without complications (Association of Chief Police Officers. 2012). As a result, agencies need to invest a considerable amount of time evaluating the technologies to determine which is most appropriate to suit their needs – time which they currently don't have.

Table 1: Crime Scene Documentation Technology Specifications

Photographic Technology											
Technology	**Lens Type**	**Image Resolution**	**Field of View Vertical x Horizontal**	**Minimum Capture Time/ seconds**	**Storage Format**	**Storage Device**	**HDR/ f stops**	**Battery Life/ hours/ shots per charge**	**Cost***	**Additional Lighting**	**Measurements**
iStar Fusion	Fisheye f 2.6 (x4)	50MP (10000 x 5000px)	180° x 360°	5	nctri	SD Card or USB 2.0 transfer	HDR 3	5-6	£4,750	LED panels	Not currently – software in development
Panoscan MK-3	Mamiya 645 format. Fisheye	(9000 x 18000)	180° x 360°	7	TIFF and Adobe PNG	Hard Drive USB 2.0	HDR 12	6	~ £41,500 with software	Optional Lighting Unit	Yes using photogrammetry
SceneVision Panorama	Nikon Coolpix P300 (Or comparable)	16MP	Panorama Mode 180° x 360°	Less than 240	JPEG	SD Memory Card	----	240 shots	~£1616 US equivalent **	Flash on Camera	Yes using photogrammetry
Spheron SceneCam	Fisheye f 2.8	50 MP	180° x 360°	7	sph	USB 2.0	HDR 26	8	~£60,000	Quad column white LED array	Yes using photogrammetry
CSI:360	Sigma 8mm f/ 3.5 Fisheye Nikon D7200	16MP	180° x	4 shots at 90° intervals	NEF (RAW) or JPEG	USB hiSpeed Card reader SD Card	----	850 shots	£3906.00 US equivalent	Speed Light kit included	Not currently
Laser Scanning Technology											
	Range	**Distance Accuracy**	**Field of View Vertical x Horizontal**	**Measurement Speed/ points per second**		**Storage Device**	**Battery Life /hours**	**Cost**	**Additional Lighting**	**Measurements**	
FARO Focus X 330	0.6m up to 330m	+/- 2mm	180 x 360	Up to 976,000		SD Card	4.5	~£45,000	Not needed	Yes	
Leica Scanstation C10	Up to 300m	+/- 2mm	180 x 360	Up to 50,000		SSD or USB Transfer	3.5 (internal) 6 (external)	~£97,000	Not needed	Yes	

*Costs are approximate **Higher Price outside the US

Advancements in technology have enabled some scene of crime officers to go paperless, through utilisation of modern technology. Table 1 details a range of different systems for capturing a crime scene which are available to police forces, ranging from low cost manually operated systems to higher cost high end automated systems. All of these technologies aim to create the same output; a panoramic representation of an environment, whether through photographic or laser scanning methods. Both panoramic imaging and 3D laser scanning techniques produce a permanent visual record of a scene in its untouched and original state (Strandberg, 2015).

At the lower costing end of the technology spectrum, photographic systems such as CSI:360[1] and SceneVision[2] Panorama utilise standard Digital Single Lens Reflex (DSLR) cameras as the environment capture method. This is not dissimilar from how crime scenes are currently captured, however, the companies have created their own rotating stage for the camera to attach which allows the camera to remain in one position but turn on a central axis. Additional components can be added to these systems as a range of packages sold by the manufacturers; the lens types can be changed on the camera system and additional lighting packages are available to account for low lighting scenes.

Photographs captured with these systems require the use of stitching software to allow multiple digital images to be collated to create a panorama. Each manufacturer provides its own software application to allow users to import their photographs and stitch them to create a panorama of a scene. These applications reduce the requirement to have extensive knowledge and experience of software stitching applications, previously needed with other applications.

At the opposite end of the spectrum are the more automated and higher cost photographic systems such as the Panoscan Mk-3[3], iStar Fusion produced by NCTech[4], and the SceneCam produced by Spheron VR Ltd[5]. These systems have been created to eliminate the requirement for manually stitching photographs and the complementary software applications automatically process the images to create spherical panoramas. Both of these systems have been designed so that anybody can operate them, and no previous photographic experience or knowledge is needed, as capturing an environment is a simple button press operation. The Spheron SceneCam has the ability to take measurements of a scene, using photogrammetry, which is the process of taking measurements from a photograph, using triangulation methods. The iStar system currently cannot take measurements, but a software application is being developed so that measurements may also be taken (iStar, 2015). Photogrammetry as a technique itself is not as accurate as laser scanning systems (Chavalas, 2015).

All of the photographic systems discussed create an end product of full spherical immersive images and produce virtual tours, whereby individual panoramas can be 'linked' so users are able to 'walk through' the scene viewing it from each camera position.

Laser scanning systems such as the Leica[6] ScanStation C10 and FARO[7] Focus X 330 can capture a 360^{o} x 180^{o} view of a scene in the same way that the photographic systems do. Due to the fact that these systems use a laser, the ranges of these systems are far greater than that of the photographic systems, which are limited by their resolution, and the number of pixels used to create a panorama (Chavalas, 2015).

Advantages

Traditional methods of investigating crime scenes involve capturing a scene and those items within that scene which the investigator deems relevant at the time of the investigation. Panoramic photography and 3D laser scanning methods can eliminate this 'what is relevant at the time' issue as the whole environment is captured in a single scan. This technology has been developed to make criminal investigations more efficient and they can speed up the crime scene documentation process significantly (Crambitt and Grissim, 2010). In addition, each of them has the ability to transmit the data on a real time basis, so personnel not at the scene can quickly view the scene as it is captured.

Laser scanning and panoramic photography methods are often considered to be two completely separate entities and they are in respect of their methods for capturing an environment. However, one of the major advantages of both the panoramic imaging technology and the 3D laser scanning technology is that they are complimentary to one another and can be used together to create highly accurate and highly detailed crime scene reconstructions (Strandberg, 2015). The Leica Scanstation C10 and FARO X 330 laser scanners can be used to create point cloud data of a scene but can also utilise other photographic systems to provide colour to the data. Utilising the highly accurate point cloud data from the laser scanner and the highly detailed colour panoramas from the photographic equipment, a highly accurate and very detailed visual representation of a scene could be created.

Limitations

As with any new technology integration, there are limitations that have to be considered before adoption. Due to the costs of some pieces of equipment a decision to implement technology must be based upon criteria demonstrating effectiveness and value for money. Forces must assess whether the technology will be cost effective and how frequently it will be utilised to justify its purchase. In addition forces need to consider whether it will be compatible with already enforced operational systems or whether this new piece of technology will become an add on to existing systems.

Due to the lack of technology integration into the Courtrooms, these systems could not yet fully replace traditional digital photography, as these images are still required in most courtrooms. However, with the Digital Reform stating that all courtrooms will be paperless by 2016 and the digital by default plan (Ministry of Justice, 2014), traditional digital cameras may no longer be needed and may be superseded by these more advanced systems.

Police forces do not have the time or financial resources to conduct research investigating which technology is available to them that may aid in the investigation process and police are therefore not able to maximise the opportunities that technology could provide them (Association of Chief Police Officers, 2012). To aid forensic investigators in making these decisions about which particular type of technology to adopt, based upon the needs of that department, which will differ for the 43 existing services across the country, a comprehensive comparison study of different crime scene documentation technologies available should be conducted.

To date only one evaluation study has been conducted looking at three panoramic imaging technologies; SceneVision Panorama, Panoscan MK-3 and the Leica Scanstation C10. This investigation was conducted by the National Institute of Justice (NIJ) in America and focused upon hardware, cost, training, set up and calibration, data capture, image capture, software requirements and processing, and presentation preparation, as the categories with which each technology was evaluated (National Institute of Justice Technology Center of Excellence. 2013).

To build on the study conducted by the National Institute of Justice research is currently being conducted at Staffordshire University comparing and contrasting crime scene documentation and visualisation technologies, based upon criteria determined through discussions with Forensic Investigation Managers. Manufacturer specifications provide services with an overview of a piece of technology, but Police Services need to consider much more than those alone when adopting new technology and must consider how the technology will be used operationally in the field.

The technologies will be critically analysed to determine how accurate and precise the measurements taken with each system can be and what parameters can affect these measurements. The accuracy and precision of the measurements will be further evaluated in complex environments such as fire scenes to determine whether the measurements accurately represent the scene. The research aims to determine any photogrammetry and measurement issues that arise in different scenes and to suggest any potential solutions to these identified issues.

5. Conclusions

The adoption of technology, and in particular deliberation over which piece of technology, needs to be considered and assessment made as to whether it will facilitate Police services requirements and produce minimised risk to current procedures, operations and outcomes. The adoption of these technologies can be affected by many factors, ultimately the cost of the equipment and how they will be used operationally within a service. Future advancements in the portability, cost, speed of capture and the accuracy of these systems will facilitate the increase in adoption. These methods for documenting crime scenes will not replace current digital imaging processes at crime scenes, such as close up photographs of evidence, but these newer systems will be a welcome addition to more complex crime scenes.

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[5] Spheron – www.spheron.com/home.html
[6] Leica - www.leica-geosystems.co.uk/en/index.htm
[7] FARO – www.faro.com/home

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Following on from the last issue of CSEye Dr Paul Yates of Intelligent Fingerprinting Ltd talks more about the company's new drug screening technology...

Revolutionary test provides early drug use intelligence for coroners at the touch of a fingertip

A new non-invasive drug screening technology developed by a British company could bring significant benefits to coroner services in the UK and beyond. Cambridge-based Intelligent Fingerprinting has developed a mobile drug screening device which detects recent drug use by analysing of a person's fingertip sweat for drug metabolites. The device, which can be used with the deceased as well as the living, has potential for use in mortuaries to provide early intelligence on possible cause of death, helping coroners to prioritise when costly post mortems are needed and enabling earlier release of bodies to relatives.

Last year 226,841 deaths were reported to coroners in England in Wales. Of these around 90,000 required a full post mortem examination to assist in determining cause of death and inquests were opened into almost 26,000 deaths *.

Post mortems and inquests are costly and time consuming to administer. Currently, if recent drug use (whether illicit or pharmaceutical) is suspected of contributing towards a person's death, the coroner is obliged to request a post mortem to enable toxicology tests to be carried out. This is because conventional screening techniques require the invasive collection of body fluid or tissue samples for analysis and they cannot be obtained from the deceased without an official post mortem. However, the new fingertip sweat-based technique is wholly non-invasive and sample collection is quick and easy. The device will screen for up to five drug groups simultaneously, providing results in under 10 minutes.

The new device is the first product to be released by Intelligent Fingerprinting, a company specialising in the development of non-invasive, fingertip sweat-based diagnostic screening technology. The cutting-edge technology detects drug metabolites within a person's fingertip sweat. Metabolites can be detected in sweat for many hours after the initial substance was ingested, providing a valuable insight into the drugs which may have been used immediately prior to death.

In 2012 Intelligent Fingerprinting secured funding from Innovate UK, the UK's innovation agency, to enable a feasibility study in conjunction with Mr Christopher Dorries, HM Coroner South Yorkshire West Area to trial non-invasive drug screening of the deceased and test the potential of the new technology as a tool to help determine a possible cause of death more quickly and cost effectively and inform the decision whether to proceed with a post mortem or inquest.

Building on the promising preliminary results and following a presentation of the pilot project data at the 2015 Coroner's Society of England & Wales Annual Conference, Intelligent Fingerprinting is widening out its study to include in-situ mortuary tests at nine further coroners' offices during the first part of 2016. The new device is expected to launch commercially in 2016.

www.intelligentfingerprinting.com

- *The Ministry Of Justice Statistics Bulletin 'Coroners Statistics 2014 England and Wales'.*

Evidence Management Systems are the Standard for Collection and Analysis

By Robin Gall, Ph.D.

The success of a criminal investigation depends on thorough and accurate collection and analysis of evidence found at the crime scene. In recent years, the use of Evidence Management Systems (EMS) has become a major trend in forensic labs throughout the U.K. These systems are regarded as essential tools helping forensic analysts work more efficiently to support the full evidence lifecycle from scene of crime to court.

Combine Evidence Analysis and Quality Management

Many forensics laboratories are streamlining evidence documentation with EMS solutions, as they provide out-of-the-box functionality. For example, Abbott's web-based laboratory information management system, the STARLIMS Forensics solution, may be adapted to serve the needs of most law enforcement organisations. The forensics package addresses all aspects of criminal investigations, including crime scene evidence collection, property management, laboratory analysis, court testimony, and quality-assurance activities. A single comprehensive system, such as STARLIMS, mitigates the need for purchasing and maintaining multiple interfaces for these related functions, yet is flexible enough to interface with existing systems that law enforcement organizations rely upon.

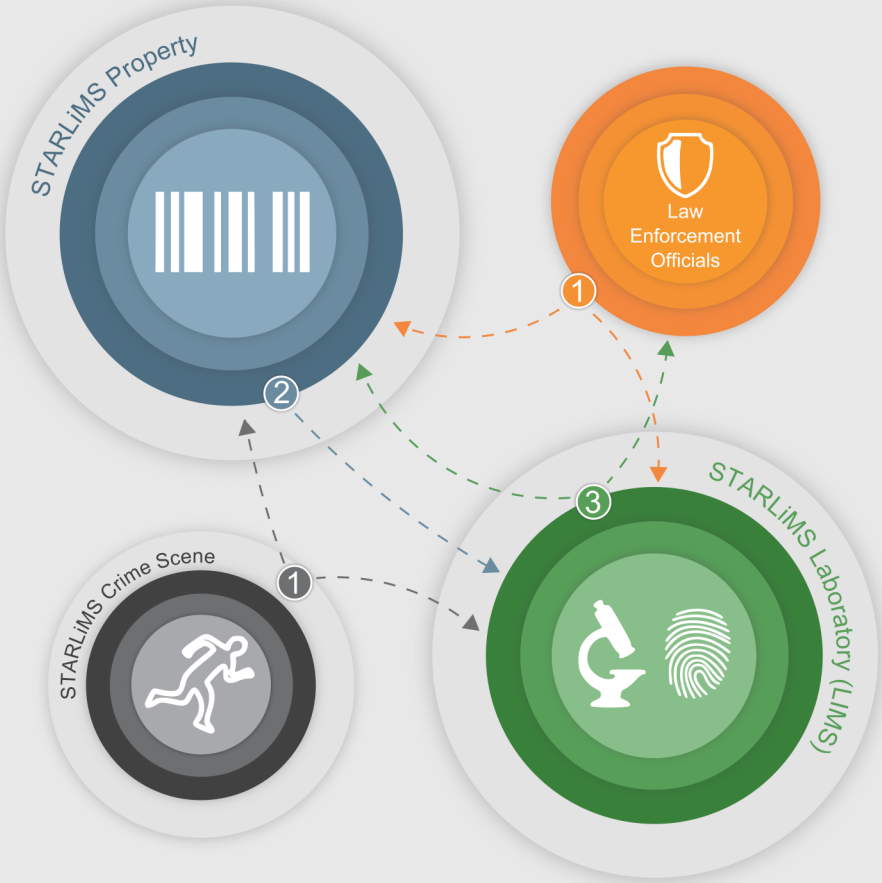
The typical forensics laboratory workflow includes evidence receipt, analyst assignment, chain-of-custody transfers, assignment of tests, results entry, and reporting and review. The system makes it easy to access data and pull all relevant information together when preparing for a trial. Evidence may progress through the forensics lifecycle without users having to re-input data time and time again.

Storing evidence information electronically saves a great deal of time for busy lab technicians. For example, instrument data is parsed automatically into predefined fields or worksheets, enabling analysts to concentrate on data interpretation more than data entry. All data from case notes, property receipts, submittal forms, instrumental results, and quality assurance activities are stored in the software and readily available with the click of a mouse. This capability enables technicians to prepare reports much faster because selected data are pre-populated onto the report and commonly used terms are easily inserted.

While it is important for law enforcement agencies to be able to process evidence quickly, software solutions should also offer ongoing quality assurance checks to help labs achieve and support compliance with ISO 17025, the main standard used by testing and calibration laboratories. STARLIMS gives prompts to perform QA checks on instruments and reagents and document them. If an analyst enters or scans the barcode of an expired reagent, that reagent will not be available to perform a test. Also, for labs with new analysts in training, the system has checks to assure that trainees will be permitted to perform only the examinations for which they have been approved.

Other key features offered in the STARLIMS forensics solution include document control and equipment and materials management. The document management feature allows users to keep track of archived training manuals, standard operating procedures (SOPs) and other materials. Documents are linked to analyses, individuals assigned for review, and cross-referenced to quality standards they support. Individuals responsible for the documents may be identified and then alerted when it is time to review the materials. The system tracks all inventory and easily extracts lists of every case, exhibit and analyses for which a given reagent was used.

After the evidence data is analysed, users have the option to draft reports in Microsoft Word with unit-specific templates and version control, and save final reports as PDF files for manual or digital distribution.



An EMS Must be Compatible with Mobile Devices

Today, most law enforcement and judicial networks permit connections with smartphones and tablet devices, and forensics laboratories are evaluating the abilities of their EMS to allow appropriate tasks to be performed on mobile devices.

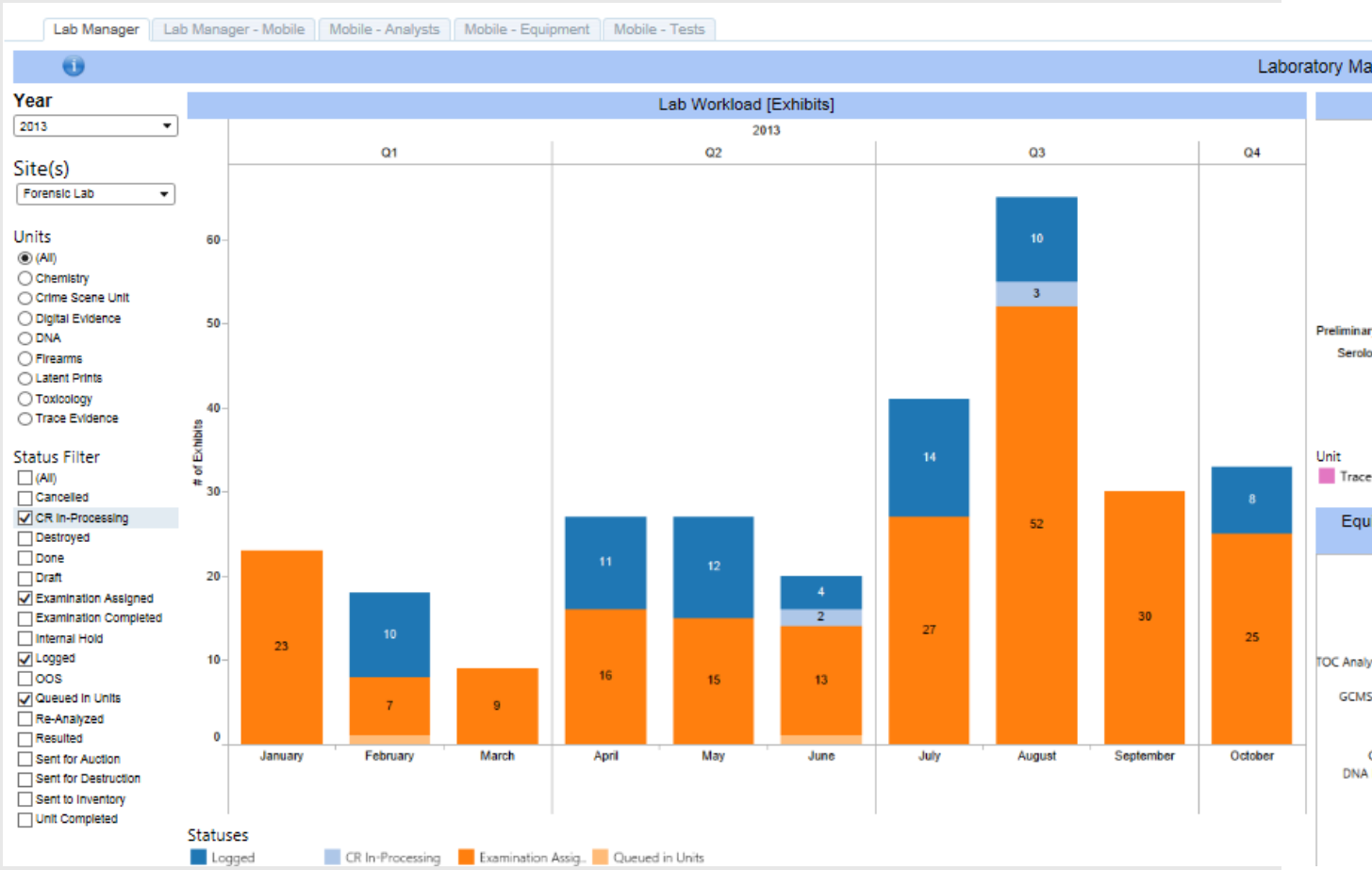
Clearly, EMS solutions should have robust, easily adaptable mobile applications. The days of being tethered to a desktop in order to interface with the EMS are over. The guiding principle should be whether EMS solutions enable users to use the right screen—desktop, laptop, smartphone or tablet—for each task.

Selecting the right screen for the task enables lab managers to view laboratory key performance indicators remotely or to authorize and release urgent results. Prosecutors should be able to view evidence sample status and released results in real-time without calling busy laboratory staff. STARLIMS software creates forms to run on alternative browsers and includes a single mobile application. The software allows access to Chrome, Safari and other alternative browsers and permits display of EMS information on tablets and smart phones.

Advanced Analytics Turn Data into Actionable Information

Another potential advantage of EMS solutions is advanced analytics, which offers powerful visualisations for users to view data, providing them with insights and trends to help make better decisions. Workflow and productivity data may be accessed on the spot for prompt analysis and decision making. STARLIMS software offers advanced analytics capabilities with out-of-the-box dashboards that make an immediate impact on law enforcement operations, such as optimising workflow and identifying bottlenecks.

Agencies get fast answers about case loads; case breakdowns by unit, analyst or offence; turnaround times for various agencies served by the lab; number of cases out to court, number and type of crime scenes worked year after year, number of corrective actions in a given year; and repair histories for lab instruments.

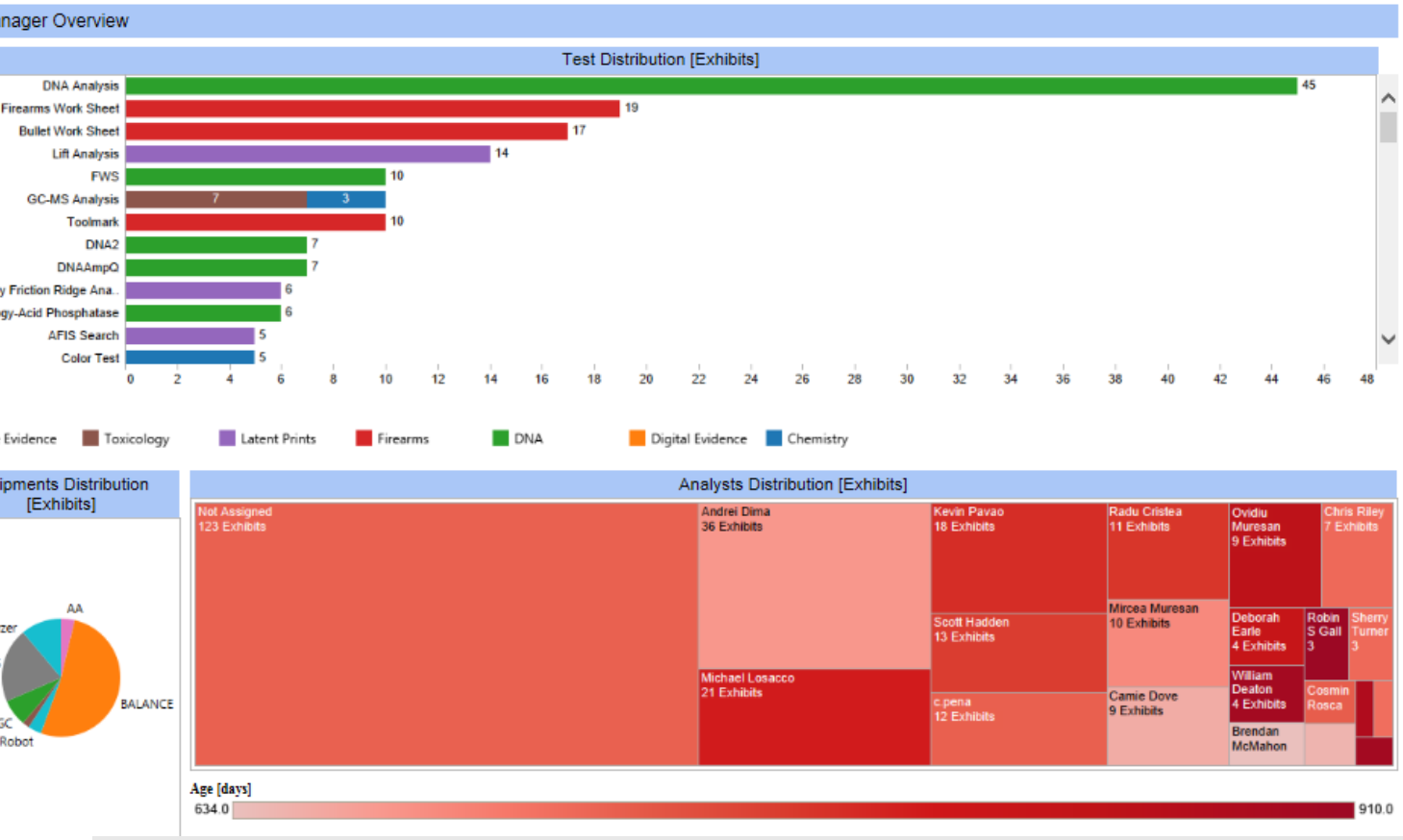


Crime Scene and Property Solution

Collecting evidence at a crime scene is an intricate and tedious process. Just one mistake could have a disastrous impact on the disposition of a criminal case. As a web-based crime scene solution, STARLIMS offers a comprehensive application designed to help streamline the evidence-documentation process. For example, when evidence is barcoded and entered into the EMS at the scene, standardised drop-down lists and crime scene processing checklists improve efficiency and ensure accuracy. Every piece of evidence is documented and tracked from crime scene to courtroom.

In the property warehouse, every item must be tracked at all times. Loss of evidence is not an option. STARLIMS offers real-time tracking, documentation and reporting. Barcodes assure efficient transfer and chain of custody, tracking evidence from receipt through disposition, including destruction, auction or return to owner.

Given the pressures faced by law enforcement agencies today, it is essential to employ the most up-to-date information management technology to better assist analysts with efficient data entry, dynamic reporting, comprehensive documentation and effective quality control. Evidence Management Systems, such as STARLIMS, provide the right solution for tracking and accessing evidence from crime-scene collection to final deposition.



About the Author

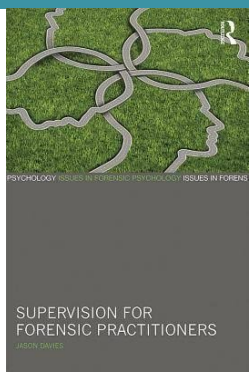
Robin Gall, Ph.D. is senior product manager of forensics in informatics at Abbott and is based in Hollywood, FL, USA.

For more information about STARLIMS, visit https://www.abbottinformatics.com

Book Reviews

Supervision For Forensic Practitioners

by Jason Davies



Published by Routledge,
ISBN: 978-0-415-63205-8 April 2015

Jason Davies is a Consultant Forensic and Clinical Psychologist with Abertawe Bro Morgabbwg University Health Board and Honorary Professor of Forensic Clinical Psychology with Cardiff Metropolitan University. He has worked as a practitioner in a range of forensic mental health settings and is well qualified to write such a comprehensive text on Supervision of Forensic Practitioners.

Supervision for Forensic Practitioners is a monograph that is part of a series on *Issues in Forensic Psychology,* which aims to promote forensic psychology to a broad range of forensic practitioners, by providing analysis and debate on contemporary issues. The series provides a forum for publishing and promoting the work of forensic psychologists and associated professionals.

The author has covered his subject in detail and across a considerable number of subject headings as follows:

- An Introduction to Practice Supervision
- The Emerging Evidence Base for Practice Supervision
- Supervision Types, Forms and Tasks
- Supervision Models and Frameworks
- Approaches to Learning in Supervision
- Being Supervised
- Core Skills and Knowledge for Supervision
- Managing Risk and Boundaries through Supervision
- Developing Supervision in Forensic Practice: Structures, Systems and Audit
- Supervisor and Supervisee Training and Development

Special Topics

- The Impact of the Setting on Supervision
- Ethical Issues
- Supervising Group Work
- Supervising Non-client Work: Research Leadership and Management Activity
- Critiques of Supervision and Reflective Practice
- Overcoming Problems in Supervision
- Creative Approaches to Supervision
- Assessments and Measures for Use in Supervision and Research
- Team Supervision
- Reflective Practice

The End of the Beginning: Summary, Observations and Future Directions

I echo what has been stated by various colleagues in their glowing reviews of this valuable work. The combination of ten comprehensive chapters with a focus on specific themes and an additional ten special topics provides those involved in supervision with a comprehensive and an essential resource. This monograph should be read and retained as a reference by Leaders, Managers, and Supervisors, as they practice their daily supervision activities as well Students and Researchers, who are involved in studying and advancing the subject of the supervision process, particularly in a forensic setting.

The thrust of this monograph is aimed primarily at the forensic medical fraternity, aiming mainly at those practicing in mental health. The author has indicated, and it certainly 'reads' that way, that the monograph is aimed at all those working in forensic settings who have direct contact with

the perpetrators and victims of crime and is written for both those new to supervision and those with many years' experience.

As a forensic practitioner involved in the science side of forensic practice as a practitioner, supervisor, manager and leader, I can see the value of this text across the entire discipline in the practice of Forensic Science. As everyone is well aware the application of forensic science is usually grouped, with some variance, as follows:

Field Sciences
Crime Scene Investigation
Fires and Explosions
Clandestine Laboratories
Fingerprints
Firearms Examination

Medical Sciences
Pathology
Psychiatry
Psychology
Forensic Medicine
Forensic Dentistry
Anthropology

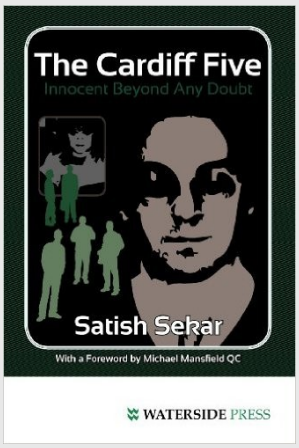
Laboratory Sciences
Chemistry
Biology
Botany
Toxicology
Drugs
Questioned Documents
Electronic and Computers

I can see this monograph as a resource for learning, applying, and as a reference for all forensic practitioners involved in the application of forensic science no matter what their core subject is and their contribution to the overall subject of forensic science.

This text is well written and an extremely valuable addition to the forensic literature. It would be an asset for any forensic science laboratory library and a very much required addition to the libraries of those directly involved, both as supervisor and supervisee, in the day to day supervision of any Forensic Facility as well as those advancing the subject of Supervision for Forensic Practitioners by research.

John Horswell
MSc MPM MA FSSocDip FCSFS

The Cardiff Five: innocent beyond any doubt
By Satish Sekar



Published by Waterside Press, 2012 , 978-1-904380-76-4

Firstly, this book was published in 2012 and this review is in early 2016 so there has been a three year gap. However, given the speed at which most miscarriage of justice cases take to be independently reviewed this is no more than the blink of an eye, which in itself should be unacceptable.

This book relates largely to the murder of Lynette White in Cardiff in 1988 following on from which five men stood trial, two were acquitted and three were convicted and sentenced to life imprisonment. Eventually, the real and sole killer was convicted and DNA analysis played a significant role.

The book is written by a man with passion for this case. In my experience, miscarriage of justice cases do not get overturned without at least one person, and preferably a team, constantly driving into the criminal legal system and often against the odds, over many years, in order to get a proper review undertaken – clearly Mr Sekar was one such person.

As with many miscarriage of justice cases, there were multiple twists and turns and some truly bizarre events had to be accepted by the criminal legal system in order for the scientific results to be explained, the police investigation to continue along its track and ultimately convictions to be achieved. In the case of the murder of Lynette White one scientific issue (there were, as is often the case, several) was with blood grouping: either the Cardiff Five plus another person never previously mentioned by the Police had to be involved in order to account for the blood group results, or one person (not including any of the Cardiff Five) acted alone and it was that person's blood that was present at the scene. The system chose to accept six offenders contributing to one blood result rather than consider the far more likely scenario of one person and the police investigation being incorrect.

Time of death issues and offender profiling also occurred in this case, the details of which are morbidly fascinating and disturbing because they will be familiar to anyone involved in crime investigation. Having said that, the care with which the scene was re-examined and samples collected from underneath paint years after the crime occurred are impressive and, much as I am loathe to say it, would have a great place in an episode of *CSI* – and actually be an accurate portrayal of forensic science for a change.

Mr Sekar's passion for the case is apparent throughout this book. The stories of the Cardiff Five and the other cases to which he refers are incredibly important. At times though it seemed the passion caused some of the detail to be a bit jumbled for a reader unfamiliar with the case to follow and a certain amount of repetition crept in.

However, there can be no doubt that there is a need for books to be written and education to be provided about how these cases occur in the hope that their occurrence diminishes in the future. Miscarriages of justice occur wherever people are involved in making decisions about how they think crimes occurred; I have been involved in re-investigation of three of New Zealand's most high-profile such cases and there are more on the horizon, so the issues raised by Mr Sekar are international and current.

It is critical there be transparency and open reporting of such cases and this book adds to the growing pile of publications that have been written and need to be written so that we do not become complacent and accept that miscarriages of justice are simply a cost of the investigation of crime. As stated by Michael Mansfield QC in the Foreword, "Questions asked behind closed doors by internal reviews are self-serving and left to collect the dust of darkness."

As for the point raised by Mr Sekar towards the end of the book, "Knowingly allowing the innocent to suffer wrongful imprisonment, whether convicted or not, should carry a penalty" - anyone who learns about potential miscarriages of justice should not disagree.

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10 years of 1:1 taping in Belgium: A selection of murder cases involving fibre examination

K.De Wael, L.Lepot, K Lunstroot, F.Gason
National Institute for Criminalistics and Criminology, Brussels, Belgium

Highlights

- Literature review on 1:1 taping and zonal taping
- Review of fibre examinations in 36 murder cases in which 1:1 taping was used
- High percentage of fibre examinations with "positive outcome"
- Useful findings for cases in which 1:1 taping is used to verify statements of suspect
- Advantages, inconveniences and points of interest are discussed using case examples

Abstract

Since 2002, the 1:1 tape lifting technique on murder victims has been introduced in Belgium. Thirty-six murder cases for which a fibre examination was carried out in our laboratory between 2002 and 2012 are reviewed. These cases all involved the collection of microtraces on 39 victims using a 1:1 taping or similar technique, called semi 1:1 taping. The degree of "positive outcomes" for investigative and comparative fibre cases is high. Especially in cases where the modus operandi of suspects had to be verified, the examination of the 1:1 tape lifting led to very useful fibre results. The findings from some of these fibre cases are used to illustrate the advantages, drawbacks and points of interest of the two collection techniques. These are also compared with the zonal taping technique, another microtrace collection technique applied on victims at the crime scene.

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Date: 20-24 June 2016
Venue: EPA's purpose built facilities, Lincoln

Postgraduate Research Symposium
Date: November 2016
Location: tbc

Autumn Conference & AGM
Date: November 2016
Location: tbc

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Date: December 2016
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