Forensic science report: Mrs Ward

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Abstract. In autumn of 2018 we received a new case. According to the testimony of Gordon Ward, him and his wife, the victim Anne Burth, were mugged in their car at 3 pm. Anne Burth refused to give her jewels and after a struggle, the mugger shot Gordon on the shoulder and then shot Anne on the forehead. The mugger run away and Gordon run to the opposite direction looking for help. As a result, 15 minutes later, he came across Alan Dougan, who went back with Gordon to the crime scene. Finally, the ambulances and the police arrived.Anne Burth was known to have lots of enemies due to his behaviour. Her principles led to enminities for different reasons. She was used to discriminate against people by the wealth of their families and also to discover dangerous secrets. Between the lifes in which she interfered, we can distinguish the love between Alexandra Burth and James Andrews, the mysterious Bill Thompson, Debbie Anderson, John Branks and Stephen Blue.After giving this general overview, we did pick up different evidences from the crime scene: fingerprints from the handle of driver's door, a cartridge shell, white dust scattered over the co-driver's seat, hairs and fibres on a jumper, a red liquid, a plastic… to find out more details about the crime.

1 INTRODUCTION

Forensic science techniques are often used in criminal trials to infer the identity of the perpetrator of crime and jurors often find this evidence very persuasive. Unfortunately, two of the leading causes of wrongful convictions are forensic science testing errors and false or misleading forensic testimony. Therefore, it is important to understand jurors' pre-existing beliefs about forensic science, as these beliefs may impact how they evaluate forensic evidence in the courtroom. In this study, we examine people's perceptions of the likelihood of error and human judgment involved at each stage of the forensic science process (i.e., collection, storage, testing, analysis, reporting, and presenting). In addition, we examine people's perceptions of the accuracy of — and human judgment involved in — 16 different forensic techniques **[1]**.

Nevertheless, serious problems have persisted in the field of forensic science, and unfortunately have been given too little attention. Lamentably, some believe that there is little chance to reinstate criminalistics to its full potential **[4]**. Worse yet, there are newly

minted scientists who are not even aware of the legacy of criminalistics by virtue of incomplete educations and lack of relevant mentoring in favor of over-specialization. We are hopeful that this can be changed **[2]**.

2 ANALYSIS AND TESTING PROCEDURE

Analized evidence (materials and methods)

- Fingerprints
- Bullet shell
- Soil analysis
- Plastic analysis
- Hairs and fibres
- Blood
- Drug tests

Testing procedure

Fingerprints' analysis:
Fingerprints from gathered evidences were revealed by putting them with iodine pellets into an extractor hood. Afterwards, by sublimation, the solid iodine became gas. The fat of the gathered evidences reacts with the iodine so the reaction makes the fingerprints visible and ready for the study. We used the following chart to study it.

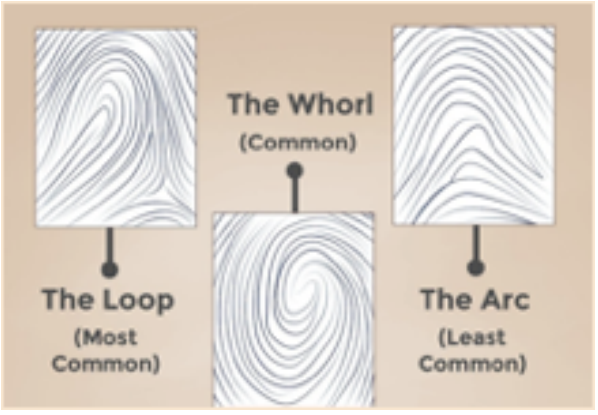

***figure 1**. General overview of a fingerprint*

The chart shows 3 different fingerprints' models. First of all, we placed the specimen on a clean, flat surface and examine it carefully under strong light with the magnifier. Depending on the specimen, you may see only faint orange smudges with little or no ridge detail , or you may see well developed orange fingerprints with considerable ridge detail.

Bullet casing:
Nowadays, there are two common methods for developing latent fingerprints on brass cartridge cases, both of which depended on the fact that the fat in the fingerprint residues coat the brass and prevent aqueous solutions from contacting it. The method we used, consisted on pouring 30 ml of hydrogen peroxide at 3% with 21 ml of acetic acid into a fask

In the crime scene we recovered a bullet shell made of an alloy of copper and zinc. By the method described in the previous paragraph, the aqueous solution reacted with the fat impregnated on the fingerprint so it became visible. With the revealed fingerprint we can proceed to the analysis explained in the “fingerprints` analysis” section.

Figure 2. *General overview of a bullet shell*

Soil analysis:

We collect an evidence in the crime scene from the tyres of the Mr. Ward car. When we had the main evidence we needed to compare the one that we already had with those we took from different parts of the surroundings. All this with the purpose of discovering where was the car coming from. Soil is one of the most common forms of physical evidence found at the crime scenes. But how can forensic scientists determine whether one soil specimen is consistent with another? After all, dirt is dirt? not at all, soil evidence by itself is seldom sufficient to secure a conviction because it usually establishes only the likelihood that a suspect person or object was present at the crime scene at some time, but not when that visit took place. Soil evidence can be exculpatory. For example, the police may suspect someone who has mud stains on her clothing that appear visually to be consistent with the soil at the crime scene. If subsequent forensic tests establish that the mud stains on the clothing are inconsistent with the soil at the crime scene, the police can redirect their efforts elsewhere.

First of all with a microscope we looked at the porosity of the different types of soil and the size each evidence has.

Later, we started with the main analysis by filling the different test tubes with 150 ml of water and then adding the main evidence at first and later on, the different types that we picked up from 5 different places. All this, because we wanted to know the density with the intention of comparing the data with the main evidence.

Table 1: Soil analysis' summary of results

ANALYSED SOILS	ORIGIN	MASS (g)	INCREASE OF VOLUME (ml)	DENSITY
Soil from the tyre	UNKNOWN	15,24g	9 ml	1,69 g/ml
Soil 1	JETTY OF ROSS PRIORY	52,99g	21 ml	2,465g/ml
Soil 2	CLADDOCHSIDE PARK	34,06g	29 ml	1,18 g/ml
Soil 3	LAGGANBEG CARAVAN PARK	61,64g	27 ml	2,28 g/ml
Soil 4	PORTNELLAN FARM	59,7g	23 ml	2,62 g/ml

Soil 5	LOCH LOMOND	59,54g	22 ml	2,71 g/ml

Plastic analysis:

First of all it is important to clarify what is the plastic analysis. This is an important part of the workload of any forensics lab. For example, a forensic scientist may be asked to examine plastic tail light fragments found at the scene of a hit-and-run accident to determine the make and model of vehicle from which those fragments originated. On the following chart it is all explained in a more visual way.

Table 2: Plastic analysis' summary of results

PLASTICS ANALYSIS	MASS (g)	INCREASE OF VOLUME (ml)	DENSITY (g/ml)	FLOATABILITY	RELATIVE ERROR
Pattern specimen	0.39	0.4 ml	0.975 g/ml	NO	
Vinyl polychloride	0.45	0.4 ml	1.125 g/ml	NO	5.39%
Polystyrene	0.44	0.4 ml	1.1 g/ml	NO	2.82%
Polyethylene	0.37	0.4 ml	0.925 g/ml	YES	5.13%
Polypropylene	0.40	0.4 ml	1 g/ml	YES	2.56%

We extracted a plastic from de crime scene and compared it in many aspects with 4 different types of plastics to obtain the composition of that piece of plastic. To compare those plastics we first measure the mass of all the different components. Then, we drop the plastics into a glass of water in order to see the increase of volume. After that, we measured the density. At that point we thought the material of the pattern specimen was the polyethylene but we decided to make the last test to be sure of our result. Finally, we did the flowability test and with that information we came across we were wrong and the material which corresponded to the pattern specimen was the polystyrene, as a result, Stephen Blue was forgive as the murderer because that was the only evidence which related him with the case.

Hairs and fibers:

Together with the other evidences we found out hairs and fibers. Obviously, it is not possible to distinguish hair from fibers at first sight. Nevertheless, it was useful to compare them by their size, colour and opacity for a more accurate conclusion.

To make a difference between hair and fibers it was necessary to incinerate them to answer questions like: How does the fiber burn, if at all? What odor is emitted by the burning fiber? Does the fiber continue burning when removed from the flame source? What does the residue look like?

As a result, we could have classified the evidences by five main classes of fibers: animal fibers, plant fibers, artificial fibers, reconstituted fibers and mineral fibers.

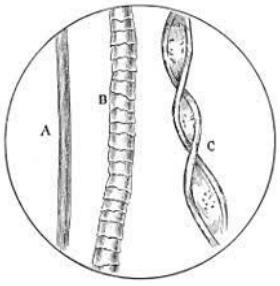

Figure 3. *General overview of hairs and fibres*

Drug test:

Drug tests are a major part of the workload of most forensic labs. The vast majority of forensic drug testing focuses on recreational drugs rather than pharmaceutical drugs, although, of course, many pharmaceutical drugs are misused for recreational purposes. Recreational drugs, for example, cocaine, have few or not legitimate medical uses such as oxycodone which have legitimate medical uses but are often divertered for recreational use. Finally, recreational drugs including those sometimes referred to as

This consists of combining different substances that produce three reagents. Scott, Mandelin and Marquis that by depositing these three items in which we put different drugs. Then, the color that was common in the three reagents was the drug. In the Mandeline reaction, we first weight 0.1 grams of NH_4V and drop it in a test tube, then add 10 ml of concentrated sulfuric acid (96-98%). In the Marquis reaction we did a similar job, dropping 0.25 ml of formalin reactive (37%) and mixed it with 10 ml of concentrated sulfuric acid.

Finally, in the Scott reaction we weight 0.5 grams of cobalt thiocyanate (II) and add it to 0.25 ml of distillate water. In the following image appears how this test was done.

Figure 4. *General overview of the drug test*

Blood:

Detecting blood, in the field and in the lab, is an important part of forensic work, but it is surprisingly difficult to establish unambiguously that a suspect strain is in fact blood. Even if obvious splatters or pools of blood-like material are found at a crime scene, it can not be assumed that they are blood. More than one investigator has been fooled by paint, or other liquids that resemble blood. Furthermore, bloodstains are by no mean always obvious.

To be sure that it is blood we made a reaction that makes excited 3-APA molecules quickly return to their base state, emitting photons that are visible as a characteristic weak blue luminescence, this happen due to the hemoglobine.

Figure 5. *General overview of the blood*

3 DISCUSSION

As I have said before, whilst acknowledging that forensic science critically needs strategic investment across every domain, forensic science needs to bring both ‘hedgehog’ and ‘fox’ **[5]** approaches together to address the roots of the major challenges the discipline faces.Addressing these challenges in a way that incorporates a holistic understanding of the complex matrix that is forensic science offers huge potential. However, just as a holistic understanding of the whole forensic reconstruction process is critical, the unifying principles of the ‘hedgehog’ and the identification of the range of factors that contribute to the complex landscape we are working within of the ‘fox’, are both fundamental **[3]**.

4 CONCLUSION

Although we collected some evidences we are not sure about who is the murder, we have had some results but we are not able to tell a final conclusion, as the evidences only tell as surely who was at the crime scene. Consequently, despite we have done all we could do, there is much more to investigate. In fact, even having all the information about the crime, it is not our job to find out the criminal.

5 ACKNOWLEDGEMENTS

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6 REFERENCES

1. Gianni Ribeiro, Jason M. Tangen, Blake M. McKimmie. Beliefs about error rates and human judgment in forensic science. Forensic Science International 297 (2019)

2. David San Pietroa, Brooke W. Kammratha, Peter R. De Forest. Is forensic science in danger of extinction? Science & Justice 59 (2019)
3. Martin Paul Evison, Forensic Science policy and the question of governmental University research quality assessment, Forensic Science International 290 (2018)
4. María Luisa Soria Forensic science in a process of transition. Red Esp Med Legal 44 (2018)
5. Brett O. Gardnera,, Sharon Kelleya, Daniel C. Murriea, Itiel E. Drorb.What do forensic analysts consider relevant to their decision making? Science & Justice