IT'S A PHOTO FINISH, NOT JUNK SCIENCE!

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In recent weeks, two south Florida newspapers, the *South Florida Sun-Sentinel* and *The Miami Herald,* as well as several other forensic newsletters have cited many facts about the trial of Victor Reyes. About the only truth contained in those articles is that the jury acquitted Victor Reyes of first-degree murder, rejecting the prosecutors' argument that Victor Reyes was guilty of the fatal shooting, because his fingerprint appeared on duct tape that had been wrapped around the victim's body.

Both articles stated that the defense attorney, Barbara Heyer, had attacked "new fingerprint technology the Broward Sheriff's Office used to connect Reyes to the slaying."

During a 60 Minutes II interview in November, 2002, and again during a post trial interview, Barbara Heyer did refer to the technology as "junk science." This statement lead to the shocking headline *Jury Cites "Junk Science" in Clearing Man of Murder*. Unfortunately, the headline itself was more shocking than the statements made by the defense attorney, for the simple fact that the jury did not cite junk science as any part of their decision. During a post-trial discussion with the jurors, members of the jury confirmed that they fully accepted (1) the fact that the latent print on the duct tape was left by Victor Reyes, (2) the competency and validity of the enhancements performed by Dave Knoerlein, and (3) the technology used to enhance the print. The truth of the matter is that the jury was not concerned about the use of the technology.

The members of the jury cited two primary reasons for their verdict. First, there was a concern about where the latent print was found in relationship to all of the tape used to wrap the body. Even though it was argued that the latent print was on tape overlapped by other tape, thus indicating a person involved in the disposal of the body. In their minds, however, the wrapping of the body could have easily been done after the murder, meaning that Victory Reyes could merely have been an accessory after the fact and not guilty of first-degree murder. A second concern cited by the members of the jury was that the case revolved around the testimony of a key witness, Bruce Mitchell, a drug addict and dealer with ties to the defendant's brother, Jose Reyes.

During opening statements, the prosecution told the jury that Mitchell would testify that while he was in North Carolina with the defendant's brother, he over heard a telephone conversation between Jose Reyes and the victim, Henry Guzman, who was calling from Victor Reyes' house. During that conversation, gunshots were heard over the phone. Mitchell was to have testified that Reyes subsequently drove from South Florida to North Carolina and explained how and why he had killed Henry Guzman while Guzman was on the phone.

On the day he was to testify, Bruce Mitchell refused to testify. The jurors said that had they heard his testimony, the outcome of the case could have been different.

The bottom line is that the reliability of the enhancement process was not questioned by the jurors. It was, in fact, given great weight and accepted by the jurors. In this purely circumstantial case, which is what the Reyes case became once Mitchell refused to testify, the jurors wanted more solid proof that Victor Reyes was the actual shooter or that he was responsible to a greater extent than an appearance he could have wrapped the victim's body with duct tape.

So why did the issue of "junk science" raise its ugly head? Why did the defense focus on this issue post-trial when the use of the technology had not been challenged during the actual trial? In her closing argument, the defense attorney told the jury that the software, Adobe Photoshop, used to enhance the latent print was the same software used to alter and manipulate photographs appearing in supermarket tabloids, citing a photograph showing a being that was half baby and half alligator.

I believe the defense attorney did an outstanding job of creating confusion and misdirection. This tactic was demonstrated repeatedly throughout the Frye hearing in this case as well.

To continue our focus on the specific misstatements contained in the articles, it was reported that a BSO crime lab technician, Dave Knoerlein, used a "new fingerprinting technology" called "dodge and burn."

The *Sun Sentinel* stated that this technique was used to make the image darker in some places and lighter in others. The *Miami Herald* stated that this technique works by removing noise or "distracting background designs." The fact of the matter is that this is not a new technology. Dodge and burn techniques have been used by photographers as far back as the Civil War. The dodge function does indeed lighten an area while the burn function darkens an area. Dodge and burn are local enhancement techniques that are similar to adjusting the brightness and contrast control on your TV, and they can be applied to a specific area of an image. In addition, there are specific guidelines available for the use of these tools within a forensic environment.

Both articles stated that the dodge and burn software was "developed by a Tacoma, Wash., forensic expert, the technique is similar to the software of Adobe Photoshop…." This is statement is entirely false. Erik Berg did not develop the dodge and burn techniques. These are the digital implementation of traditional photographic tools, and they are basic tools offered by Adobe Photoshop.

The *Miami Herald* also reported that "For example, 'Dodge and Burn' put a Washington rapist and murderer away for 26 years in a landmark case that allowed investigators to extract a print from a bedsheet, by erasing the bedsheet's fabric design."

Quoting a statement from Erik Berg, "There is not a single truth in the entire sentence. Dodge and burn techniques were not applied to any image connected with the Eric Hayden case." Erik also stated that he used a technique called "Curves" in the Hayden case. This technique is used to create extraordinary contrast, and was used throughout the entire image, and not just a select portion of the image.

Erik also stated that the fabric pattern was removed using the ***MORE HITS*** Pattern Removal Filter, a filter he helped to develop. This filter runs in Adobe Photoshop and is based upon a mathematical formula known as a Fast Fourier Transform (FFT) that was designed by a French Scientist, Jean Baptiste Fourier, in the early 1800's to measure heat transfer in metal. The FFT has been used in a variety of digital processing tasks, including eliminating pops and scratches from audio recorded on vinyl records, removal of repetitive frequencies in digital images, and the encoding of fingerprints stored in the FBI's digital fingerprint database.

During a post-trial interview with the *Sun Sentinel* Barbara Heyer said, "The methods cross the line between uncovering evidence and creating it. … The computer programs used to enhance the print were too susceptible to being tampered with and do not have enough safeguards to prove that law enforcement is not manipulating the evidence." Heyer further stated, "They take something that is of no value to begin with and start doing this boosting and they turn up something that they claim is someone's print."

What Ms. Heyer failed to mention, however, was that the same negatives were submitted to the FBI, where the prints were independently enhanced by a FBI forensic photographer and subsequently identified by an FBI latent print examiner. Broward County was not involved in either process.

The truth in this case is that both the Broward County Sheriff's Office and the FBI used the ***MORE HITS*** Forensic Image Tracking System to acquire and enhance the images involved in this case.

Ms. Heyer's belief that the Adobe Photoshop software could be used to create fraudulent prints has no basis in fact and the insinuation that it might have been so used is without a factual basis and is highly prejudicial and unwarranted. In *Cross v. U.S., 149 F.3d 1190, 1998 WL 255054 (10th Cir. Kan. 1998)* the Court stated that the "mere possibility" of tampering was insufficient to prove bad faith. Similarly, in *United States v Balzano, 687, F.2d 6, 7-8 (1st Cir. 1982)* the Court also approved the trial court's decision to admit duplicate audiotapes where the defense had alleged that "hypothetically" tampering could have occurred.

Furthermore, the fundamental, principal requirements for admitting a photograph into evidence — whether it is digital or film-based — are relevance and authentication. Mr. Knoerlein testified that the digital photograph was an accurate representation of the image captured on the negative.

During the Frye hearing, I demonstrated to the Court's satisfaction that the ***MORE HITS*** program could successfully authenticate the image, thus proving that the images were not susceptible to tampering and that there are indeed enough safeguards to prove that law enforcement is not manipulating the evidence.

Unfortunately a lot of focus has been put on the use of dodge and burn, and other enhancement tools that are available within Adobe Photoshop. There has also been a great deal of emphasis placed upon maintaining a detailed history (recording) of the enhancement process.

First, there seems to be a common belief that when an image is enhanced by one person and is subsequently enhanced by another person that both images must be mathematically equal. It is believed that this "requirement" is fallout of the scientific principal of repeatability.

The laws of physics prevent 100 percent accuracy even in terms of scientific principal. Two individuals performing the same DNA test with the same samples can only guarantee a 99% rate of accuracy. So why are we challenged with a requirement that is mathematically unattainable? Further, there is no conclusion of any court or other legal precedent established that requires this level of repeatability.

The underlying concept is two fold. First, it is necessary to maintain records of your process (enhancement history) for both verification and repeatability purposes. Second, it should be possible that you can give the same "original" image to another individual and they should be able to enhance that image independent of your procedures and come up with the same image.

For example, to validate the accuracy of the imaging process, I could perform a simple three step test:

Step 1: Give a copy of an original latent print image (each digital image being identical in that the electronic files consist of exactly the same, identical series of ones and zeros) to 25 different people

Step 2: Each individual performs their own, independent image enhancement of that image and provides me their end result

Step 3: Compare and analyze the results of their images. If the all 25 results lead to the same conclusion by an expert in the field of Latent Print Comparison, then we have validated both repeatability and reliability of the processes used.

It is true that the contrast for each of the 25 prints may be slightly different. For example, one may be lighter or one may be darker, or perhaps one person used levels to adjust the contrast within the image while another used curves, or perhaps yet another person used brightness and contrast while others may have used hue and saturation or color balance to achieve the desired results. Photography is a subjective process and what may be clear to

one person may not be clear to another. Some people even require the assistance of glasses or a magnifying glass to see things.

The results can and should vary from person to person. For example, each of us sees things quite differently. The brightness and contrast of the monitor can play a significant role in the final results, as does the level of toner or ink in your printer. The results will also vary with the output of the same image if you print the image on an HP inkjet printer or an Epson inkjet printer. The image quality can also vary from printer to printer even within the same brand because of the different types of inks, different types of papers, and so forth. Or perhaps you are using a dye sublimation printer instead of an ink jet printer. Again, the resolution, color balance and contrast may vary. But as long as there is no wrongdoing and people are not misusing the tools available to them, the image will still clearly be identifiable as the same image. In other words, the end result will be the same fingerprint, ridge for ridge.

If this process were performed in a traditional photographic environment, I would come up with very different results as well. For instance, the length of time that the print is exposed to light during the development process will vary the appearance of the print, making it lighter or darker. The length of time the print is exposed to the chemical baths, as well as the age and temperature of those baths, can change the appearance of the image. And similarly to the process described above, the type of paper can vary the appearance of the image depending upon whether I am use glossy or non-glossy paper. Plus, each time the negative is exposed to light, heat, humidity, or just the age of the negative will cause the image to fade, thus changing the results that I can achieve with that negative.

And finally, independent verification (analysis) means that I should be able to give a latent print that I have identified to another latent print examiner and that person would be able to validate my analysis of the quality and quantity of ridge characteristics, as well as validate the comparison of that detail in the latent print to the standard (known) print.

I would never point out the characteristics that I used during the identification process to someone verifying the identification. Doing so would invalidate the independent nature of the verification process. Similarly, I would never give my enhancement history to someone enhancing an image that I previously enhanced because I would not want to create a bias within their mind that they had to use the same techniques that I used during the enhancement process.

Maintaining a detailed history of the steps that I used during the enhancement process is essential to satisfying the burden of proof essential for demonstrating that the image was not altered or manipulated. It also eliminates the doubt and confusion implied by defense attorneys such as Ms. Heyer when they make claims of, “They take something that is of no value to begin with and start doing this boosting and then turn up something that they claim is someone’s print.”

This is not a new science; it is an automation of a manual process. Much like balancing a checkbook, if done properly, I should have the same balance as the bank. The reliability, instant results, and advanced capabilities of digital versus analog make this a valid, more accurate and reliable science, not “junk science.”