

**THE ADMISSIBILITY OF DIGITAL EVIDENCE IN CRIMINAL
PROSECUTIONS**

Presented by:

**Jonathan W. Hak
Crown Prosecutor
Department of Justice
Alberta, Canada**

(jonathan.hak@gov.ab.ca)

January 2003

THE ADMISSIBILITY OF DIGITAL EVIDENCE IN CRIMINAL PROSECUTIONS

Introduction

Advances in technology have led to the use of various digital techniques in the presentation of evidence to the courts. In some cases, digital techniques have allowed the court to gain more valuable information from evidence than would otherwise have been evident. In other cases, it has allowed the court to receive evidence that it would not have been able to receive without the assistance of digital technology. Digital evidence has been presented to the courts in various areas including audio enhancement, photograph enhancement, forensic video analysis and the digital enhancement of latent fingerprints.

Where digital technology adds little to the original evidence, it is rarely worth the time and effort in preparing and presenting such evidence in a digital environment. However, where digital assistance allows the court to see or hear evidence that it would not otherwise have seen or heard or where it allows the court to see or hear such evidence in a more thorough, analytical format, it is well worthwhile. There have been numerous cases over the past decade where forensic video analysis has made the difference between a justified conviction and an unjust acquittal. Equally, it has also allowed for the exoneration of defendants who might otherwise have been wrongfully convicted, a travesty we as a civilized society can ill-afford.

The ability to convince the court that digital evidence is worthy of reception into the criminal process is dependent on the qualifications and competence of the tendered expert, the skill and knowledge of the prosecutor in leading such evidence and the quality of the digital evidence itself. Digital evidence has been successfully led in many jurisdictions in the United States and Canada over the past decade.

New scientific techniques are subject to admissibility hearings under *Frye v. United States*, 293 F. 1013 (1923, D.C. Circuit Court) or the more restrictive federal test in *Daubert v. Merrell Dow Pharmaceuticals Inc.*, 113 S. Ct. 2786 (1993, United States Supreme Court). The *Daubert* test is being utilized in a number of state jurisdictions as well.

A review of case law dealing with digital evidence is instructive.

Case Law Review

English v. State of Georgia, 422 S.E.2d 924 (September 28, 1992, Court of Appeals of Georgia)

Facts

An undercover agent videotaped a cocaine sale. The videotape was digitized and images of the defendant were subjected to “computer enhancement” and printed as single images. A copy of the original videotape was entered as an exhibit at trial as well as a copy of the single computer enhanced image of the defendant seller.

Issue

Did the trial court err in admitting the computer enhanced image?

Ruling

The technician who produced the computer enhanced image testified as to the process used and said that it was a fair and accurate representation of what appeared in the videotape copy. Accordingly, the computer enhanced image was admissible. The conviction was upheld.

[Note: the use of a copy of the original videotape for digitization is puzzling and contrary to proper SOPs]

United States v. Mosley, 1994 U.S. App. LEXIS 23969 (August 31, 1994, United States Court of Appeals for the Ninth Circuit)

Facts

Mosley was charged with six counts of bank robbery. An FBI Agent testified that he subjected surveillance video from one of the banks to digital image processing. This procedure sharpened the images. He further testified that he was then able to detect a mark on the face of the robber. He then compared this mark with a mark on Mosley’s face which was visible in a booking photograph and described the similarities noted.

The defence argued that the trial court erred in admitting this evidence.

Issue

Did the trial court err in admitting this digital analysis evidence?

Ruling

In a very brief ruling, the Court concluded that the trial court reasonably concluded that this evidence would assist the jury and that it was properly admitted.

State of Minnesota v. Newman, 1994 Minn. App. LEXIS 1246 (December 13, 1994, Court of Appeals of Minnesota)

Facts

Newman was charged with the theft of \$474 worth of baseball cards from the Tom Thumb store. At trial, the evidence against Newman consisted of the testimony of the cashier and a surveillance videotape which showed two men leaving the store with the baseball cards.

Following the verdict of guilt, Newman moved for a new trial alleging a prosecution discovery violation. As part of this post-trial process, the trial court viewed “computer-enhanced” still images from the videotape. It heard evidence from a defence witness, a digital imaging technician. The technician testified that the computer enhanced images showed a mark on the suspect’s left cheek whereas the defendant had a mark on his right cheek. The trial court disagreed with this finding and denied a new trial.

Issue

Did the trial court err in denying the motion for a new trial?

Ruling

The trial court did not err in denying the motion for a new trial. The post-trial computer enhanced images were inconclusive on the issue of identification but the cashier’s evidence was strong, coupled with the fact that the cashier had dealt with Newman on several occasions.

Though not stated, implicit in the ruling of both the trial court and the Court of Appeals of Minnesota is the acceptance of the digital imaging evidence that was presented by the defence.

Nooner v. State of Arkansas, 907 S.W.2d 677 (October 9, 1995, Supreme Court of Arkansas)

Facts

This was a capital murder case where portions of the incident were captured on videotape. The defendant contended that stills taken from the videotape should not have been admitted as they had been manipulated and that therefore the silent witness theory did not apply.

The following process occurred:

- a) the original videotape was slowed down by making an exact duplicate of it in Betacam format and then freezing each frame for several seconds
- b) still frames were then taken from the duplicate video and digitized
- c) pixels on the suspect's face were softened to remove graininess
- d) no features were added or subtracted to/from the original, except to mosaic out the face of the victim
- e) still photographs were prepared from the digitized images
- f) in producing the still photographs, the number of pixels per square inch were increased to improve the contrast, and the brightness was also adjusted
- g) no alteration was made of the original images

Issue

Are the digitally created stills admissible?

Ruling

The Court noted at page 686:

Reliability must be the watchword in determining the admissibility of enhanced videotape and photographs, whether by computer or otherwise.

The Court ruled that computer generated stills are admissible if they are verified as being reliable representations of images recorded on the original videotape. Further, the original videotape should be entered as an exhibit for the trier of fact to view.

As each of these requirements was met in this case, the defendant's argument failed.

State of Arizona v. Paxton, 925 P.2d 721 (April 16, 1996, Court of Appeals of Arizona)

Facts

Paxton was convicted of first degree murder and appealed his conviction. The victim was the driver of the car in which Paxton was a rear seat passenger and Smauling was the front seat passenger. While the vehicle was moving, Paxton shot the victim through the driver's seat back. He then reached between the two front bucket seats and fired five more times into the victim's right side. Once Paxton stopped the car, he and Smauling pulled the victim out of the car and put him in the rear hatchback. The victim's body was later dumped in a ditch. Once it became apparent that the police were focusing on Paxton and

Smaulding, Smaulding burned the car. Smaulding eventually led police to the victim's body.

At trial, Paxton testified that in fact Smaulding was the killer, not Paxton. He testified that the three of them had driven to a secluded spot where they smoked marijuana. The seating arrangement was the same. Paxton said that Smaulding pulled a gun and shot the victim five times in his right side and when the victim tried to escape out the driver's door, Smaulding shot him in the back. Paxton said that Smaulding then dragged the victim from the car and dumped his body in a ditch.

A blood-stained seat cover was found with the victim's body. At issue at trial was whether the seat cover had been on the driver's seat when the victim was shot. If it had, Smaulding's evidence that Paxton shot the victim through the driver's seat would have been impossible because there was no bullet hole in the seat cover. The State contended that the victim had removed the seat cover earlier because the straps were broken and that he was storing it in the hatchback where it became bloodstained when his body was placed there after being shot.

The victim's mother testified that the driver's seat cover was not on the seat two days before the murder. A friend of the victim also testified that he rode in the victim's car the day before the murder and did not recall the seat cover being on the driver's seat. Further, he said that it had been "floating around" in the back seat and hatch in the months prior to the murder due to the straps being broken. The victim's girlfriend testified that she knew that the passenger seat had a cover but was unsure if the driver's seat did. The state tendered photographs of the car that the girlfriend had taken within three months of the murder. The photographs appeared to show that only the passenger seat had a seat cover on it.

Mark Little was qualified as an expert witness. He digitized, clarified and analyzed the photographs of the victim's car. He testified that there was a difference in the colors of the front seats, thereby allowing the court to draw the inference that the driver's seat cover was not in place at the time the photographs were taken.

Issue

Amongst other issues, Paxton argued that the evidence of Mark Little was irrelevant because it was based on photographs taken too remote in time from the murder.

Ruling

The Court ruled that the expert evidence was relevant and admissible because if the seat cover was off the driver's seat up to three months before the murder, it

was likely off at the time of the murder, especially given the fact that the straps were broken. The Court expressed no concern with the admissibility of the forensic digital analysis of the photographs. The conviction was upheld.

Commonwealth of Pennsylvania v. Auker, 681 A.2d 1305 (July 31, 1996, Supreme Court of Pennsylvania)

Facts

Auker was convicted of the first degree murder and kidnapping of his former wife. The body of the victim was discovered on a hot day, June 12, 1989, by a young woman who was walking down a rural dirt road. She smelled an odor, investigated and found the badly decomposed body of the victim clad in a jacket, jeans and sneakers. The Coroner observed holes in the victim's jacket that continued through the sweater underneath, which were consistent with between 7-10 stab wounds in the back and chest area. He concluded that the wounds would have impacted the vital organs. However, since the body was essentially skeletonized, no organs were present as they had disappeared from both decomposition and insect activity.

An entomologist testified that the presence and relative maturity of insects in and around the body allowed him to estimate the approximate date of death, that being 19-25 days prior to discovery.

It was determined that the victim had been missing since May 24, 1989 (19 days earlier) and was last seen wearing clothing similar to that found on the body.

The evidence established that the victim was afraid that the defendant would hurt her and take away their child, that he was following her and that the victim and the defendant were involved in a bitter divorce and custody battle.

Amongst other evidence, the Commonwealth led evidence of videotape from an ATM at a local bank located just outside the entrance to the victim's workplace. The ATM camera photographed the location directly in front of it at ten second intervals. At 15:47:24, the camera recorded a woman wearing clothing similar to the victim's walking from the area where the victim's car was found toward the mall where the victim worked. The next frame, taken at 15:47:34 showed the same woman leaning into an open front passenger door of a vehicle that had pulled across her path and was stopped with its brake lights on in the wrong lane of travel. No other images of the woman or the car were found. This video was shot on May 24, the day the victim was last seen alive.

The incident was reenacted using the bank's ATM camera. A Chevrolet Celebrity, the same vehicle Auker was using on May 24, was placed in an identical position and captured on video. Digital image enhancement was used

to clarify the images taken from the ATM video. The original video was of poor quality and contrast and lightening effects were applied to gain a more usable image.

The original video frames were compared to the reenactment frames in both the enhanced and unenhanced format. A Chevrolet representative testified that the vehicles depicted in both the original and reenactment video appeared to be Chevrolet Celebrities within certain production years including that of the car Auker was proven to have been driving. It does not appear that anyone testified regarding a comparison of the woman or her clothing to that of the victim.

This motor vehicle identification evidence was important because forensic evidence had been found in Auker's parents' Celebrity, which Auker had used without their permission on May 24.

Issue

Amongst other issues, Auker argued that the comparison evidence of the video images should not have been admitted.

Ruling

The Court noted that expert testimony is permitted as an aid to the jury when the subject matter is distinctly related to a science, skill or occupation beyond the knowledge or experience of the average lay person. Where a witness has a reasonable pretension to specialized knowledge on a subject in issue, the witness may testify and the jury will assign the appropriate weight to that evidence. Expertise, whether gathered from formal education or by experience, is expertise. Here, the Chevrolet representative had specialized knowledge and was properly permitted to express an opinion as to the make and year of the car depicted in the video.

The Court expressed no concern with the admissibility of the digital image enhancement evidence.

State of Washington v. Hayden, 950 P.2d 1024 (February 18, 1998, Washington Court of Appeals)

Facts

The defendant was charged with and convicted of felony first degree murder. It was alleged that he had raped and murdered a woman in her apartment. Bloody handprints were visible on the fitted bed sheet covering the victim's mattress, near where her body was found.

Fingerprint evidence obtained at the scene was of insufficient quality to allow the latent print examiner to make a proper comparison. The examiner took the questioned exhibits to Erik Berg, an expert in enhanced digital imaging at the Tacoma Police Department. Berg generated digital images of the pieces of bed sheet. He then used computer software to filter out background patterns and colors to enhance the images so that the prints could be viewed without the background patterns and colors. This process allowed the latent print examiner to conclude that the prints belonged to Hayden.

Following the practice in Washington, a *Frye* hearing was conducted. The trial court found that enhanced digital imaging is not novel scientific evidence to which the *Frye* test applies. In any event, the trial court found that the process passed the *Frye* test.

Issue

Did the trial court err in admitting the evidence of the digitally enhanced fingerprint comparison?

Ruling

Berg testified in detail as to the history of digital imaging. He said that computer software improves sharpness and image contrast. Pattern and color isolation filters remove interfering colors and background patterns. This is a subtractive process in which elements are removed or reduced; nothing is added. He further testified that the software he used prevented him from adding to, changing or destroying the original image. He contrasted image enhancement, which makes what is already there more usable, with image restoration, in which things that are not already there are added based upon preconceived notions as to what the end result should look like.

The Court noted that the evidence led supported the trial court's finding that the technique utilized by Berg was 100% reliable and had a zero percent margin of error. Further, the results are visually verifiable and could easily be duplicated by another expert using his or her own digital camera and appropriate computer software.

The Court of Appeal examined enhanced digital imaging for the first time and applied the *Frye* test. Noting the evidence led in the trial and the absence of any evidence to the contrary, the Court ruled that enhanced digital imaging is generally accepted in the relevant scientific community. Accordingly, the appeal was dismissed and the conviction affirmed.

United States v. Beeler, 62 F. Supp.2d 136 (July 1, 1999, United States District Court, D. Maine)

Facts

The defendant was charged with blowing up a car by means of a pipe bomb. Surveillance video from a nearby Mobil Mini-Mart captured the accused in the store shortly before the explosion when he asked for incriminating directions from the clerk. The clerk was unable to identify the defendant in a photo line-up. The surveillance video was critical in proving the case.

An ATF audio and visual enhancement expert digitized relevant images from the original tape using Image Lab. He then enhanced the quality of the images by adjusting the contrast and brightness of those images and enlarging portions of the images that depicted the subject. He did not modify the original images – rather, he made them easier to see. The ATF expert testified that he recorded each step he undertook in this process.

Issue

The defendant argued that the enhanced images were inadmissible pursuant to the best evidence rule and that they were untrustworthy because they are susceptible to tampering and subsequent modification through enhancement.

Ruling

The prosecution must establish that the enhanced images are accurate, authentic and trustworthy. The Court was satisfied on each point in this case.

The enhanced version is different only in that extraneous frames are no longer present and the images are larger, clearer and easier to view...The edited and enhanced versions of the Mobil Mini-Mart surveillance videotape are admissible because they have been proven accurate and serve to present the substance of the original videotape in a more easily understood form which is in accord with the spirit of the best evidence rule. (para. 13-14)

Dolan v. State of Florida, 743 So.2d 544 (July 21, 1999, Court of Appeal of Florida, Fourth District)

Facts

Dolan was charged with multiple offences arising out of the sexual battery of a store clerk in a lingerie shop. The event and the perpetrator were captured on store surveillance video equipment. The shop owner testified as to the placement of the cameras, their operation and the loading of the tape. The police seized the tape immediately after the incident and established proper

continuity. While the tape quality was poor, the perpetrator's physical characteristics were discernable.

Fort Lauderdale Police sent the video to an expert for forensic video analysis. At trial, the analyst testified that she digitized the images and then enhanced the digitized images to clarify and focus the images of the perpetrator. The result was a computer enhanced image that was "bigger, brighter and better." Still prints were then made for court purposes. Both the prints and the original video were entered at trial.

The forensic video analyst testified that the still prints were fair and accurate representations of what appeared on the original videotape. She testified that she did not edit the images.

The defence argued that the State failed to prove that the prints were fair and accurate representations of the incident.

Issue

Were the computer generated stills verified as reliable representations of images recorded on the original videotape?

Ruling

The Court held that the original videotape was properly admitted under the silent witness theory.

As to the computer generated digitized stills, they were admissible providing the following requirements were met:

- a) evidence is required as to the location and operation of the surveillance equipment
- b) it must be shown that the original videotape accurately reflected the location shown in the videotape
- c) continuity of the tape must be established
- d) it must be shown that the computer generated stills did not alter or distort the images on the original videotape
- e) the original videotape must be available to the trier of fact for review

The Court stated that:

Once the tape is authenticated and the forensic analyst explains the computer enhancement process and establishes that the images were not altered or edited, then the computer enhancements become admissible as a fair and accurate replicate of what is on the tape, provided the original tape is in evidence for comparison.

The Court admitted the forensic video analysis evidence because each of the above requirements had been met.

R. v. Cooper, [2000] B.C.J. 446 (March 2, 2000, British Columbia Supreme Court)

Facts

Cooper was charged with the robbery of a bank. The only issue before the Court was the identification of the robber. The prosecution led three types of evidence to prove this issue. First, the videotape itself. Second, recognition evidence by several corrections officers and a parole officer who were familiar with the defendant. Third, forensic video analysis led by Cst. Grant Fredericks, then of the Vancouver Police Forensic Video Unit.

The camera system in the bank consisted of five cameras that recorded sequentially to one video recorder.

The Court summarized the evidence of Grant Fredericks as follows:

[55] Constable Fredericks said that the digitization of videos involves transferring images on the video into the realm of computers. He assists investigations by protecting the evidence and securing it. Once the digitized elements are transferred into the computer, the video tape is returned to the investigators. The digitization does not change the original images in the video tape. The reason it is done is because it enables the investigators to receive the tape and play it only once. This avoids damaging or [sic] stretching the tape caused by frequent playing. Further, once the images are in the computer the investigators can examine them as long as they like. They can be distributed to the crown, to the defence, and shown in Court. Digital images never change, while tapes can be damaged. Images are not damaged or altered by the process.

[56] The process enables its user to digitize a specific frame of a video, and then take one copy and isolate a specific area, and then blow it up, which may be of some value to the Court. Exhibit #9, which is four pages of stills or prints taken by Constable Fredericks from the Bank video tape, is an example of this. On the left side of each page there is a normal still. On the right side, a part of each still has been isolated and blown-up. The process also enables its user to lighten dark pictures or darken light pictures, so that there is a better contrast to be seen. I observe here that the blown-up images in Exhibit #9 do make it easier to see the distinguishing features of the robber's face.

[57] Constable Fredericks also prepared a number of video slides which I carefully perused. They contained three known photographs of the Accused, one of which is the photograph used in the photograph line-up. The other two are more up-to-date, the first being taken on May 8, 1999, about 20 days before the robbery, and the second on August 3, 1999, about three months after the robbery. The video also contains slides of stills he took from the Bank video tape. The purpose of the slides is to enable the Court to compare the blown-up known photographs of the Accused's face, to the blown-up stills of the [sic] suspect's face, which he selected from the video tape; also to compare the latter to the Accused in the Courtroom. When I did so the similarity between the stills and the

Accused's face generally, but more particularly, with regard to his eyes, cheek bones, cheek lines, nose and mouth, were even more remarkable. The comparison simply bolstered my previous conclusions. The eyebrows, the eyes, the cheek bones, cheek lines, nose and mouth of the two faces were, in my view, identical.

[58] On cross-examination Constable Fredericks acknowledged that when digitizing the analogue images he is simply transferring them into a format that can be read and processed by the computer. A software tool is used to "crop", that is to blow up certain portions of an image taken from the video tape. The contrast in the stills can be changed, which the witness described as "more akin to changing the lighting in a room". He agreed that the VCR itself was not capable of cropping, nor could it alter the black and white level of the picture elements.

[59] It was put to him that in effect he was adjusting the image on the video tape. He did not agree. He noted that all of the images on the left side of Exhibit #9 are untouched copies of the video images; that those on the right are simply blown-up copies of those images. He did acknowledge that one of the purposes of digitization was to improve the quality of the image coming out of the video tape. However, in my view, his evidence on cross-examination in no way suggested that the process changed the images, which appeared to be the thrust of the cross-examination.

Issue

Does the process of forensic video analysis change the images as recorded to the original videotape such that they are no longer reliable images?

Ruling

The Court stated that:

In my opinion the digitization, blowing up, and lightening of the images on the videotape does no more than enhance or clarify the images. They are not changed. The digitized images are the same images seen on the videotape. One need only compare the faces to see that the images have not been changed in the manner contemplated by *Nikolovski*. Digitization is clearly a useful tool to assist the court in viewing and comparing the videotape images. Accordingly I find that Constable Fredericks' video slides and other work product are admissible into evidence. (p. 11)

And at p. 13-14, the Court stated:

[90] *Leaney* and *Nikolovski* make it clear that a Trial Judge may on his own observations of a video tape, and of his comparisons of the tape to the Accused in the stand, conclude beyond a reasonable doubt that the person seen in the video is the Accused. In *Nikolovski*, Cory, J., speaking for the majority, reviewed the evolution of the use of audio tapes, photographs, and video tapes as evidence in Canada. At pg. 411 he pointed out that in *R. v. B(K.G.)* (1993), 1 S.C.R. 740, the Supreme Court of Canada praised the evidence obtained from video tapes as a "milestone" contributing to the "triumph of a principled analysis over a set of ossified judicially created categories". And after referring to the majority decision of McLachlin, J., as she then was, in *Leaney*, he had this to say:

Similarly, in *R.v. L.(D.O.)* (1993) 4 S.C.R. 419, 85 C.C.C. (3d) 289 (S.C.C.) L'Heureux-Dube, J., in concurring reasons, noted that the modern trend has been to admit all relevant and probative evidence and

allow the Trier of Fact to determine the weight which should be given to the evidence in order to arrive at a just result. She observed that this is most likely to be achieved when the decision-makers have all the relevant probative information before them. She wrote at pg. 455 that:

"It would seem contrary to the judgments of our Court, (**Seaboyer v. B.(K.G.)** ...) to disallow evidence available through technological advances such as video taping, that may benefit the truth seeking process".

In my opinion the forensic video evidence of Constable Fredericks did not alter or tamper with the images on the video tape in the case at Bar. His digitization and video analysis was a most useful tool in the performance of my task. It is in my view the type of evidence referred to by Mr. Justice Cory in **Nikolovski**, and by L'Heureux-Dube, J., in **R. v. L. (D.O.)**, being at most an extension of the video taping evidence.

State of Ohio v. Jones, 739 N.E.2d 300 (December 27, 2000, Supreme Court of Ohio)

Facts

Jones was a hotel worker at an Embassy Suites Hotel in Blue Ash, Ohio. It was alleged that he had illegally entered a guest room and then robbed and murdered an elderly guest. The victim died of multiple trauma to the head and trunk.

During the investigation, police sent a walkie-talkie, used by hotel employees, to the FBI. A forensic pathologist used digital image processing to compare autopsy photographs of the victim's wound patterns to the patterns of the walkie-talkie and the door chains seized from Jones' car and found them to be consistent. An FBI specialist in forensic photography compared autopsy photographs to the walkie-talkie and also found the wound patterns consistent with the metal rivets and snaps on the walkie-talkie's leather case.

Following a trial, the defendant was convicted of capital murder and sentenced to death. He appealed initially to the Court of Appeals of Ohio, First Appellate District.

Issue

Amongst other issues, the defendant argued that the trial court erred in admitting the digital comparison evidence of the forensic pathologist and the FBI Agent.

Ruling of the Court of Appeals of Ohio

The digital imaging comparison evidence was reliable and admissible.

This ruling was appealed to the Supreme Court of Ohio.

Ruling of the Supreme Court of Ohio

Both the forensic pathologist and the FBI Agent were presented as expert witnesses. Accordingly, Evid. R. 702 applies. The Court held that the evidence of the FBI Agent was admissible as the comparison evidence given was similar to the techniques used to compare fingerprints and shoeprints. The evidence was therefore admissible and the jury could assign whatever weight to the evidence it chose.

The conviction and death sentence were affirmed.

United States v. Calderin-Rodriguez, 244 F.3d 977 (March 29, 2001, United States Court of Appeals for the Eighth Circuit)

Facts

The defendant was convicted of conspiracy to distribute various illegal drugs. Part of the evidence for the prosecution was digitally enhanced audiotapes of undercover buy operations. The government retained a Spanish translator who enhanced the tapes by using a software program to reduce background noise and increase the volume of the speech. The translator had done this more than fifty times in the past. He testified that he did not add or subtract anything from the tapes but merely made the words more intelligible.

No *Daubert* hearing was held.

Issue

Did the court err in admitting the digitally enhanced voice recordings without conducting a *Daubert* hearing to lay the foundation for the tapes as scientific evidence?

Ruling

A *Daubert* hearing was not required as the digital enhancement simply makes it easier for the listener to hear the conversation on the tape. Although technically a “change” has been made to the recordings by the digital enhancement, it only changes the volume of the sounds. There is no legal significance to this process. Providing the other requirements for the admissibility of audio recordings are met, as were met here, the enhancements are admissible.

The convictions were affirmed.

***State of Ohio v. Hartman*, 754 N.E.2d 1150 (October 3, 2001, Supreme Court of Ohio)**

Facts

Hartman went to the victim's apartment and brutally murdered her by tying her to the bed, stabbing her 138 times, slitting her throat and cutting off her hands. There was a considerable amount of evidence against Hartman, including the fact that at the crime scene, police found Hartman's bloody fingerprint on the leg of a white plastic chair that was draped over the victim's body and another of his fingerprints on the victim's bedspread.

Patrick Warrick, a fingerprint examiner from the King County Sheriff's Office in Seattle, Washington, testified that by using enhanced digital imaging, he concluded that the fingerprint found on the bedspread was that of the defendant. He also reached the same conclusion without using digitally enhanced imaging.

Hartman was ultimately convicted of aggravated murder, kidnapping and tampering with evidence. He was sentenced to death. He appealed on a number of grounds including the admissibility of the digitally enhanced fingerprint evidence.

Issue

Did the trial court err in admitting the evidence of digitally enhanced fingerprint analysis? More specifically, did the State's expert have the necessary expert qualifications to give such evidence and is digitally enhanced fingerprint analysis reliable?

Ruling

The Court noted that in addition to relevance, expert testimony must meet the following criteria (per Evid.R. 702):

- a) the testimony must relate to matters beyond the knowledge or experience of lay persons,
- b) the witness must be qualified as an expert by specialized knowledge, skill, experience, training, or education regarding the subject matter of the testimony,
- c) the testimony must be based on reliable scientific, technical or other specialized information

The Court found that the first two prongs of the test were met as expert evidence was required to make fingerprint comparisons and there were no objections to Warrick's qualifications. On the third prong, defence counsel argued that

Warrick's testimony was "blazing new ground" and that the reliability of digitally enhanced fingerprint evidence had not been established.

The trial court accepted the reliability of digitally enhance fingerprint evidence, finding that:

"the use of the computer in this instance is no different than would be the use of an overhead projector, microscope, a magnifying glass or anything else like that would enhance an expert's ability to make his determination and therefore I find that there's nothing, no new trails being blazed here and I'm overruling the objection for that reason" (p. 9)

In reviewing this finding the Supreme Court of Ohio cited four factors to be considered in evaluating the reliability of scientific evidence:

1. whether the theory or technique has been tested,
2. whether it has been subjected to peer review,
3. whether there is a known or potential rate of error
4. whether the methodology has gained general acceptance

The Court noted that none of these findings were a determinative prerequisite to admissibility.

The Court found that digitally enhanced imaging meets Evid.R. 702's reliability standard. It also noted that in *State of Washington v. Hayden* the court approved the admissibility of digitally enhanced fingerprint evidence utilizing the *Frye* standard. The *Hayden* court considered expert testimony, articles from forensic journals and other material in concluding that the digital imaging enhancement of latent fingerprints is "generally accepted in the relevant scientific community." This conclusion under the more stringent *Frye* standard (which is not followed in Ohio) supported the conclusion of the Court that digitally enhanced fingerprint evidence meets the Evid.R. 702 reliability standard.

Therefore, the evidence of the State's expert Warrick was properly admitted.

The convictions and death sentence were affirmed by the Court.

In Re: The Disciplinary Action of Patrick J. Gianforte, unreported, November 7, 2001, State of Illinois, Department of Revenue, Illinois Gaming Board, Administrative Hearing Division)

Facts

The Grand Victoria Riverboat Casino had a give-away game promotion that required that tickets be drawn from a drum to select a winner. Gianforte was the Executive Host and was to make the drawings. The drawings were videotaped. On the draw in question, Gianforte placed his right hand into his right jacket pocket, removed it, placed it in the drum, swished the entries around and

purported to pull out the winning ticket. It was alleged that Gianforte rigged the drawing.

None of the witnesses to the drawing noticed anything amiss. Jim Wood, a forensic video analyst from the Louisville, Kentucky Police Department, conducted a full forensic video analysis, including a Powerpoint presentation, of the videotape. He was able to show that from the time Gianforte removed his right hand from his right jacket pocket, to the time his hand entered the drum, there was a white object, which appeared to be a white slip of paper resembling an entry ticket, slightly emanating from the bottom of his hand.

Issue

Should the Gaming Board rely on the forensic video analysis in determining whether Gianforte was guilty of misconduct?

Ruling

The Judge found that Jim Wood was qualified to give expert evidence. His evidence was of assistance to the trier of fact in understanding the videotape evidence. The opinions of Jim Wood were supported by an adequate factual foundation.

The Judge ruled that Gianforte's occupational licence be revoked.

State of Florida v. Reyes (unspecified date, 2002, Circuit Court of the 17th Judicial Circuit, Broward County, Florida)

Facts

This was a motion brought by the defence seeking a ruling that digital enhancement fingerprint analysis does not meet the *Frye* standard and therefore should be ruled inadmissible.

The State called three expert witnesses to demonstrate that digital imaging to enhance a latent print is not new or novel and is accepted within the relevant forensic community.

Erik Berg, developer of the PC Pros MORE HITS program, testified that while digital enhancement of fingerprints is not a new procedure, it has only received widespread acceptance in its application to the enhancement of fingerprints within the past decade. Conversely, digital enhancement of videotapes and photographs has been in use for more than a decade.

Reference was made to the International Association for Identification's (IAI) Resolution 97-9 which states:

...The International Association for Identification recognizes that electronic/digital imaging is a scientifically valid and proven technology for recording, enhancing, and printing images and like conventional silver-halide based photography, it is accepted by professional commercial photographers, law enforcement photographers, and the identification community.

The Court said that this Resolution has offered legitimacy to the technology and has encouraged its adoption among the members of the IAI. Since its adoption by the IAI, digital imaging technology has spread to nearly every major law enforcement agency in the United States.

David Witzke, an expert in forensic digital imaging, testified as to the standard image enhancement processes and procedures that are taught and followed in the United States, Canada and England.

David Knoerlein testified that he is a forensic analyst and is well trained and proficient in the use of digital image enhancement. Over the past five years, he has enhanced more than 10,000 images, most of which were latent prints. He testified that the procedures used by the Broward County Sheriff's Office in no way changes the basic fingerprint image. Rather, it only makes the image clearer. The relevant SOP for BCSO provides that:

...all enhancements shall be performed on exact copies of the original image, and that at no time during the enhancement process will any area of an image be deleted or altered in any way. All enhancement processes shall be accomplished by adjusting the values of each pixel that make up the total image. Each of these processes is then recorded for purposes of authenticating the image enhancement process.

Mr. Knoerlein further testified that these procedures follow the Scientific Working Group on Imaging Technologies' (SWGIT) recommendations and guidelines for the use of digital image processing in the criminal justice system. The stated purpose of the SWGIT guidelines is to ensure the successful introduction of forensic imagery as evidence in a court of law.

In the testimony of [defence witness] Ms. Myers, she stated that there is no documentation that exists which records the steps that were taken during the enhancement process. Both Messrs Witzke and Knoerlein demonstrated in this Court how that process is documented. Mr. Witzke also testified that the process of recording of digital enhancement processes is actually more thorough than the recording process of traditional photographic processes in which there is no record of any enhancement process, i.e., in traditional darkroom processing there is no record of how long the exposure was, where dodge and burn functions were performed, and so forth.

Issue

Does digital enhancement fingerprint analysis meet the *Frye* standard?

Ruling

Both Witzke and Knoerlein demonstrated that the digital enhancement procedure does not change the basic image. The Court concurred with the *Hayden* court that digital enhancement methodology does not involve new scientific principles and should not require a *Frye* hearing but nevertheless the methodology does satisfy the *Frye* requirements.

The defence was unable to provide credible witnesses or documentation to contradict the State's experts and the literature submitted by them.

The Court rejected the evidence of a proffered defence witness who said that Adobe Photoshop could be used to create fraudulent prints and held that her opinion 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.

The Court stated at page 5:

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, and Mr. Witzke demonstrated for this Court that the MORE HITS program could successfully authenticate the image.

And further at pages 6-7:

This Court finds that the process of digital enhancement of fingerprints used in this case, i.e., the "MORE HITS software program" is currently being used by the Federal Bureau of Investigation (FBI), US Department of Justice Drug Enforcement Agency (DEA), US Department of Treasury Inspector General for Tax Administration (TIGTA) (Formerly the IRS), US Postal Inspection Services, United States Air Force Office of Special Investigations (USAF OSI), United States Army Crime Lab, United States Customs, the United States Secret Service as well as more than 150 different state and municipal law enforcement agencies throughout the United States, and it is also being used in Canada and England.

This Court finds that there is no reason to depart from the accepted law in Florida and in all other States and Federal Courts in the United States of allowing into evidence the opinion of duly qualified experts as to the identification of a latent fingerprint with that of a known rolled fingerprint.

This Court finds that there are specific rules and standards that govern the use of digital images, including but not limited to the minimum accepted resolution of digital images. These standards are published as the FBI's guidelines regarding digital image quality standards, and have been accepted within the fingerprint community for more than two decades.

The Court ruled that the two proffered defence witnesses were of no value and were not allowed to testify before the jury.

The motion was denied.

Case Law Review Postscript

Relatively few reported cases exist in the field of digital evidence. The paucity of reported decisions is not indicative of the infrequency in the presentation of digital evidence. Most criminal cases are never reported. As such, they do not form part of the printed common law that can assist the courts in future cases. Indeed, the writer has led forensic video analysis evidence in a number of serious criminal prosecutions but the cases have not been reported. It is important to take steps to have cases involving digital evidence reported where the court offers comments on the admissibility of digital evidence. That will serve to broaden the common law in this area which will in turn assist the courts, prosecutors, defence counsel (sometimes), the police and victims of crime.

Conclusion

There is a perception, largely undeserved, that digital evidence somehow alters the true nature of the original evidence and is therefore unreliable. Presented properly, digital evidence is capable of being of tremendous assistance to the courts. Digital evidence has been led in courts in the United States and Canada over the past decade, sporadically at first and more frequently of late. Even though it has been around for a while, we are still at the forefront in developing and presenting this potentially valuable evidence.

The number of times that digital evidence will be subjected to *Frye* or *Daubert* hearings will decrease in time as the evidence will no longer be considered novel. That does not detract from the care with which this technology must be applied. The use of qualified and competent technicians and experts is critical to developing and maintaining a credible reputation for digital evidence. **Comprehensive SOPs are a must for any agency that uses digital technology in the examination and presentation of evidence.** Poor work or poorly presented work can undermine the gains that have been made thus far. Reliability is the watchword when it comes to the use of digital evidence in criminal prosecutions.