

PHOTOGRAMMETRY GOES TO TRIAL IN ELKO, NEVADA

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ABSTRACT

Measurements from photographs of fists and bruises were used by the prosecution as evidence in a murder trial to “positively” identify the defendant. Not only were their measurements wrong, but the whole concept that even good measurements could be used to identify anyone is what is called in the judicial system “junk science”. What is presented in this paper is a very shortened and chopped version of the full report. The full report can be seen at my website at <www.eriotech.com>.

INTRODUCTION

On September 27, 2005, three year old Ricardo (Ricky) Ortega. was beaten to death at a home in Elko, Nevada, and on December 5, 2005, at the Coroner’s Inquest, a young woman, Melissa E., was charged with the brutal murder based greatly on the evidence provided by a local surveyor acting as an expert witness for the prosecution. This evidence consisted of distances between knuckles as measured from photographs of fists of several persons who may have been involved in the murder. According to the prosecution, Melissa’s knuckle measurements were “positive identification”, matching bruises on Ricky’s head to within one millimeter.

On May 6, 2005, the Preliminary Hearing was conducted, and on May 18, 2006, I was contacted by the Elko County Public Defender’s Office (ECPDO) at the suggestion of a local surveyor and friend of mine and former employer of Melissa. I was offered the charge to verify or refute the measurements of the prosecution’s expert witness. I accepted the charge.

To say that the measurements were botched is the understatement of the year. To say that the prosecutions expert witness was completely unqualified to make these measurements is also an understatement. And because of these understatements, a young woman was incarcerated in the Elko County jail for almost one year awaiting trial, while her infant child was put in a foster home. Melissa was allowed to see her child twice during that time.

This report is about my investigation into the accuracy of the measurements of fists and of knuckle impressions, and even more absurd, rifle butt marks, that were prepared by the prosecution’s expert witness (PEW) from photographs taken by the Elko City Police Department (ECPD) and entered as evidence in Ricky’s murder case.

In this paper I may use the plural terms “we” and “us” to refer to the ECPDO and those employed by them in Melissa’s defense. Also, the terms “fist” and “knuckle” measurements are interchangeable.

THE PROSECUTION’S EVIDENCE

The prosecution’s only physical evidence was measurements of:

- (1) Melissa’s left and right fists;
- (2) the alleged knuckle imprints on Ricky’s forehead;
- (3) the alleged rifle butt mark on Ricky’s left side.

The gun butt evidence will not be discussed in this paper. The gun butt evidence actually makes the knuckle evidence look scientific. How pathetic!

When first interviewed by ECPDO, I was given some paper copies of the displays presented by the prosecution at the Coroner’s Inquest. On May 27, 2006 I received two picture CD’s from EPCDO, and I prepared a spreadsheet

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of the various cameras and dates and exposures. This would be the standard procedure in a mapping project, to get the imagery and identify the taking cameras, and I decided to “go with what you know”. The camera list is not presented in this report.

Neither of the CD’s contained the “head shot” used in the prosecution’s displays. After some searching, I found the original picture among the autopsy pictures on yet another CD that was supplied to me by the ECPDO. The term “head shot” comes from the CD that was given to me. It turns out that the picture presented as evidence is a not the actual autopsy photo, but a cut-and-paste version. After submitting my preliminary report to the ECPDO, somehow the “head shot” was removed as evidence, and the “flap shot” alone was used.

The Testimony of the Prosecution’s Expert Witness (the PEW)

These comments refer to the Coroner’s Inquest, from which Milessa was put in jail. The use of AutoCad by the PEW seems to have been a big issue to the prosecution, so let’s start by saying that AutoCad **IS NOT** a measuring tool. It **IS** Computer Aided Drafting (CAD). It is a drafting system, not a measuring system, and certainly not a measuring system for photographs. Taking reliable measurements from photographs is called photogrammetry, and requires another level of mathematics and technology.

The term “rectification” was misused by the PEW. What the PEW did was apply one scale to the entire photograph, which is against all the rules of measuring from photographs. Rectification requires a 3-dimensional solution.

Good to 10%. In the September 8th hearing, the PEW states that his measurements are accurate (or good) to 10%. I can only assume that he meant 10% of the measured distance. If the PEW is correct about the accuracy of his measurements, and if the forehead marks are knuckle marks, then , according to his measurements, any one of the three women could have made the marks. As I will show with my measurements, if the forehead marks are knuckle marks, then Melissa could not have possibly made them.

When using the AutoCad files provided by the prosecution, I matched their knuckle measurements to within 1 mm, **at first**. After taking my own pictures and making my own measurements I realize that the PEW’s measurement on Melissa’s right fist, index to little finger, was off by over 6 mm.

Sidebar: I am making the case about misidentifying the knuckle mark **at first** to show how nebulous a misidentification can be.

Sources of Measurement Error

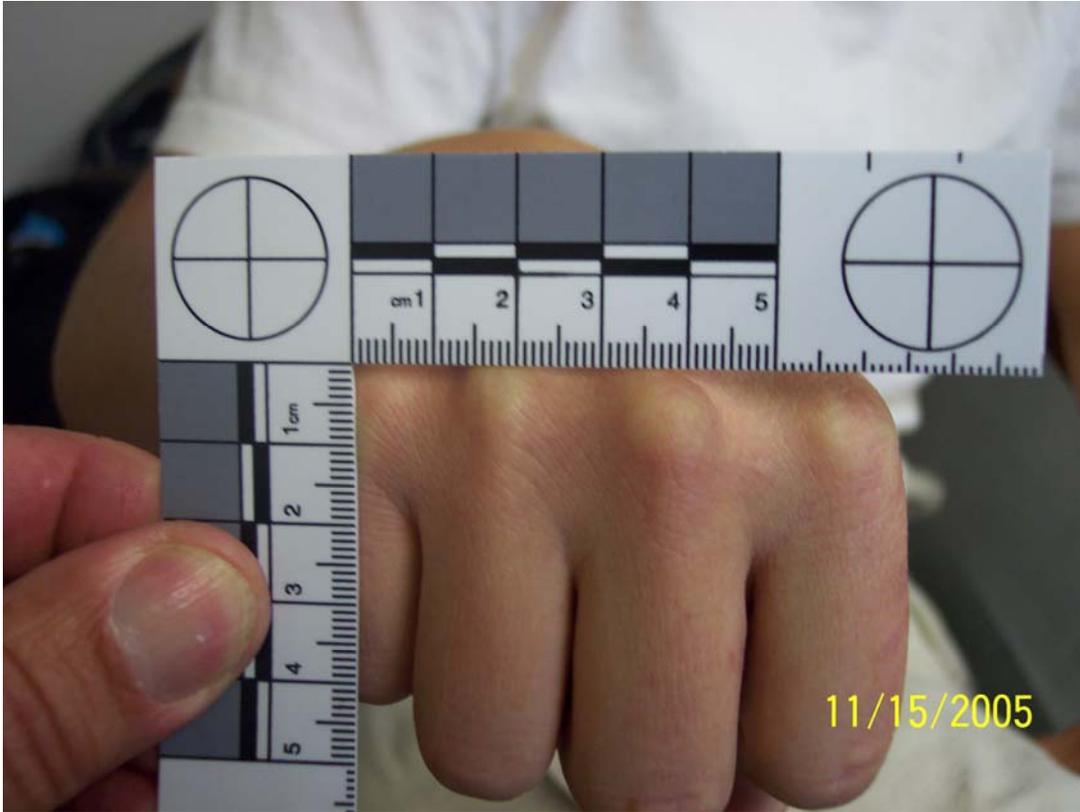
There are two sources for this inaccuracy, procedures and pointing.

Procedures. In the prosecution’s quest to obtain reliable measurements of the suspect’s fists, they chose what might be called the “single photo, straight on” approach. This was accomplished by laying scales over the knuckles, and trying to take the pictures as “normal” as possible. The word “normal”, in this case, refers to having the axis of the camera’s lens as perpendicular as possible to the object (fist), and that the object and the scale are in the same plane.

Using single photo space resection, I analyzed the tip and tilt of the prosecution’s photo of Melissa’s right fist. The cardboard scale was held as the rectification plane. The results in Appendix D show that the camera was out of “normal” to the scale by 10 degrees in both tip and tilt. Over 40 years in photogrammetry, and I have never seen an aerial flight so much out of “normal”.

This “abby-normality” was not the prosecution’s only source of error. When the photographer went to take the fist pictures, he used the camera’s shortest focal length (8 mm), probably thinking that he would strengthen the measurements by getting as close as possible to the subject. (The default zoom of many digital cameras is the widest angle.) Instead, he was weakening the measurements by shortening the focal length and exacerbating the perspective displacement, that is, the shorter the focal length, the greater the perspective displacement.

Pointing Error. Even though the procedures used were inadequate in the first place, the main error was in the pointing. In my opinion, you cannot point to a knuckle better than 1 mm, even if it were well marked, because you can’t even mark it that close. With a single photo solution, you add the problem of perspective. With stereo-photogrammetry, you are allied with perspective displacement, which actually adds strength to the horizontal solution by adding the vertical solution.



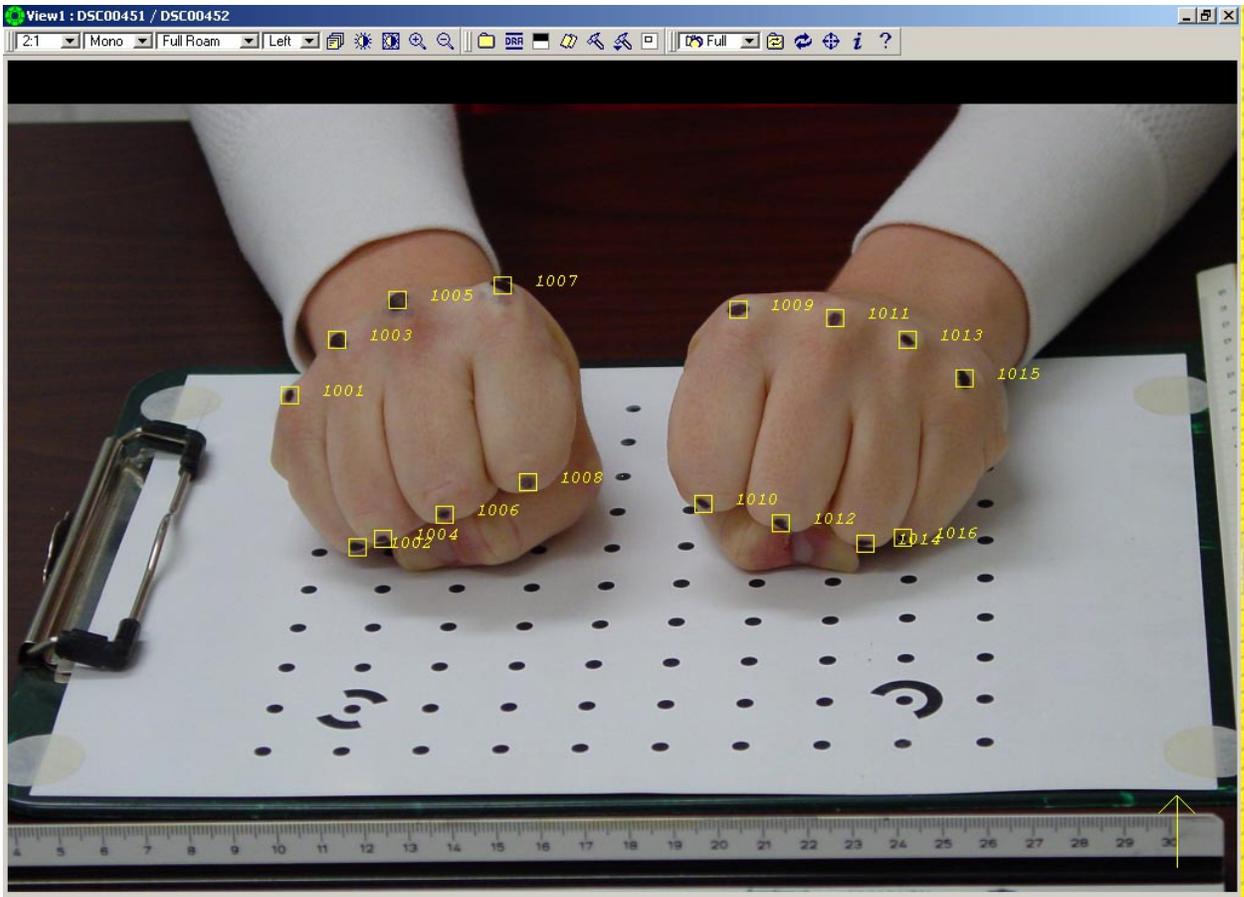
REMEASUREMENT

On August 31, 2006 at 9:30 am, I met with a rep from ECPDO (the PI) at the Elko County Sheriff's Office to take photogrammetric pictures of Melissa's fists. I had constructed a simple stereo camera system using off-the-shelf Bogen Tripod parts, and two Sony DSC-S85 digital cameras (4MP each). The camera base was 19cm, very acceptable for the fist measurements. Melissa set her fists on a calibration grid, and two engineering scales were placed at the front and the left side of the grid. This was overkill, but we wanted our procedure to be unquestionable.



Sidebar. At this time the PI and I also took physical measurements of Melissa's right fist, and came up with a solid 6 cm between the index and little knuckle of her right hand. Solid here means "at least".

After taking the stereo pictures of Melissa's fists, the images were measured on a Socket Set softcopy system, and the image measurements were run through the Albany program for phototriangulation. The largest image point residual was 0.016mm (< 2 pixels), which is about half the diameter of a human hair. The control points came in at 0.031cm, or about 1/3 of a millimeter, standard error. This puts the maximum error of the photogrammetric measurements at one millimeter at object scale.



My measurements show Melissa's right fist knuckle separation to be 6.17cm, and that is a substantial 6 mm different from the prosecutor's measurements.

THE FLAP SHOT

The autopsy pictures were taken by the Salt Lake County Medical Examiner (SLCME) with a Nikon N80 film camera and a Quantum 28-300mm zoom lens and positive film. There is no way of determining the focal length for the autopsy pictures because the camera had a zoom lens. ELCME made negative copies of their positive slides and sent them to the ECPD, and the disk we received from ECPD was made by Walmart from these negatives.

The "flap shot" is a picture of the forehead skin turned down to expose the inner side. The bruise marks are not on the skull, they are on the inside of the flap. The flap is being held up by a hand in the lower-right portion of the picture. How much curvature is in the flap?... "I don't know, do you?"

I decided to reconstruct the shot and determine how much error could be in the measurements.



The masking tape on the forehead is marked at 1cm graduations. On a separate piece of paper, mark of 5cm from the scale at the bottom of the picture and see how many graduations it measures on the tape.

Sidebar: It was during the reconstruction of the shot that I realized that the marks on Ricky's head could not have been made by the upper knuckles of anybody's fist. The head is convex and the knuckles are convex. Marks can only be made with one or two knuckles at a time, therefore, four marks would require two hits...So, what are we measuring?