LEGAL AND PRACTICAL RESPONSES TO THE MOST COMMON CHALLENGES FACED BY FORENSIC VIDEO ANALYSTS

by

Jonathan W. Hak, Q.C., Dipl., B.Sc., LL.B., LL.M.

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1. Introduction

Forensic video analysis is a field of expertise that is relatively new for many attorneys and judges. As a result, there are often questions about the admissibility and acceptable parameters of such evidence in court. This paper is designed to set out the most common questions about forensic video analysis evidence followed by practical and legal responses to each question. The law in the United States and Canada will be the focus of this paper.

This paper does not address the issue of whether it is permissible to clarify video evidence as this has been well established by many courts in North America.[2]

2. Interpretation and Narration of Video Evidence

2.1 Why is expert interpretation and narration of video evidence necessary?

The silent witness theory provides that once video evidence is properly authenticated, it is admissible and is capable of speaking for itself. No witness who viewed the events need testify as to what is shown on the video. This

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[2] ***Nooner v. State of Arkansas***, 907 S.W.2d 677 (1995, Supreme Court of Arkansas); ***United States v. Beeler***, 62 F. Supp.2d 136 (1999, United States District Court, D. Maine); ***Dolan v. State of Florida***, 743 So.2d 544 (1999, Court of Appeal of Florida, Fourth District); ***State of Tennessee v. McCarver***, 2003 Tenn. Crim. App. LEXIS 784 (Tenn. C.A. 2003); ***United States v. Seifert***, 351 F. Supp. 2d 926 (2005, United States District Court, Minnesota); ***State of Texas v. Henley***, 2009 WL 1464247 (Court of Appeals of Texas); ***R. v. Brown***, [1999] O.J. No. 4865 (Ontario Court of Justice, General Division); ***R. v. Cooper***, [2000] B.C.J. 446 (British Columbia Supreme Court); ***R. v. Olivera***, [2002] B.C.J. 2157 (British Columbia Provincial Court); ***R. v. Jamieson***, [2004] O.J. No. 1780 (Ontario Superior Court of Justice); ***R. v. Gill***, [2004] B.C.J. No. 851 (British Columbia Court of Appeal); ***R. v. Pasqua***, 2008 ABQB 124; 2008 CarswellAlta 221 (Alberta Court of Queen's Bench), appeal allowed 2009 CarswellAlta 974, 2009 ABCA 247 (Alberta Court of Appeal) for reasons not relating to video evidence.

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theory of admissibility is very helpful and in some cases, it will be sufficient to simply play the video evidence and the trier of fact will garner what is needed from unassisted viewing of the video. In most cases however, it has become abundantly clear that expert interpretation of video evidence is required in order to properly assess and utilize its content. Relying on video evidence without expert interpretation risks failure to reach the correct conclusions based on the evidence or worse, reaching the wrong conclusions. Expert analysis and interpretation will assist in understanding the impact of such technical and practical issues as:

- Multiple camera views – piecing together and understanding the events
- Frame rate – how does frame rate affect the interpretation of video evidence?
- Aspect ratio – the accurate display of video evidence
- Compression – interpretation of compression artifacts and motion prediction and how compression affects image reliability and accuracy
- Tracking of people, vehicles and objects
- The alignment of audio to video images

The Supreme Court of Canada, in ***R. v. Nikolovski***[3] recognized and endorsed the analysis of video evidence at the image by image level, clearly accepting that merely playing surveillance video evidence will not maximize the value of such evidence.

The untrained eye is rarely able to fully understand video evidence. A properly trained and qualified expert will have spent many hours examining the video evidence and can assist the trier of fact in appreciating not only the overall events that are depicted but the fine details that are often otherwise overlooked or misunderstood. A competent expert will be able to draw on his/her knowledge and experience in assisting the jury in this meaningful and helpful way.

In a recent murder trial in Canada, the trial judge ruled on the value of expert interpretation of video evidence and why it was necessary for the jury to have the benefit of such expert assistance. In ***R. v. Pasqua***[4], the Court stated as follows on the issue of the relevance of expert interpretation and narration:[5]

> The video evidence is unquestionably probative as to the altercation that was alleged to have taken place and it is accurate and unaffected by the well-recognized frailties of eyewitness accounts. However, in its raw form it is difficult to interpret. The image quality is poor and the individuals pictured are difficult to track. The enhanced video evidence, together with the opinion of the expert Ms. McCaw is also unquestionably probative because it provides a clearer picture of the altercation as well as an explanation of how

[3] (1996), 111 C.C.C. (3d) 403
[4] 2008 ABQB124, 2008 CarswellAlta 221 (Alberta Court of Queen's Bench); appeal allowed 2009 CarswellAlta 974, 2009 ABCA 247 (Alberta Court of Appeal) for reasons not relating to video evidence
[5] At page 2

> the digital video has been analyzed to provide that clearer picture. In my view it does not pose the risk of confusing or confounding the jury, nor is the jury likely to be overwhelmed by scientific language -- even more so with an appropriate instruction from the Court in instructions to the jury -- and thereby give the evidence more weight than it deserves.

As to the requirement of necessity in assisting the trier of fact, the Court said:[6]

> As noted earlier, the raw video is very grainy, has low-quality still images, and colour variations are extremely subtle. The actions of the persons displayed are extremely difficult to track with the untrained eye. The proposed evidence describes technological processes used to enhance the video and to track the images therein, and provides knowledge not readily accessible to, and insight outside the experience of, the triers of fact. The digitization and enhancement is a useful tool in enhancing and clarifying the video, to assist the court in viewing and assessing the original images. Moreover, the expertise of Ms. McCaw in reviewing in detail and (as she later stated in evidence) "toggling" from the end to the beginning of the video, and forward and back, is helpful in following the subjects shown. With respect to Ms. McCaw's opinion that the individual seen fleeing the scene in later images was the same individual seen earlier in the altercation with Mr. Prevost, this forms a part of her analysis of the images. It is helpful in the interpretation of the video, though it is, in a sense, incidental, because her assistance will allow each juror (properly instructed) to come to their own conclusion, the expert's ultimate conclusion being a matter of weight, in the final analysis. As Sopinka J. pointed out in *Mohan*, at p.24, the possibility that expert evidence may overwhelm the jury (which, in any event, I do not find this expert would) can often be offset by proper instructions.

In some cases, it is the investigating officer that provides narration to the jury. Narration is similarly very helpful to both the judge and the jury. That assistance was exemplified in ***R. v. Mohamed***[7] where the Court commented on the merit of narration evidence as follows:[8]

> 17 It takes a number of times watching the videos**,** even in the slowed down format, to make any sense of how the action moves from quadrant to quadrant. Sometimes it is possible to see the same action in two different quadrants from different vantage points at the same time, which can also be quite disorienting at first. Identification of the participants was not an issue at trial. However, it is still difficult at times to tell which persons are which, or to know what part of the screen you should be watching in order to follow the events at issue.
>
> 18 The Crown proposed introducing both formats of the videotapes through Detective Fowler, who is intimately familiar with the footage having watched it probably hundreds of times. I ruled that Detective Fowler would be permitted to testify as to how the video cameras were set up and how to watch the action through the four quadrants sequentially. Further, I permitted Detective Fowler to pause the video at points and to direct the attention of the jury to particular individuals or areas where those aspects were of particular importance from the perspective of the Crown. On cross-examination, defence counsel had the same opportunity to have Detective Fowler point out relevant portions that were important from the perspective of the defence. On the *voir dire*, I had the benefit of watching the videos without explanation, and then having the Crown guide

[6] At page 3
[7] 2009 CarswellOnt 463 (Ontario Superior Court of Justice)
[8] At pages 5-6

> me through it. This guidance made an enormous difference to my ability to view the video properly, even after the fact when I was viewing it by myself on my own computer. In my opinion, it would have been of considerable assistance to the jury to have this sort of assistance when first watching the video**.**
>
> 19 Defence counsel conceded that in their final addresses to the jury all counsel could use the videos as an aid, that they could illustrate their points by slowing the footage and stopping and starting it, and that essentially they could do in their closings what the Crown did during her submissions to me on the *voir dire.* It seems to me that at the end of the trial, after all the evidence has been concluded, is not the point in time when the jurors should understand for the very first time what is going on in the video**.** Since it would not be appropriate for the Crown to provide any type of narration when the video is first being introduced and played for the jury, such assistance was appropriately provided through a knowledgeable police officer such as Detective Fowler.

While a police officer would have the ability to narrate the events transpiring on video, such evidence would not inject any expert assistance into the technical interpretation of the video evidence. A police officer would not be able to address issues of frame rate, compression artifacts and other technical issues that impact the proper interpretation of video evidence. Of greater concern is that an untrained police officer may in fact misinterpret the video evidence due to a fundamental misunderstanding of these technical issues. It is recommended that an expert be consulted for such purposes. This will serve to maximize the evidential value of the video evidence.

2.2 Who is qualified to interpret and narrate video evidence?

In addition to the requirements of relevance, necessity and the absence of an exclusionary rule, before expert evidence can be admitted at trial, the Court must be satisfied that the proposed expert is properly qualified. As with most areas of scientific expertise, this assessment is based on a full review of the proposed expert's knowledge, skill, experience, training and education. This is the position at common law and is also codified in Rule 702 of the Federal Rules of Evidence as follows:

> If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as a expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if
>
> (1) the testimony is based upon sufficient facts or data
> (2) the testimony is the product of reliable principles and methods, and
> (3) the witness has applied the principles and methods reliably to the facts of the case.

It follows that the proposed expert must actually assist the trier of fact and bring expertise to the table. An illustration of this principle is ***Dunlap v. Hood,***[9]

[9] 2009 WL 362292 (U.S. District Court, N.D. Texas, Dallas Div.)

wherein a "certified forensic analyst" proposed to perform an "elemental analysis" of jailhouse surveillance video for the purpose of determining the number of officers that were involved in removing the plaintiff from a jail cell. The Court ruled as follows regarding the admissibility of the proposed expert evidence:[10]

> Based on his "elemental analysis" of the surveillance video, Dickey concludes that at least two officers participated in extracting plaintiff from the holding cell. However, Dickey reached that conclusion just by looking at the images taken from the surveillance video, unaided by any specialized knowledge or experience. Because Dickey is no better suited than the jury to interpret the contents of the video, his supplemental opinion is not the proper subject of video testimony.

This is further exemplified in ***Lee v. Andersen and the City of Minneapolis***.[11] In this case, trustees for the heirs of Lee, who was shot and killed by a police officer, brought an action against the officer and the city alleging excessive use of force and state claims. The officer testified that he was chasing an armed suspect (Lee) who then turned to face the officer whereupon the officer shot him eight times, killing him. A gun was found a few feet from his body. Surveillance video from a nearby school captured part of the foot chase, the end of the chase, the officer drawing his gun, Lee's body and other officers arriving shortly afterwards.

In a pre-trial motion, Andersen and the city moved to exclude proposed expert testimony regarding whether Lee had a gun in his hand at the time he was shot. The trustees sought to call a video expert who had increased the contrast of the video images and clarified some of the relevant images. It was the expert's opinion that Lee did not have a gun or any other object in his hand during the moments before the shooting. At his deposition, when asked what methods and principles he used to interpret the images, the expert replied "simple observation." The trial judge granted the motion to exclude the proposed expert evidence on the basis that the jury did not need assistance in determining whether they could see a gun or any other object in Lee's hand. The judge ruled that the expert did not employ any technique or utilize any specialized skill that was unavailable to the jury. The judge did permit the expert to testify regarding how the surveillance system worked and the processes he used to clarify the video images.

On appeal, the trustees argued that the trial judge erred in excluding the expert testimony regarding whether Lee had a gun or any other object in his hand. The Court of Appeals noted that Federal Rule of Evidence 702 permits a qualified expert to give opinion testimony if the expert's specialized knowledge would allow the jury to better understand the evidence or decide a fact in issue. However, if the subject matter is within the jury's knowledge or experience, the expert testimony is subject to exclusion because it does not meet the helpfulness

[10] At page 2
[11] 616 F.3d 803 (U.S. Court of Appeals, Eighth Circuit)

criterion of Rule 702. Opinions that "merely tell the jury what result to reach" are not admissible. The Court ruled as follows:[12]

> Dierks's opinion that Fong Lee did not have a gun in his hand was properly excluded under Rule 702. The opinion would not have assisted the jury but rather would have told it what result to reach. Dierks explained in his deposition that the first method he uses to interpret images is "simple observation." He compared the images and considered the position of Fong Lee's hand, the size of the objects, and the shadows. When asked what specialized knowledge he had to assist the jury in deciding what the clarified images show, Dierks responded, "I believe that a reasonable person looking at the clarified photograph and looking at Fong Lee's hand would conclude that his hand does not have a firearm in it." Although Dierks testified that his experience and training allow him to look at an image more critically than a lay person, the jury was entirely capable of analyzing the images and determining whether Fong Lee had anything in his hands.

This decision illustrates what is expected of an expert in order to meet admissibility criteria.

Forensic video analysis is a scientific discipline and it takes a considerable amount of training, education, experience and skill to truly be an expert in this field. A properly qualified expert in forensic video analysis should possess the following attributes:

- considerable relevant education and training
- an array of prior casework
- demonstrated objectivity (for example, working in criminal and civil cases, for either side in the litigation)
- thorough understanding and implementation of the scientific method in all case work
- the ability to effectively handle technical challenges in a case
- demonstrated competence exemplified by teaching in the area of forensic video analysis
- membership in forensic video analysis groups such as the Law Enforcement and Emergency Services Video Association (LEVA)

Courts will apply a reasonable amount of latitude in assessing expertise as noted by the Court of Appeals of Texas in ***State of Texas v. Stevenson***:[13]

> An expert may add precision and depth to the ability of the trier of fact to reach conclusions about subjects that lie well within common experience. Because the possible spectrum of education, skill and training is so wide, a trial court has great discretion in determining whether a witness possesses sufficient qualifications to assist the jury on a specific topic in a particular case.[14]

[12] At page 809
[13] 304 S.W.3d 603; 2010 WL 323562 (Tex. App. – Forth Worth 2010)
[14] At page 34

The Court further noted that when considering whether a trial judge should permit expert testimony, the court must consider the qualifications of the expert. The following factors are relevant:

1. The more complex the field of expertise, the more important the expert's qualifications become.
2. The more conclusive the expert's opinion, the more important the expert's qualifications become.
3. If the expert's evidence is critical to solving the issue before the court, the more important the expert's qualifications become.

There are many cases wherein the prosecution or the defense have put forth a proposed expert witness to give evidence about his/her forensic analysis of video evidence. Experience has shown that not all such witnesses are actually experts. Sometimes that lack of expertise is detected in the qualification phase and in others not until the witness is actually testifying at trial. Pseudo-experts market themselves as being forensic video analysts when their background is limited to production or commercial video, and where they have no forensic training, do not understand and apply scientific methodology and lack objectivity. Using a witness who is not properly qualified and competent can lead to improper verdicts and injustices.

An example of a case wherein an unqualified expert was utilized by the prosecution and where it became evident that the expert had improperly processed video evidence to achieve a desired result is the case of ***State of Iowa v. Pollard***.[15] This case illustrates the danger that can arise when video evidence is subjected to technical processes that, if unchallenged, may give the trier of fact a false impression of the true meaning of the video evidence. In this case, the defendant was charged with first degree murder arising out of the hit and run death of a woman in a store's parking lot. The State alleged that the defendant was driving his pickup truck in the darkened parking lot when he struck and killed the victim. Key evidence in the case was surveillance video from three different stores that captured portions of the event. The State's expert compiled a DVD with sequential clips from approximately 20 surveillance cameras that captured (or appeared to capture) portions of the event. This expert was not a forensic video analyst, nor did he have any training in this field of expertise. The expert modified the compilation digital video evidence by speeding up portions of the video so as to make it look more likely that the truck shown prior to the hit and run was also the truck that struck the victim. The stated reason for speeding up this portion of the video was to make the images smoother. The actual end result was to make the video evidence stronger and more compelling than it was in its original form.

Grant Fredericks was retained to analyze the video evidence for the defendant and after a thorough review of all of the original video evidence, he determined

[15] 2007 WL 2408114 (Iowa District Court)

that the State's expert had modified the speed of the compilation video evidence. Further, Fredericks demonstrated that the methods used to convert the original video to DVD format removed detail, added digital artifacts and resulted in an incorrect aspect ratio. As a result, the compilation DVD was not a true and accurate depiction of the events, as it was created without proper regard for the requisite forensic video methodology.

In analyzing the State's video evidence and the evidence presented by Mr. Fredericks, the Court noted that the State is obliged to show that the compilation DVD evidence is authentic, that is, that the video evidence is an accurate representation of the event recorded. Pursuant to the "silent witness" theory of video admissibility, there must be testimony from a witness capable of establishing the integrity, authenticity and competency of the video evidence. The Court concluded that the probative value of the altered portion of the video evidence was substantially outweighed by the danger of unfair prejudice. This ruling was based on the fact that the altered version of the video evidence made it seem more likely that the pickup truck shown earlier was also the same truck that struck the victim, a conclusion that is not supported when viewing the real time version of the video as presented by Mr. Fredericks. The Court ruled that the altered portion of the video evidence was inadmissible as a result and that the balance of the concerns raised by the defendant's expert were issues that should be considered by the trier of fact. Subsequently, the charges against the defendant were withdrawn by the State.[16]

The lesson that should be drawn from this case is that only properly trained forensic video technicians or analysts should work on video evidence. Further, a technical review and analysis of the work of one expert by another expert can sometimes shed a different light on the interpretation of video evidence. Only properly qualified forensic video analysts are competent to accurately interpret video evidence.

Given that forensic video analysts acquire their knowledge, education, skill, training and experience from a variety of sources, the courts will always examine what a proposed expert witness offers by way of credentials when deciding if the witness should be allowed to testify in an expert capacity, and further, what weight should be afforded to such evidence if permitted to testify. In ***R. v. Gill***,[17] the defendant was prosecuted for murder arising out of a fatal stabbing and was ultimately convicted by a jury for manslaughter. Part of the prosecution's evidence consisted of a surveillance videotape generated from a camera that a neighbor had installed at the rear of her residence. A forensic video analyst digitized the original analog tape and clarified the images. The trial judge ruled that the video evidence was admissible, over the objections of the defense. On appeal, the defendant argued that the trial judge erred in admitting the video

[16] A retrial in 2010 resulted in the defendant being acquitted.
[17] [2004] B.C.J. No. 851 (British Columbia Court of Appeal)

evidence. One of the objections raised was that the forensic video analyst was not properly qualified.

The Court of Appeal stated as follows on this issue:

> [30] As to the latter issue I find myself in respectful agreement with the view taken by the trial judge in his ruling on the admissibility of the enhanced tape:
>
> > THE COURT: The Crown tenders Mr. Walker as an expert in the area identified by Crown as forensic video analysis. Essentially, Mr. Walker has been asked to view an analogue, surveillance videotape, taken on the evening of the incident and to see if he could enhance that by, in his words, transferring it from the analogue format to the digital format which then allows him to perform certain exercises on the videotape with a view to enhancing what we see on the tape.
> >
> > I have seen the tape and I have seen the process which Mr. Walker went through to accomplish that objective. On the basis of his evidence, I am satisfied that the transfer from analogue to digital does not add to or detract from the content of the original videotape. I am also satisfied on the basis of the evidence that this is an area of technology where an expert can assist the trier of fact with his knowledge and experience beyond that of the ordinary lay trier of fact.
> >
> > I recognize that this area is a developing area of technology, and I also recognize, on the basis of the evidence before me, that people are acquiring whatever expertise they can offer in this area in what might be termed less traditional ways; that is, there is not a particular university course that would qualify one as a forensic video analyst on the basis of Mr. Walker's evidence before me.
> >
> > I refer to R. v. Russell (1994), 95 C.C.C. (3d) 190, a decision of the Ontario Court of Appeal, and I note the quote at p. 191 from R. v. Marquard (1993), 85 C.C.C. (3d) 193 (S.C.C.) quoting Justice McLachlin (as she then was), with approval:
> >
> > > The only requirement for the admission of expert opinion is that the "expert witness possesses a special knowledge and experience going beyond that of the trier of fact" [citation omitted]. Deficiencies in the expertise go to weight, not admissibility. As stated by Sopinka, Lederman and Bryant, The Law of Evidence in Canada (1992), pp. 536-7:
> > >
> > > > "The admissibility of [expert] evidence does not depend upon the means by which that skill was acquired. As long as the court is satisfied that the witness is sufficiently experienced in the subject-matter at issue, the court will not be concerned with whether his or her skill was derived from specific studies or by practical training, although that may affect the weight to be given to the evidence."
> >
> > Reviewing Exhibit A, that is, the qualifications of Mr. Walker and his educational and professional background, it seems to me that the evidence meets the test contemplated by the Russell decision.
> >
> > As well, in my view, the proposed evidence meets the threshold of reliability and necessity as posited by the Supreme Court of Canada in R. v. Mohan (1994), 89 C.C.C. (3d) 402, and neither does the evidence present any of the risks highlighted in that case.

> In these circumstances, I conclude that Mr. Walker's evidence is admissible as expert evidence in the field of forensic video analysis.
>
> [31] The trial judge found as a fact that the enhancement process did not distort the tape. The tape was, in my view, properly given to the jury. The weight to be attached to the evidence was for them to decide. I can see no reversible error in the trial judge's ruling on the evidence.

This ruling is important because it respects the role of the trial judge in assessing whether a proposed expert witness is sufficiently qualified to be allowed to testify in an expert capacity and further, what weight should be assigned to such evidence. It should be remembered that qualifying as an expert witness requires less expertise than truly being an expert in the field. Those seeking to hire a forensic video analyst should thoroughly review the qualifications of the proposed witness. Demonstrated and proven competence is a must.

Another case that closely examined the qualifications of the prosecution's tendered forensic video analyst was ***R. v. Pasqua***.[18] The defense argued that the expert was not sufficiently qualified. On this point, the Court was impressed with the analyst's training and in particular the training she received through LEVA:[19]

> Ms. McCaw's curriculum vitae was marked as Exhibit VD-1. She was examined extensively on it. She has been employed as a Forensic Video Analyst with the Calgary Police Service since 1999, and prior to that time worked as a videotape editor for the Calgary Police Service and, still earlier (and since), in the video replay aspects of broadcast television. Her educational history indicates that she has completed a very substantial number of courses in the field of forensic video analysis being only two to four courses short of the highest certification recognition currently available. She has instructed others on the science and art of forensic video analysis to others in the highest levels of law enforcement in North America. She has been previously qualified as an expert in forensic video analysis by this Court and by the Provincial Court of Alberta. I am satisfied that Ms. McCaw has the training and experience, and thus the expertise to give opinion evidence as a forensic video analyst.

It is critical in forensic video analysis that the expert must be able to truly assist the trier of fact in assessing the video evidence. This principle was recognized and applied in the case of ***State of Maine v. Twardus***.[20] In this murder case, there was a pre-trial motion to suppress the evidence of a forensic video analyst whom the prosecution intended to present. Grant Fredericks was called by the prosecution to testify regarding surveillance video which purportedly showed the defendant in a convenience store in the vicinity of where the victim's body had been found. The defense argued that the videotapes speak for themselves and that no expert witness was required. Parenthetically, this is the most common

[18] 2008 ABQB 124; 2008 CarswellAlta 221 (Alberta Court of Queen's Bench); appeal allowed 2009 CarswellAlta 974, 2009 ABCA 247 (Alberta Court of Appeal) on grounds not relating to video evidence

[19] At page 4

[20] Citation pending, January 26, 2010, Maine Superior Court

defense objection to competent forensic video analysis evidence. It is typically premised on a fundamental misunderstanding of the evidence or on a recognition of the damaging effect such evidence could have for the objecting attorney's case. Here, the Court ruled that Mr. Fredericks' qualifications gave him knowledge that was superior to that of the trier of fact and that this would be of assistance to the jury in determining the facts in the case. The motion to exclude the expert's evidence was therefore denied. The further issue of attempting to limit the scope of the expert evidence was left to be addressed at trial.

It should be noted that forensic video analysts must have a competent understanding of the computers and other equipment used in conducting their analysis. This principle was clearly enunciated by the Supreme Court of Connecticut in ***State of Connecticut v. Swinton***,[21] and ***State of Connecticut v. Melendez***.[22] In ***Swinton***, the Court issued an important ruling on the issue of authentication and the use of computer generated evidence and while this case does not deal with video evidence, the principles enunciated have direct application to forensic video analysis.

In analyzing the issue of what is necessary to lay a proper foundation for the admission of computer generated evidence, the Court said at pages 812-814:

> We agree that "reliability must be the watchword" in determining the admissibility of computer generated evidence; Nooner v. State, supra, 322 Ark. 104; and we conclude that these six factors adequately refine our requirement enunciated in American Oil Co. that, in order to lay a proper foundation for computer generated evidence, there must be "testimony by a person with some degree of computer expertise, who has sufficient knowledge to be examined and cross-examined about the functioning of the computer." American Oil Co. v. Valenti, supra, 179 Conn. 359. In addition to the reliability of the evidence itself, what must be established is the reliability of the procedures involved, as defense counsel must have the opportunity to cross-examine the witness as to the methods used. We note that "reliability problems may arise through or in: (1) the underlying information itself; (2) entering the information into the computer; (3) the computer hardware; (4) the computer software (the programs or instructions that tell the computer what to do); (5) the execution of the instructions, which transforms the information in some way - for example, by calculating numbers, sorting names, or storing information and retrieving it later; (6) the output (the information as produced by the computer in a useful form, such as a printout of tax return information, a transcript of a recorded conversation, or an animated graphics simulation); (7) the security system that is used to control access to the computer; and (8) user errors, which may arise at any stage." R. Garcia, "'Garbage In, Gospel Out': Criminal Discovery, Computer Reliability, and the Constitution," 38 UCLA L. Rev. 1043, 1073 (1991); see also K. Butera, "Seeing is Believing: A Practitioner's Guide to the Admissibility of Demonstrative Computer Evidence," 46 Clev. St. L. Rev. 511, 525 (1998) (proper authentication requires that reliability of computer process and accuracy of results be subject to scrutiny).
>
> We believe that these factors effectively address a witness' familiarity with the type of evidence and with the method used to create it, and appropriately require that the witness be acquainted with the technology involved in the computer program that was used to generate the evidence. These factors also ensure that the hardware and software used to

[21] 268 Conn. 781; 2004 Conn. LEXIS 190 (Conn. 2004)
[22] 291 Conn. 693, 970 A.2d 64 (2009)

> generate the evidence were adequate for that purpose and that the technology was reliable. As in our decision in Porter, we stress that these factors represent an approach to the admissibility of computer generated evidence, and not a mechanical, clearly defined test with a finite list of factors to consider. See State v. Porter, supra, 241 Conn. 79. "Trial courts must have considerable latitude in determining the admissibility of evidence in this area as in others." American Oil Co. v. Valenti, supra, 179 Conn. 360. Although a trial court should weigh and balance these factors and decide whether they ultimately support the admissibility of the evidence, we offer these factors to serve as guideposts, and do not suggest that these factors necessarily are to be held in equipoise…

And at pages 829-830:

> A witness must be able to testify, adequately and truthfully, as to exactly what the jury is looking at, and the defendant has a right to cross-examine the witness concerning the evidence. Without a witness who satisfactorily can explain or analyze the data and the program, the effectiveness of cross-examination can be seriously undermined, particularly in light of the extent to which the evidence in the present case had been "created."

This decision has direct application to any video evidence that undergoes forensic processes. The witness who presents such evidence must have sufficient knowledge of the processes and equipment used in order to lay the appropriate foundation for the evidence. It is not necessary for the witness to be an expert in the computer programs involved but certainly the skills and knowledge limited to the level of a “button pusher” is not sufficient for authentication purposes. This is yet a further criterion that must be considered when selecting a forensic video analyst for a case.

The ***Swinton*** case was revisited by the Connecticut Supreme Court in the context of video evidence in ***State of Connecticut v. Melendez***. At issue was whether digital video of drug buys was admissible at trial. The State sought to introduce DVDs of drug buys. Some of the video had been enhanced, slowed to 10% real time or both. The State did not call sufficient evidence to comply with the requirements of ***Swinton*** and even though the trial court admitted this video evidence, the Supreme Court ruled that it should not have done so. The Court excluded the video evidence. Other video evidence consisted of DVDs that contained a copy of the original 8 millimeter video and that were not subjected to any modifications. At pages 709-710, the Court stated:

> We reach a different conclusion, however, with respect to the portions of the DVD containing the footage that Brunetti did *not* modify, that is, the two video clips that are exact copies of the footage originally captured on the eight millimeter videotape while the transactions were occurring. In *Swinton* we acknowledged the difficulty in establishing a precise definition of what constitutes “computer generated” evidence. We did, however, draw a distinction between technologies that may be characterized as merely *presenting* evidence and those that are more accurately described as *creating* evidence. With that fundamental distinction in mind, we conclude that the portions of the DVD containing the exact duplicates of the original, unenhanced footage played in real time, simply do not constitute computer generated evidence for purposes of *Swinton*. Thus, to the extent that

> Brunetti merely transferred a copy of the contents of the original eight millimeter videotape to the DVD, that process, which Rubinstein witnessed, does not implicate the foundational standard that we adopted in *Swinton.* Although it is true, of course, that generating such a copy required the use of technology, that technology, which is widely used and readily available, involves nothing more than the reproduction of video footage from one medium to another. Indeed, the defendant has provided no reason why the admissibility of copies that are produced by that process-copies that have not been enhanced, altered or changed in any way-should be subject to the more rigorous requirements of *Swinton.* We conclude, therefore, that compliance with *Swinton* was not a prerequisite for admission of the unmodified video clips contained on the DVD.

Therefore, ***Swinton*** is clearly applicable to digital video evidence but the detailed requirements set out by the Court do not apply to the process of copying video without modification. Note that the process of copying video evidence can result in modification by compression. Therefore a trained and knowledgeable person should do all copying of video evidence. In a true forensic video analysis case, much more processing would likely be done and the analyst would have to have proven competence and knowledge of the tools used to conduct the analysis.

A final comment should be made on the issue of certification. In ***R. v. Kalle***,[23] part of the evidence for the prosecution was the evidence of a forensic video analyst. He was called to give expert evidence in the comparison and contrast of known and questioned images. The defense objected to the analyst being qualified on the basis that he had no university degree and that he was not a certified forensic video analyst. The Court allowed the analyst to be qualified as an expert witness, noting that he had sufficient training and experience to meet the expert threshold. On the issue of certification, the Court noted that while certificiation is an important factor, it is not determinative.

This case illustrates the general principle that it is not necessary to be a certified forensic video analyst to be qualified as an expert witness. In some instances it may be that an analyst is not practically able to be certified. Where, for example, an analyst teaches many of the courses in a certification program, he would not meet the requirement of completing the courses as a student. That administrative roadblock does not detract from the expert's qualifications.

2.3 Are there court rulings that permit a forensic video analyst to interpret and narrate video evidence for the court?

A common objection from opposing counsel is that a forensic video analyst should not be able to narrate for the trier of fact what the video evidence depicts. This of course deprives the court of valuable evidence as noted in Section 2.2 above and it is for that very reason that the objection is made. There is ample case authority that supports narration evidence by the analyst.

[23] 2007 WL 298566 (Ont. S.C.J.)

In ***State of Washington v. Robinson***,[24] the defense argued, among other things, that the trial court erred in allowing the analyst to explain the contents of the video evidence to the jury. The Court of Appeals found no merit to either argument. The Court stated:[25]

> Some of the witness accounts that Robinson contends were cumulative were inconsistent, contradictory, or less comprehensive than other witness testimony. In contrast, the condensed surveillance video, Exhibit 3, provided a cohesive time frame and objective portrayal of the surroundings and the involved parties' activities.

This case reinforces the objectivity that surveillance video can bring to an investigation and prosecution and the key role a forensic video analyst can play in maximizing the value of the video evidence by narrating its contents to the jury.

State of Texas v. Gonzales[26] is a case that is sometimes cited as being authority for the proposition that narrative evidence is inadmissible. In fact, this case demonstrates that narrative evidence is quite proper, but that, as with many types of testimonial evidence, there are limitations on narrative evidence.

The defendant was one of three men charged with the robbery and murder of a store clerk. The robbery was captured on an analog quad CCTV system with audio. Portions of the murder were also recorded. The State's forensic video analyst, Grant Fredericks, clarified the video images and provided narrative as to what each of the suspects did during the recorded events. Evidence was also given as to the estimated height of each of the suspects. Additionally, known images were obtained of the suspects and their clothing and these were compared to the images recorded during the event in a photographic/video comparison process.

The defendants were tried separately. Gonzales was convicted of murder and sentenced to life imprisonment. He appealed his conviction citing two alleged errors during the trial. The first was the failure to instruct the jury on the lesser included offense of felony murder. The second alleged error was that the trial judge allowed the forensic video analyst to provide a narrative to the jury of the surveillance video evidence. The defendant argued that the expert testified to information that the jury already possessed and could understand without the expert's assistance. As noted earlier, this is a common argument against narrative evidence that is rarely successful.

Mr. Fredericks was qualified as an expert in forensic video analysis and video comparison. He testified that he digitized the surveillance video, clarified the video images and audio content, separated the quad images, made them full screen, and showed them in chronological order. The forensic video evidence was admitted without objection. The prosecutor then asked Mr. Fredericks to

[24] 2005 Wash. App. LEXIS 3037 (Wash. C.A.)
[25] At page 5.
[26] 2006 WL 820387, not reported in S.W.3d (Court of Appeals of Texas, Fort Worth)

"please narrate what you observe as an expert when you're evaluating and clarifying this tape." Fredericks provided two days of testimony, during which he described hundreds of narrative observations regarding the technical interpretation of the video images and gave detailed descriptions of the actions of each of the people depicted in the images. The defendant objected on the basis that the jury did not require narration to understand the evidence, but the objection was overruled. On appeal, the defendant challenged only one sentence of narration by the expert. At page 3, the Court of Appeals stated:

> Despite the several objections appellant made to Fredericks's testimony, on appeal appellant challenges only one of Fredericks's statements as an improper narration. Appellant asserts that when Fredericks testified that:
>
> "male number two runs into the scene and goes directly to the counter where the money is…pulls the money and begins to stuff his pocket with money and continues to do so even after we hear the bang on the video which is consistent with a gunshot…he waves to the gunman…consistent with somebody saying 'come this way…'"
>
> he exceeded the permissible scope of his testimony as an expert by interpreting the evidence for the jury when it was not necessary. He cites to no statute, rule, or case authority as the basis for his objection. The State contends that the expert's comments qualify as admissible witness testimony either under rule of evidence 702 as technical, scientific, or other specialized knowledge that would assist the fact-finder in deciding the case or, in the alternative, under rule of evidence 701 as lay testimony that is helpful to make a clear understanding of the witness's testimony or to a determination of a fact in issue.
>
> Initially we note that it is a general rule of evidence that opinion testimony is inadmissible because it is not based upon personal knowledge of the existence of facts capable of being proved by direct evidence. Clearly, there is nothing to be gained by permitting a witness to proffer an opinion on a subject when any other person in the courtroom, any member of the jury, could form an opinion on the issue equally readily and with the same degree of logic as the witness. Id. But when the jurors are not competent to infer, without the aid of greater skill than their own, the probable existence of the facts to be ascertained, or the likelihood of their occurring from other facts actually proved, expert opinion evidence is rendered admissible. Id.
>
> Here, while the jury viewed the videotape, Fredericks testified that appellant waved to the gunman consistent with his saying "come this way." However, there is no evidence that Fredericks had any special training in a field that qualified him to offer an expert opinion as to what appellant's intent was in gesturing to the gunman. And even if Fredericks did have some special training that qualified him to offer an opinion as to what was meant by appellant's hand gesture, the jury did not need Fredericks's assistance to determine appellant's intent. The jury members viewed the videotape themselves and were as capable as Fredericks in determining what appellant's intent was in making the gesture. Therefore, Fredericks's opinion testimony was of no assistance and was inadmissible as expert or lay testimony. See Steve v. State, 614 S.W.2d 137, 139 (Tex.Crim.App.1981) (holding lay witness's opinion in capital murder prosecution excludable where evidence existed upon which jury could form its own opinion, thus rendering accomplice witness's opinion not helpful); see also K-Mart Corp. v. Honeycutt, 24 S.W.3d 357, 361 (Tex.2000) (holding jury did not need any special interpretation of facts by expert to determine whether reasonable for plaintiff to sit on railing because matter was within "average juror's common knowledge."). We hold that the trial court erred by allowing Fredericks to testify as to what the videotape showed.

> Having found error, we must conduct a harm analysis to determine whether the error calls for reversal of the judgment. Erroneous admission of evidence is non-constitutional error and must be disregarded unless it effects substantial rights of the defendant. A substantial right is affected when the error had a substantial and injurious effect or influence in determining the jury's verdict. Substantial rights are not affected by the erroneous admission of evidence if the appellate court, after examining the record as a whole, has fair assurance that the error did not influence the jury, or had but a slight effect.
>
> In this case, the jury heard evidence that appellant confessed in writing to planning the robbery that led to the murder of Meraj. They also heard that appellant obtained the murder weapon and ammunition from his cousin. The jury viewed the videotape that showed appellant stuffing his pockets with the cash from the store's register as Meraj was being shot. Additionally, in closing argument the State only briefly mentioned Fredericks's testimony, and the State never referred to Fredericks's statement that appellant's waving to the gunman was consistent with his saying "come this way." Moreover, because the jury itself saw the videotape, it could still interpret and apply its own meaning to the one gesture to which appellant objected.
>
> We conclude that, in the context of the entire case against appellant, the trial court's error in admitting Fredericks's testimony that appellant's waving to the gunman was consistent with his saying "come this way," did not have a substantial or injurious effect on the jury's verdict and did not affect appellant's substantial rights. Thus, we disregard the error and overrule appellant's second issue.
>
> Having overruled both of appellant's issues, we affirm the trial court's judgment.

In reality, Mr. Fredericks gave extensive narrative evidence over two days of trial that was clearly of assistance to the jury. Of all of the evidence he presented, the defense objected to only this one point, a point that the Court of Appeals agreed with, but held that it had no impact on the verdict. This case therefore places a limitation on narration evidence (ascribing intention to a gesture) but otherwise clearly endorses the use of narrative evidence.

In ***State of California v. Nero,***[27] the trial judge refused to allow a defense forensic video analyst to testify about what actions he did and did not see in the surveillance video. On appeal, the Court of Appeals of California did not rule that such evidence was inadmissible, but rather that the trial court did not abuse its discretion by excluding it.

In ***State of Texas v. Stevenson***,[28] a murder case arising out of a convenience store robbery, the state's forensic video analysis expert overlaid 911 calls onto the store's surveillance video and developed a PowerPoint™ presentation to show what occurred during the robbery. As the presentation was shown, Mr. Fredericks narrated the events as they occurred. The defendant objected to the expert's evidence, relying on a *Daubert* challenge.

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[27] 181 Cal.App.4th 504; 104 Cal.Rptr.3d 616 (Court of Appeals of California, Second District, 2010) [the forensic video evidence portion of the case is in Part I, which has not been published]
[28] 304 S.W.3d 603; 2010 WL 323562 (Tex. App. – Fort Worth 2010)

The Court noted that before admitting expert testimony under Texas Rules of Evidence 702, the trial court must be satisfied that three conditions are met:

1. The witness qualifies as an expert by reason of his knowledge, skill, experience, training or education.
2. The subject matter of the testimony is an appropriate one for expert testimony.
3. Admitting the expert testimony will actually assist the fact finder in deciding the case.

The Court noted that a trial judge need not exclude expert testimony simply because the subject matter is within the comprehension of the average jury. If the witness has some special knowledge or additional insight into the field that would be helpful, then the expert can assist the trier of fact to understand or to determine a fact in issue.

> An expert may add precision and depth to the ability of the trier of fact to reach conclusions about subjects that lie well within common experience. Because the possible spectrum of education, skill and training is so wide, a trial court has great discretion in determining whether a witness possesses sufficient qualifications to assist the jury on a specific topic in a particular case.[29]

When considering whether a trial judge should permit expert testimony, the court must consider the qualifications of the expert. The following factors are relevant:

1. The more complex the field of expertise, the more important the expert's qualifications become.
2. The more conclusive the expert's opinion, the more important the expert's qualifications become.
3. If the expert's evidence is critical to solving the issue before the court, the more important the expert's qualifications become.

After noting that there had been an unsuccessful ***Daubert*** challenge at trial, the Court held that it was reasonable for the trial judge to conclude that the expert could assist the jury by clarifying what they were seeing in the video, particularly with regard to height comparisons.

This case is significant because it expressly permits narrative evidence and recognizes that such evidence is of value to the trier of fact. Further, the Court notes that as the importance and complexity of the task the expert is engaged in increases, the more important the qualifications of the expert become. It follows that it is preferable to retain a forensic video analyst who is fully qualified and who has ample court experience. There is skill involved in providing effective narrative evidence and that skill comes with experience.

[29] At page 34

Trans North Turbo Air Ltd. v. North 60 Petro Ltd.[30] is a civil case wherein the plaintiff alleged that the employees of the defendant negligently set fire to an airport hangar. A significant part of the plaintiff's evidence was the forensic video analysis of an airport security camera system. By isolating and stabilizing relevant images and using reverse projection to isolate light sources, the plaintiff's forensic video analyst was able to identify where the fire started, namely, at the base of a sign on the roof where one of the defendant's employees had earlier been using a cutting torch. A defense expert questioned the conclusions reached by the plaintiff's analyst. No challenge was made to the scientific validity of the forensic video analysis itself, rather the challenge was to the interpretation of the results.

This case included narrative evidence, during which Mr. Fredericks described what was occurring on the airport hangar roof and surrounding area. This evidence was central to determining the point of origin of the fire. The trial judge relied on the forensic video analysis (and other evidence) in finding the defendant liable. On appeal to the Yukon Territory Court of Appeal,[31] the Court found that the forensic video analysis evidence was critical to determining the origin of the fire and that the trial judge was correct to rely upon it.

In ***R. v. Pasqua***,[32] the defendant was charged with murder for pushing the victim in front of an approaching commuter train. The station's surveillance video was of poor quality and did not allow for any identification of individuals at the time the push occurred. The prosecution's forensic video analyst tracked the images of interest backwards in time so as to show who was involved in the incident. This involved Ms. McCaw narrating the movement of the individuals shown. This evidence was of considerable assistance to the trier of fact in understanding what occurred and who was involved. The defense challenged this evidence and on this issue, the Court said:[33]

> The images in the enhanced video have not been changed. They are the same images as seen in the original video, only enhanced and with attention drawn to aspects of them. The enhanced video does not add or detract from the content of the original. The original video evidence remains substantially unaltered and the enhancements (each in separate digital files) serve merely as a visual aid to assist the triers of fact.
>
> The evidence is tendered solely, and is only helpful, for the purpose of interpreting the events that are actually shown on the video that led to the death of Mr. Prevost and allegedly showing that the individual later seen fleeing the scene is the same individual involved in the earlier altercation. In this context, I do not believe that any prejudice (as that word is properly used in a legal context) that may arise from viewing the enhanced video, or hearing the opinion of Ms. McCaw, would outweigh the probative value of the

[30] [2003] Y.J. No. 47 (Yukon Supreme Court)
[31] [2004] Y.J. No. 55
[32] 2008 ABQB 124; 2008 CarswellAlta 221 (Alberta Court of Queen's Bench); appeal allowed 2009 CarswellAlta 974, 2009 ABCA 247 (Alberta Court of Appeal) for reasons not involving video evidence
[33] At page 3-4

> evidence. Nor will the evidence distort the fact-finding process such that the "province of the jury" might be usurped. Were Ms. McCaw to simply state the conclusion of her analysis (her opinion that the person seen leaving the scene was the same person involved in the altercation) by itself, it might replace the conclusion of the individual and collective jurors in viewing the original video. However, as I noted above, her opinion in this regard is largely incidental to the video evidence itself, and properly instructed jurors will determine how much weight to give the opinion and will come to their own conclusions.

This decision endorses the value of narration evidence in assisting the trier of fact to understand the video evidence.

R. v. Chanthabouala[34]

In this murder case, the prosecution's forensic video analyst recovered analog video from a nightclub's surveillance system. The analog video was then converted to a digital format and a series of still images were produced. The analyst spent many hours analyzing the individuals seen in the video images. He started from the point where the individuals could be identified, including reference to items of distinctive clothing and footwear. He then followed each individual's movement after the point when individual characteristics were less discernible. Color-coded dots were placed above each individual so that movement could be followed through the video image sequences. These "tracking photos" were challenged by the defense arguing that it is the function of the jurors to view the evidence and draw their own conclusions as to the actions and the individuals in the video images. The defense further argued that the analyst's evidence might cause the jurors to fail to perform their required function and simply adopt the analyst's conclusions as their own. The defense also argued that if the evidence was to be admitted, each of the individuals should be independently identified before the "tracking photos" were shown to the jury. The Court ruled that the proposed evidence was admissible provided each individual was independently identified prior to the "tracking photos" being shown to the jury.

> 29 No objection was taken to the accuracy of the photos themselves or that they presented a distorted view of the scene. The objection taken was that the evidence should be excluded as it had the potential for the jurors to misuse the evidence by simply accepting Cst. Hallgren's conclusions rather than being simply informed by his method of analysis. The suggested danger is that Cst. Hallgren's conclusions might be given too much weight. I was not directed to, nor am I aware of, any other rule that could operate to exclude the evidence.
>
> 30 I find that the evidence of the tracking photos was logically probative, relevant and material to issues in the trial and that the photos illustrated evidence that was not easily given by oral testimony. Each of the individuals identified by the tracking photos was identified independently by other witnesses before Cst. Hallgren gave his testimony. The probative value of the evidence was not out-weighed by its prejudicial effect.

[34] 2010 CarswellBC 1424; 2010 BCSC 808 (British Columbia Supreme Court)

> 31 The danger of the jurors misusing the evidence was tempered by both a mid-trial instruction to the jury instructing the jurors to consider the evidence carefully and warning them against simply accepting Cst. Hallgren's conclusions. That instruction was repeated in the final charge to the jury.

This case is helpful as it shows the level of analysis that the courts may permit if the proper groundwork is laid by the expert.

In ***State of Florida v. Muro***,[35] the issue was what impact the frame rate of a "nanny cam" had on interpreting the actions of the defendant nanny when interacting with the infant. To the untrained eye, it could appear that the defendant was abusing the infant. However, when taking into account the frame rate, a different interpretation emerged. At a suppression hearing, the State's nanny cam video evidence was ordered suppressed due to discovery violations. On appeal to the District Court of Appeal,[36] the suppression order was overturned. The Court held that at trial the defense could call expert evidence regarding the accuracy of the video images and that this evidence would go to the jury for their consideration.

The interpretation of the video evidence and the impact of the frame rate would be critical in deciding the guilt of the defendant. The defendant retained Grant Fredericks to assist her in analyzing and interpreting the video evidence. As a result of the work performed by Mr. Fredericks, the State stayed the proceedings against the defendant and she was released from jail.

There is clearly case authority in both the United States and Canada that not only permits narrative evidence but endorses it as being helpful to the trier of fact. There are many other cases that have made similar rulings, but have not been reported. For example, I have led narrative evidence many times both with and without objection, but those cases did not result in any published ruling. Most trial cases, in fact, do not get reported.

2.4 Are there court rulings that prohibit a forensic video analyst from interpreting and narrating video evidence for the court?

There is only one reported case (***State of California v. Nero***[37]) that at first glance appears to prohibit a forensic video analyst from interpreting and narrating video evidence for the court. On closer examination, this case is not at all determinative of this issue. ***Nero*** is an interesting murder case that addresses the issue of the trial judge's discretion to limit what evidence a forensic video expert may give at trial.

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[35] 29 October 2004, Broward County, Fla No. 03-016981CF10A (17th Cir. 2004)
[36] 24 August 2005, No. 4D04-4302 (D.C.A. Fla. 4th Dist.)
[37] 181 Cal.App.4th 504; 104 Cal.Rptr.3d 616 (Court of Appeals of California, Second District, 2010) [the forensic video evidence portion of the case is in Part I, which has not been published]

The theory of the prosecution was that the co-defendant Brown handed the defendant, Nero, a knife, and that he then stabbed Yates to death. On surveillance video in this commercial parking lot, Nero is seen bending down near the back of his car and reaching for the back of his pants just before the stabbing occurs. The defense evidence was that when Nero knelt down by the back of his car, he was merely pretending to get a weapon, and that when he grabbed the back of his pants, he was merely pulling them up because they were baggy. He stated that what really happened was that Yates obtained a knife from his bicycle and stabbed Nero's arm. They then struggled, Yates dropped the knife and Nero picked it up and stabbed Yates. Nero maintained that he acted in self-defense.

The defendant called a forensic video expert who testified during an Evidence Code Section 402 hearing in the absence of the jury. Mr. Reis testified on a number of technical aspects regarding the video evidence and further, that he did not see Brown hand Nero a knife, nor did he see Nero reach for anything when he bent down at the back of the car. He also testified that he saw Yates reach for something on the bicycle that appeared to be a knife sheath or similar object.

The trial judge ruled that the expert would not be allowed to testify about his lack of observations of a knife, but that he could testify about other technical aspects of the video. The trial judge stated:[38]

> [H]e's not qualified. Well, he's qualified on the technical aspects of a video and the reasons for certain quality, the reasons in glitches and lighting, things like that. But I am not going to allow him to come in here and tell us he's a video expert, tell us he didn't see a knife, he didn't see this, he didn't see that. That's what you folks are going to have [to] argue from the evidence.

As noted by the Court of Appeals:[39]

> The trial court ruled that Reis [the expert] could testify about what he does. He could not, however, offer an opinion as to what was on the bicycle frame. "[W]e knew that before. And he says he didn't see it, a knife pass from the hand of one defendant to another. Well, that's his opinion. He doesn't see it. I don't know. Maybe the jurors will see it. Maybe they won't see it either. The attorneys can argue that. And they have the video there. ...It's a question of fact the jury is going to have to make a decision on, and it's not something that an expert, I think, should be able to give an opinion on, when that's something the jury has to decide." The court, however, told Nero's defense counsel that he would be allowed to talk about his expert experience, what he did with the videos, the glitches and gaps, and the technical aspects of the video.
>
> Reis then testified before the jury. He discussed the video's low resolution; where light was coming from; a jump in action which indicates that the video is missing several

[38] In unpublished part of case
[39] In unpublished part of case

> frames; and that one of the video camera angles does not start until after the incident began. Reis was not asked to give and did not give an opinion about what any of the videos showed, e.g., a hand-off of a knife from Brown to Nero.
>
> During his closing argument, the prosecutor argued that Brown handed Nero the knife. He commented on the video expert's testimony: "Now the video expert gave us a lot of information about videos. But you remember a couple things that he did not do. He never made an opinion as to what he sees. He never makes any type of opinion. What we do have from this color view angle is we have that portion that is skipped in the black-and-white video."
>
> Before defendants were sentenced, defendant Nero filed a motion for a new trial in which he argued that the court "eviscerated" his defense by precluding Reis from testifying he saw the victim, Yates, reach for a knife and did not see Brown hand a knife to Nero. The prosecutor then compounded the error by commenting in his closing argument that Reis never offered an opinion about what the video showed. Brown's counsel made a similar argument about the impact of the court's ruling limiting the video expert's testimony. The trial court denied the motions.

The issue before the Court of Appeals was whether the trial judge's restriction of the expert's evidence was within his discretion and, if so, whether that discretion was exercised properly in this case.

The Court of Appeals stated:[40]

> Expert testimony is not necessarily objectionable because it "encompasses" an ultimate issue to be decided by the trier of fact… Although courts have allowed experts to testify on matters usually reserved for the trier of fact, courts generally do not allow an expert to testify that the defendant committed the crime… Thus, while an expert's testimony may sometimes encompass an ultimate issue to be decided by the trier of fact, a witness cannot express an opinion concerning the defendant's guilt or innocence. (*People v. Torres* (1995) 33 Cal.App.4th 37, 46-48.)
>
> Here, however, defendants complain that Reis was not allowed to testify that, for example, because of "lighting in the videos," Brown never handed a knife to Nero. Such testimony, however, is tantamount to an opinion concerning Brown's guilt or innocence. Similarly, whether Reis saw Nero get a weapon from underneath his back bumper was not an observation within his area of expertise. This is different than Reis testifying—hypothetically—about the video quality or a glitch occurring at that time, to help the jury determine what Nero was doing when he bent down at the back of the car. Reis's *opinion* about what Nero was doing was not a proper subject of expert testimony.
>
> That being said, we do not perceive the trial court's ruling as precluding defense counsel from asking the expert about the technical aspects of any scene, for example, in which Brown, according to the prosecutor, handed Nero a knife. Reis could have, and in fact did, testify about shadows, lighting and "glitches." While playing the video and going frame by frame (the record is unclear which specific portion of the video was being

[40] In unpublished part of case

> played), Reis noted that one camera view was "a little bit hard to see because . . . the exposure of the video and the lighting in the particular scene make it so that this video is a little bit dark, and it's a little bit difficult to see." Such testimony is appropriate to help the jury evaluate what it was seeing on the video. Anything more—namely, the video expert witness's proposed testimony that Brown did not hand Nero the knife or that Nero did not retrieve a weapon from underneath his car—was an opinion about defendants' guilt or innocence. We express no opinion regarding whether the court could have admitted the challenged testimony; we merely hold that the court did not abuse its discretion by excluding it.

The Court of Appeals noted that the excluded evidence was ultimately an opinion about the defendant's guilt or innocence, and that on that basis the trial judge properly exercised his discretion in refusing admission. Yet the Court leaves open the possibility that the trial judge could have justifiably admitted the expert evidence as well. The issue is whether the narrative evidence amounted to an opinion on guilt or innocence. This is a question for attorneys to consider in the context of their case.

2.5 Are there limitations on the interpretation and narration that a forensic video analyst may testify about in court?

As noted in Section 2.4, the California Court of Appeals in ***State of California v. Nero*** ruled that where interpretation and narration evidence addresses the issue of guilt or innocence, the trial judge has discretion as to whether to admit such evidence.

Further, as noted in Section 2.3, the Texas Court of Appeals in ***State of Texas v. Gonzales*** ruled that narrative evidence should not ascribe intention to physical actions as that is beyond the expertise of the forensic video analyst. This is a sound ruling and dictates an appropriate limitation for this evidence.

3. Photographic Video Comparison Evidence

Photographic Video Comparison Evidence (PVCE) is often the most powerful aspect of forensic video analysis evidence. In some cases, it is sufficient to simply clarify and play the video evidence yet in other cases interpretation and narrative is required in order to properly understand the video. Beyond this lies PVCE, wherein the analyst engages in a scientific comparison of questioned and known images for the purpose of assisting the trier of fact in determining if the person, vehicle or object shown in the questioned images match that of the known images. It is this kind of evidence that opposing attorneys object to the most, because through this evidence, the truth can best be garnered from the objective lens of the camera and the analyst's trained eye. The ultimate goal of all court proceedings, whether criminal or civil in nature, should be to ascertain the truth.

In the context of identifying people, vehicles and objects that were involved in an event, the comparison component of forensic video analysis can be of tremendous value to the court in finding the truth. Comparison evidence seeks to maximize the value of the video evidence. It is often argued by opposing lawyers that the court can look at the images and do its own comparison, and that comparison evidence by a forensic video analyst is neither required, nor helpful. This argument misses the mark. By the time the analyst enters the witness stand, he/she will have spent many hours examining and clarifying the images and even longer comparing the surveillance (questioned) and known images. The comparison evidence of a skilled analyst who has studied the images far more than the court ever would, and who understands the technical aspects of video evidence is clearly of considerable value in the fact-finding process.

Comparison evidence may take many forms. A simple side-by-side image comparison may be conducted by showing the clarified surveillance image and known image on the same screen. The analyst then provides oral evidence as to the similarities and dissimilarities between the two images. A more demonstrative method of presenting this type of evidence is to supplement the side-by-side image comparison with graphics and annotations that point out items of interest. This method helps to focus the attention of the trier of fact and ensures that the analyst covers the necessary points in evidence. More advanced methods of forensic video analysis include the use of reverse projection and the superimposition of known objects and vehicles on questioned objects and vehicles for comparative purposes. Additionally, the effects of infrared light, a common feature in surveillance video that often alters the appearance of fabric, can be accurately considered and addressed by the video analyst when comparing clothing.

Only an experienced, well-trained and proven expert should engage in PVCE. Done correctly, this evidence can be of considerable assistance in the search for the truth.

3.1 What is the scientific basis for PVCE?

Comparison evidence in general is a fundamental component of numerous scientific disciplines, including the following:

- latent print comparisons
- DNA analysis
- tool mark identification
- firearms and bullet matching
- chemistry, which includes such work as identifying and matching drugs, matching paint from vehicles involved in hit and runs, matching car parts with fragments left behind at a crime scene, matching rope fragments, duct tape, etc.

- questioned document examination
- footwear comparison
- hair and fiber examinations
- image analysis
- facial mapping (which is based on video images primarily and is widely used and accepted in the United Kingdom)
- ear prints (more common in the UK and Europe)

It is beyond the scope of this paper to examine the foregoing scientific disciplines in any detail. However, it is important to understand that forensic comparison is an accepted feature of many forensic disciplines. The extension of that process to forensic video analysis is both logical and appropriate.

A forensic video analyst must be fully trained and well versed in the scientific methodology that is required to engage in image comparison. PVCE must be correctly and objectively performed. Analysts must be cautious not to reach conclusions on similarities or dissimilarities that are not demonstrably justifiable.

The technical basis for PVCE is the identification and analysis of class and unique characteristics of people, objects and vehicles. A “class characteristic” is an identifiable feature that assists in narrowing the statistical probability that a questioned person, object or vehicle belongs to the same group as a known person, object or vehicle that shares the same features. Consistent class characteristics between questioned and known images can only indicate similarity, not conclusive identification. If a crime vehicle is described as a white Ford Mustang convertible, each of those descriptors is a class characteristic as there are many white Ford Mustang convertibles in existence. Comparing such a vehicle as observed in a surveillance video with a white Ford Mustang convertible owned and driven by the defendant is of some value, because at least it can be said that the defendant drives a vehicle comparable to the crime vehicle. This certainly has more probative value than if the defendant drove a black Chevrolet SUV or rode a bicycle.

One of the challenges with class characteristics is responding to questions about how large the class is that is being considered. Statistical evidence, where available, may need to be led on this point, though to prove such class statistics, that evidence would have to come from someone other than the expert. While experts are entitled to state and rely on hearsay evidence, such as inquiries made by the expert, such evidence does not prove the fact itself. Thus, while a forensic video analyst is permitted to state that he has learned from the Ford Motor Company that a specified number of white Mustang convertibles were made, the analyst’s statement would not prove that fact. Someone with appropriate knowledge from the automotive industry would need to present that evidence.

It is the identification and comparison of unique characteristics that carry the greatest value for investigational and court purposes. A "unique characteristic" is an identifiable feature found on a questioned person, object or vehicle that is found on no other person, object or vehicle of a similar class. A unique characteristic and the relative position of a unique characteristic can be used to significantly narrow the probability that a questioned person, object or vehicle is in fact the known person, object or vehicle. Considering features of a white Ford Mustang convertible, examples of unique characteristics would be vehicle damage, license plate number, vanity plate, after-market accessories, decals, etc. Matching unique characteristics between the crime vehicle and images of the defendant's vehicle have significant probative value. Consideration must be given to when, if at all, there are sufficient unique characteristics to make any sort of definitive comparison opinion. A corollary consideration is whether any definitive opinion should be proffered at all, which will be discussed in Section 3.6 below.

The comparison of individuals involves a similar scientific analysis. Class characteristics include racial background, gender, general body shape and size, hair, etc. The fact that the defendant is a tall white male of medium build, similar to the suspect in the surveillance video, is of limited value. Unique characteristics such as matching jewelry, scars, tattoos, physical defects, clothing, etc. is much more probative on the issue of identification.

3.2 What is the legal basis for PVCE?

The key restriction affecting the use of comparison evidence is the common law prohibition against giving opinions on an ultimate issue, to the extent that such a restriction still exists. An "ultimate issue" is one whereupon the existence or non-existence of such a fact is determinative of liability. For example, if the only issue is the identification of the robber, opinions on that subject would be on the ultimate issue and therefore prohibited under this rule. If the issue is whether the defendant acted in self-defense, then opinions on identification would not touch upon an ultimate issue.

The proffered reason for this rule is that when identification is the ultimate issue, the effect of such evidence, if accepted by the jury, is decisive of the defendant's guilt and therefore invades the fact-finding role of the jury. This rule has been embodied in a number of State *Codes of Evidence*. For example, Section 7-3(a) of the Connecticut *Code of Evidence* provides in part:

> Testimony in the form of an opinion is inadmissible if it embraces an ultimate issue to be decided by the trier of fact…

Despite the apparent strictness of this rule, the Connecticut Supreme Court listed several examples of ultimate issues of fact that have been held to be exceptions

to the rule set forth in Section 7-3, including testamentary capacity, sanity, authenticity of a signature, intoxication and conditions of safety.[41]

Interestingly, the *Federal Rules of Evidence* have taken a different approach. In 1984, Rule 704 was amended to read as follows:

> **Rule 704. Opinion on Ultimate Issue**
>
> (a) Except as provided in subdivision (b), testimony in the form of an opinion or inference otherwise admissible is not objectionable because it embraces an ultimate issue to be decided by the trier of fact.
> (b) No expert witness testifying with respect to the mental state or condition of a defendant in a criminal case may state an opinion or inference as to whether the defendant did not did not have the mental state or condition constituting an element of the crime charged or a defense thereto. Such ultimate issues are matters for the trier of fact alone.

Thus in federal prosecutions, except for opinions on the mental state or condition of a defendant as described, opinions on the ultimate issue are permitted. The purpose of this rule is to admit such opinions, lay and expert, when opinions on these issues would assist the trier of fact. In order to render this approach fully effective, the "ultimate issue" rule is specifically abolished by virtue of Rule 704. It was believed that the previous rule was unduly restrictive, difficult to apply, and served to deny the trier of fact useful information. To get around these problems, many courts carved out exceptions, making the previous rule rather rhetorical. However, this does not mean that all opinions are admissible. Under Rules 701 and 702, the opinions must be helpful to the trier of fact and Rule 403 provides for the exclusion of evidence if it is more prejudicial than probative, confuses the issues, is a waste of time, or constitutes a needless presentation of cumulative evidence.

A number of states have followed the federal lead but many states have retained the "ultimate issue" rule and so challenges to comparison evidence based on the applicability of this rule will depend on the jurisdiction in which the analyst testifies.

In Canada, there is no longer an absolute rule that would prohibit an expert or lay witness from giving an opinion on an ultimate issue though the closer the testimony gets to the ultimate issue, the more inclined the judge may be to reject it.[42] The justification for being cautious is the same as in the United States, the fear of invading the province of the jury, but the reality is that the trier of fact is free to accept or reject any evidence that is put before it.

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[41] ***State v. Spigarolo***, 210 Conn. 359, 556 A.2d 112, cert. denied 493 U.S. 933, 110 S. Ct. 322 (1989)

[42] ***R. v. Graat***, supra at note 2 (for lay witnesses); ***R. v. Mohan*** (1994), 89 C.C.C. (3d) 402 (S.C.C.) (for expert witnesses)

3.3 Are there court rulings that accept PVCE?

PVCE has been used in many cases in North America. As with many areas of the law, only a small number of cases are reported, either because rulings have not been submitted for publication, or because no issue was raised regarding the admissibility of the evidence.

There have been a few rulings regarding the admissibility of PVCE and those rulings will be discussed below. For ease of reference, they will be categorized by the subject matter of the comparison evidence.

3.3.1 Vehicles

State of Iowa v. Piper[43]

The defendant was charged with first degree murder in relation to the death of a hotel employee who had been found murdered in a guest room. Part of the evidence implicating the defendant was a surveillance videotape from a neighboring convenience store depicting a white van resembling that which the defendant drove for his employer, Accurate Mechanical Contractors, at a stoplight near the hotel. The State retained a video editor to enlarge the image of the white van, sharpen the contrast and to otherwise improve the quality of the image. The video editor also superimposed a control image of an Accurate Mechanical van over top of the white van in the surveillance video for comparison purposes. The editor added arrows and the graphics “van,” “roof rack,” “logo,” and “logo text.” This was in effect a form of reverse projection. The jury was informed that this was being shown to them for comparative purposes only.

The defendant argued on appeal, *inter alia*, that the altered videotape should not have been admitted for demonstrative purposes. After reviewing the facts and argument, the Court of Appeals ruled as follows at page 8:

> We find no abuse of discretion in the district court's decision to allow the jury to see the altered videotape. Heckle testified the van in the videotape had common marks to an Accurate Mechanical van, and he used computer graphics to point out these common marks. The defense's expert as well testified there was a dark area on the rear passenger part of the van in the videotape that was in the location of the Accurate Mechanical logo on its vans. The videotape was properly introduced to allow the jury to compare the van in the QuikTrip videotape to the picture of an Accurate Mechanical van.

3.3.2 Clothing and other objects

United States v. Lightfoot[44]

[43] 2003 Iowa App. LEXIS 886 (Iowa C.A. 2003)

The defendant was convicted of bank robbery and brandishing a firearm during a crime of violence. He argued that the District Court erred in admitting comparison evidence regarding surveillance video images and articles recovered from the getaway vehicle. The Court of Appeal stated at paragraph 6:

> The district court also admitted, over Lightfoot's objection, expert testimony by an FBI agent on the comparison of articles seized from the getaway vehicle and the yard near Lightfoot's arrest with video images of articles worn or used by the robber from the bank video surveillance system. Lightfoot argues that the agent's testimony was not helpful to the jury because it did not involve observations that a lay person was incapable of making, and therefore the testimony was erroneously admitted. We review a district court's decision to admit expert testimony for an abuse of discretion. See Kumho Tire Co. v. Carmichael, 526 U.S. 137, 152, 143 L. Ed. 2d 238, 119 S. Ct. 1167 (1999). Before allowing expert testimony, the district court must determine that the testimony is both reliable, or scientifically valid; and relevant, that it will assist the trier of fact in understanding or determining a fact in issue in the case. See Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 592-93, 125 L. Ed. 2d 469, 113 S. Ct. 2786 (1993). Here, we conclude that the district court, after conducting extensive voir dire of the witness, properly admitted his testimony.

R. v. Pettman[45]

The defendant was charged with bank robbery. A forensic video analyst digitized video images from the bank's surveillance cameras. She then forensically compared the digitized images with known images of the suspect and items of clothing. This comparison was presented in the form of a PowerPoint™ presentation showing the comparison analysis. This analysis allowed the Court to conclude that the defendant was indeed the robber shown in the surveillance video.

United States v. McKreith[46]

The defendant was charged with numerous bank robberies. All of the robberies bore a similar pattern. The robber was a "light-skinned black person" wearing a plaid shirt and ski mask, who demanded that the bank tellers put money into a duffel bag that he carried with him into the bank. Bank surveillance cameras captured images of the robber on each occasion. A person familiar with the defendant viewed the surveillance images and identified him as the robber. On the strength of that identification, the FBI placed the defendant under surveillance and obtained federal search warrants for his vehicle and residence. Upon executing the search warrants, agents found a flannel or plaid type shirt, two black ski masks, a black vinyl semi-striped bag, a bag similar to that used in the robberies and other items.

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[44] 2001 U.S. App. LEXIS 5121 (4th Cir. 2001)
[45] [2003] A.J. No. 1451 (Alta. Prov. Ct.)
[46] (8 July 2005), Docket No. 03-11199 & 03-16083 (11th Cir. 2005)

The shirt and bag were sent to the FBI Laboratory where they were analyzed by a forensic analyst and compared to the bank surveillance images. The analyst testified that "[a]ll of the characteristics of this shirt matched the class characteristics of the shirt worn by the bank robber in those cases that we could see the shirt," which was seven of the eight robberies captured by surveillance images. The analyst further testified that the black bag seized from the defendant's residence was "indistinguishable" from the bag seen in the surveillance images. He also noted similarities between the defendant and the robber depicted in the surveillance images, including the "shape of the nose, mouth and chin." The jury convicted on seven of the eight bank robberies.

The defendant appealed his convictions to the United States Court of Appeal for the Eleventh Circuit arguing, amongst other things, that the District Court wrongly allowed the comparison evidence of the FBI analyst. The Court of Appeal held that the District Court did not abuse its discretion in allowing the comparison evidence, noting that the Court held a ***Daubert*** hearing before allowing the evidence to be admitted. The convictions were upheld.

R. v. Kalle[47]

A convenience store clerk was robbed at knifepoint by a masked man. The robbery was captured on three different surveillance cameras. The defendant was arrested within two hours of the incident and was wearing a reversible jacket, dark pants and shoes similar to those worn by the robber. When a search warrant was executed at the defendant's residence, a black balaclava and a pair of ski gloves were seized.

Part of the evidence for the prosecution was the evidence of a forensic video analyst. He was called to give expert evidence in the comparison and contrast of known and questioned images. The analyst testified that he placed the seized items on a mannequin. Known images were taken and then compared with the questioned video images. The Court went through the detailed comparison and color compensation evidence given by the analyst, noting that the expert evidence served to point out and elucidate the images that were available to the Court. The Court found the expert evidence to be very helpful, though not dispositive of the identification issue before the Court. It was however an important factor in ultimately convicting the defendant.

3.3.3 People

United States v. Mosley[48]

[47] 2007 WL 298566 (Ont. S.C.J.)
[48] 1994 U.S. App. LEXIS 23969 (9th Cir. 1994)

The defendant 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 which resulted in a sharpening of the images. He was then able to detect a mark on the face of the robber which he compared with a mark on the defendant's face that was visible in a booking photograph and described the similarities noted. The defense argued that the trial court erred in admitting this evidence.

At issue on appeal was whether the trial judge erred in admitting this digital analysis evidence. In a very brief ruling, the Court of Appeals concluded that the trial court reasonably concluded that this evidence would assist the jury and that it was properly admitted.

United States v. McKreith[49]

This case was discussed in Section 3.3.2 above and addresses the issue of comparison evidence regarding people as well as clothing and other objects.

The defendant appealed his convictions to the United States Court of Appeal for the Eleventh Circuit arguing, amongst other things, that the District Court wrongly allowed the comparison evidence of the FBI analyst. The Court of Appeal held that the District Court did not abuse its discretion in allowing the comparison evidence, noting that the Court held a ***Daubert*** hearing before allowing the evidence to be admitted. The convictions were upheld.

State of Texas v. Gonzales[50]

The defendant was one of three men charged with the robbery and murder of a store clerk. The robbery was captured on an analog quad CCTV system with audio. Portions of the murder were also recorded. Mr. Fredericks clarified the video images and provided narrative as to what each of the suspects did during the recorded events. Evidence was also given as to the estimated height of each of the suspects. Additionally, known images were obtained of the suspects and these were compared to the images recorded during the event.

The defendants were tried separately. Gonzales was convicted of murder and sentenced to life imprisonment. He appealed his conviction citing two alleged errors during the trial, but did not challenge the comparison evidence at trial or on appeal. His conviction was upheld. This case is discussed in more detail on the issue of narrative evidence in Section 2.3 above.

R. v. Cooper[51]

[49] (8 July 2005), Docket No. 03-11199 & 03-16083 (11th Cir. 2005)
[50] 2006 WL 820387, not reported in S.W.3d (Court of Appeals of Texas, Fort Worth)
[51] [2000] B.C.J. No. 446 (B.C.S.C.)

The defendant was charged with bank robbery and the only issue before the Court was the identification of the robber. The prosecution led three types of evidence to prove identification: the videotape itself, recognition evidence by several corrections officers and a parole officer who were familiar with the defendant and finally, forensic video analysis.

The camera system in the bank consisted of five cameras that recorded sequentially to one video recorder. The Court summarized the evidence of the forensic video analyst 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.

At issue was whether the process of forensic video analysis changed the images as recorded to the original videotape such that they are no longer reliable images.

The Court stated that:

> [77] 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.

On the use of such evidence, 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 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.

Cooper is a helpful decision regarding forensic video analysis overall and the propriety of admitting comparison evidence on the issue of identification of the suspect.

R. v. Pettman[52]

The defendant was charged with bank robbery. A forensic video analyst digitized video images from the bank's surveillance cameras. She then forensically compared the digitized images with known images of the suspect and items of clothing. This comparison was presented in the form of a PowerPoint™ presentation showing the comparison analysis. This analysis allowed the Court to conclude that the defendant was indeed the robber shown in the surveillance video.

[52] [2003] A.J. No. 1451 (Alta. Prov. Ct.)

3.4 Are there court rulings that have criticized or excluded PVCE?

R. v. Coelen[53]

This is a case where the trial judge was critical of the way the forensic video analyst planned to visually present his comparison evidence, but not the comparison process itself.

The defendant was charged with bank robbery. Part of the evidence that the prosecution wished to tender at trial was the forensic video analysis of the bank surveillance video and video images of the defendant during the booking process. The analysis consisted of clarifying the images and comparing the surveillance and booking images using a PowerPoint™ presentation. In this *voir dire*, the Court ruled that not all of the tendered evidence was admissible. First, the Court was of the view that the analyst was only a technician and not qualified to give comparison opinions. Specifically, he was not a qualified expert in the field of facial mapping. Second, the Court took exception to the headings that the analyst used on some of the slides – "Evidence to Consider," "Facial/Clothing Comparisons With Jail Video & Known Photograph," and "Inconsistencies." The Court ruled that the headings were "suggestive (if not compelling)." Third, the Court disapproved of the grouping of similar facial views from the surveillance and booking videos ruling that they were too much of an identification blueprint. Finally, the Court disapproved of the use of "charting" (using arrows and labels) as a means of comparing images of clothing. The Court did not prohibit the analyst from giving evidence regarding these comparisons, rather the Court only disapproved of the use of "charting." As a result, a number of the PowerPoint™ slides were excluded.

This decision is an aberration in the use of forensic video analysis evidence in court. The use of slide labels, image grouping and "charting" is common in forensic video analysis. It appears that the format of the charts used in the case was the issue that concerned the judge. The format that was used in this case, which included a booking photograph surrounded by a montage of images from the surveillance video, is not the format that is normally used and this likely explains the concern expressed by the trial judge. The comparison evidence was permitted at trial, but the charting format employed was rejected.

3.5 Are there court rulings that have favorably commented on PVCE?

All of the cases referred to in Section 3.3 and 3.4 above have favorably commented of the value of PVCE in criminal trials.

[53] [1999] B.C.J. No. 2867 (B.C.S.C.)

3.6 Is it proper for a forensic video analyst to give opinions on identification of questioned people, vehicles, clothing and other objects?

An important consideration is how far an analyst should go in providing comparison evidence. It is common for prosecutors in particular to expect a forensic video analyst to be able to offer conclusive opinions on the identification of suspects, vehicles, clothing and other objects. Rarely is that an appropriate conclusion to expect of an analyst. Further, that generally is not an advisable trial strategy. The basis of comparison evidence is pointing out consistencies and inconsistencies between surveillance images and known images. The more consistencies that exist, the more likely it is that the person, object or vehicle being compared is in fact the same as the one depicted in the known images. Strategically, there is merit to pointing out consistencies and inconsistencies in considerable detail without ever giving an ultimate opinion on identification. This allows, with the analyst's expert assistance, for the trier of fact to "discover" the image match, giving consideration to compression artifacts, shadows and other technical limitations that exist within the recorded images. This is very empowering for the trier of fact and does not usurp their function by pointing out what may appear to them to be obvious. Supported by the appropriate interpretation of a qualified analyst, the triers of fact can be confident with their observations.

This is not to say that an analyst is not permitted to declare that a person, object or vehicle observed in a surveillance image is the same person, object or vehicle shown in known images but it must be remembered that, as with eyewitnesses, mistakes in identification can occur with forensic video analysts as well. Unless there are an adequate number of unique characteristics to justify an identification declaration, it is recommended that analysts avoid declaring matches. The risk to be avoided is declaring a match that is later proven wrong. A lesser risk is in declaring a mismatch only to be later proven wrong. These identification errors can have a long lasting impact on the credibility and reputation of the analyst, well beyond the instant case. It can also lead to a miscarriage of justice, which should always be avoided.

Related to the issue of analysts making identification opinions is the use of subject matter experts (SME). Where it is important to comment on the identification of people, vehicles, clothing and other objects at any stage in the analysis, it is wise to consider the use of SMEs. It is far better for someone familiar with a person, a vehicle, clothing, etc. to express an opinion on identification than someone not otherwise familiar. The analyst plays a very important role in performing an objective, scientific comparison of images and in making qualitative statements on that comparison. A SME, where appropriate, is a very effective adjunct to that evidence.

3.7 Responding to the NAS Report (objective science v. subjective interpretation)

The National Academy of Sciences issued a report entitled "*Strengthening Forensic Science in the United States: A Path Forward*" in 2009. The report is critical of most forensic disciplines for a number of reasons, including:

- The lack of standards regarding the need for certification
- The lack of sufficient research to establish the limits and measures of performance in individual forensic disciplines
- The lack of sufficient research and evaluation of the sources of variability and potential bias regarding subjective identification
- That individualization has not consistently been shown to be reliable
- The lack of reliable scientific methodology to permit that analysis of evidence and report findings

The report briefly refers to "digital and multimedia analysis" as an emerging discipline and cites specific concerns in this discipline:

- The lack of a consistent certification program and minimum qualifications for digital forensic examiners
- The fact that some agencies treat the examination of digital evidence as an investigative rather than a forensic activity
- Wide variability and uncertainty regarding the education, experience, and training of those practicing this discipline

The challenge for a forensic video analyst when being cross-examined about the findings of the NAS report is to avoid focusing on the negative and instead accentuate the positive. A forensic video analyst must be prepared and able to effectively respond to the general criticism regarding forensic science leveled by the NAS, at least in so far as it relates to forensic video analysis. This does not mean that the analyst must accept the concerns raised by the NAS, or somehow take responsibility for any shortcomings in the forensic science community as found by the NAS to exist. Even though some of the concerns of the NAS have some merit, it does not follow that competent forensic video analysis performed by a qualified and competent analyst should be accorded less weight in the courtroom. As for the specific concerns raised regarding "digital and multimedia analysis," the NAS report is correct that there are no standards for analysts and no standard certification program. This issue will not go away and must be addressed on a case by case basis.

An analyst is not expected to be an apologist for the concerns expressed about forensic science by the NAS. A forensic video analyst must be able to demonstrate why he/she is qualified and competent to work in this complex area.

Further, the analyst must be able to demonstrate that he/she conducts case analysis via a robust and objective scientific method.

An analyst should be prepared to discuss the following:

- The specific training that he/she has in the relevant aspects of forensic video analysis
- The practical experience the analyst has had in this field
- How he/she remains current in the science and practical aspects of forensic video analysis
- The importance of objectivity and what steps the analyst takes to achieve that result
- SOPs that are in place in the analyst's lab and how they are followed
- That ACE-VR (Analyze, Compare, Evaluate, Verify, Report) is a robust and standard forensic methodology that has been used for years in disciplines that involve the comparison of questioned to known items and that this is the methodology followed in forensic video analysis
- That peer review is utilized
- The tools that are used by the analyst for forensic video analysis must be appropriate tools for that purpose and should be similar to the tools used by other competent analysts

It may be tempting for the analyst to be critical of the report while on the witness stand. Doing so may show defensiveness that is not warranted. It is not the role of the analyst to provide a critique of the study. Rather, the expert should focus on the fact that despite the concerns raised by the NAS, his/her competence, experience, objectivity, use of the scientific method, use of professional tools, SOPs and overall approach rise above the concerns raised by the NAS. Further, involvement in professional organizations such as The Law Enforcement and Emergency Services Video Association (LEVA), the forensic video community, the achievement of certification and other such accomplishments will be most helpful.

4. *Daubert/Frye* Challenges

4.1 How does forensic video analysis meet the requirements of Daubert and Frye?

In ***Daubert v. Merrell Dow Pharmaceuticals Inc.***,[54] the United States Supreme Court held that ***Frye v. United States***[55] has been superseded by the Federal

[54] 113 S. Ct. 2786

Rules of Evidence, particularly Rule 702. Further, it directed judges to act as gatekeepers and instructed them to examine the scientific method underlying expert evidence and to admit only evidence that was both relevant and reliable. ***Daubert*** states that in order for expert evidence to be admitted, it must be reliable and the evidence must assist the trier of fact in understanding the evidence or in determining a fact in issue.

The Court noted an important distinction between "scientific reliability" and "evidentiary reliability." The former implies general acceptance, the hallmark of the ***Frye*** test, which was rejected as the sole method of determining admissibility. "Evidentiary reliability" means that the evidence is scientifically valid, that is, it is grounded in the scientific method and on reliable information or theories. To evaluate scientific reliability, the Court suggested four factors to consider:

- Is the evidence based on a testable theory or technique?
- Has the theory or technique been subjected to peer review and publication?
- Does the technique have known or potential error rates and standards controlling the technique's operation?
- Is the underlying science generally accepted in the relevant scientific community?

The Court cautioned that this was not a closed list and that judges could employ additional criteria. FRE 403 (probative value v. prejudicial effect) must also be considered.

In practice, other factors will be considered when determining the admissibility of scientific evidence:

- whether there are analogous relationships with other types of scientific techniques that are routinely admitted into evidence
- the expert's qualifications
- the existence of specialized literature in the area
- the nature and breadth of the inference sought to be adduced from the evidence
- the clarity with which the technique may be explained
- the extent to which basic data may be verified by the court and jury
- the availability of other experts to evaluate the technique
- the probative significance of the evidence

The four main factors will be discussed below.

4.1.1 Is the theory based on a testable theory or technique?

[55] 293 F. 1013 (D.C. Cir., 1923)

Forensic video analysis is a multi-faceted discipline. At its most basic level, it involves acquiring, accessing, examining and isolating video evidence. Further complexity is injected when images require processing for the purposes of clarification, dealing with technical anomalies, separating fields, etc. Yet further complexity is involved when photographic video comparison is undertaken, as well as reverse projection and other related advanced methods of analysis.

There are at present no prescribed standards in the field of forensic video analysis. It is in part for that reason that less than qualified and competent individuals try their hand at this challenging area of expertise, usually with limited success. In the absence of prescribed standards, an analyst should operate according to a logical, scientifically sound and documented methodology such as ACE-VR. Laboratory SOPs are recommended. All steps taken in the analysis of video evidence should be properly documented.

Providing video analysis is approached scientifically and with a focus on proper methodology and documentation, all of the work undertaken and any results achieved should be able to be replicated by another competent expert with proper equipment. All aspects of forensic video analysis are amenable to testing by other experts and therefore this ***Daubert*** factor is able to be met.

4.1.2 Has the theory or technique been subjected to peer review and publication?

Peer review is an important component of scientific validation. A competent analyst will seek out and offer peer review, ranging from reviewing the analyst's methodology and report to working the case from scratch and then comparing those results with the original analyst. This is an attribute of a true expert.

There are limited publications in the field of forensic video analysis at present though there are publications on video technology and some aspects of forensic video analysis. An analyst should be familiar with the publications that do exist.

4.1.3 Does the technique have known or potential error rates and standards controlling the technique's operation?

There are no known error rates for forensic video analysis as it rarely results in a conclusive opinion on identification of people, vehicles or objects. Therefore, this is very different from latent print examinations or DNA typing where such conclusions are reached and can be statistically analyzed. Potential errors rates could exist if identification opinions based on video evidence were proven to be incorrect but forensic video analysts are not encouraged to offer such opinions.

As noted above, there are no national standards governing the video industry or the field of forensic video analysis. There are some published documents that set out recommended standards for certain aspects of forensic video analysis.[56] A competent analyst should have SOPs for approaching casework.

4.1.4 Is the underlying science generally accepted in the scientific community?

All of the science that is involved in forensic video analysis has been well established over a long period of time. Modern video technology has been around since the 1950s. Digital imaging has been in existence for decades and has steadily gained market dominance over the last twenty years. The science involved in the comparison of known to questioned images has been around for over 100 years (latent prints being the best example). See as well the various scientific disciplines noted in Section 3.1 above.

4.2 Are there court rulings on Daubert/Frye challenges for forensic video analysis evidence?

Forensic video analysis has rarely undergone a ***Frye***, ***Daubert*** or related challenge and never a successful one. The reason for the paucity of such challenges is that the underlying scientific methods are not "novel science." Analog video is based on standards set forth by the National Television Standards Committee (NTSC), which have been in place since 1953. The engineering behind the NTSC signal is hardly novel. Digital images have similarly been in widespread use for many years and are certainly not new. Further, the processing techniques that forensic video analysts use are not novel. The application of such techniques for investigative and court purposes may be relatively novel but that is not the issue. Finally, the forensic comparison process that is utilized in forensic video analysis is analogous to the comparison process that has been used in other forensic sciences for decades.

There have been a small number of cases wherein forensic video analysis in general or a particular facet of it has been subjected to challenge. Those cases will be discussed below.

In ***Commonwealth of Pennsylvania v. Wilson***,[57] the defendant was charged with murder. It was alleged that he murdered the victim and disposed of her body in an unknown location. Her body was never found. Part of the evidence tendered by the prosecution was forensic video analysis evidence. The tenor of

[56] For example, LEVA's *Best Practices for the Acquisition of Digital Multimedia Evidence, Version 3.0*, available at www.leva.org
[57] 22 March 2004, Lebanon County, Penn. No. 2003-11167 (C.P.)

this evidence was that a drive-thru ATM camera captured images of the defendant driving the victim's vehicle and it was the theory of the prosecution that these images were captured after the murder, thereby placing the defendant in possession of her vehicle at a time and in such a manner that would necessarily link him to her disappearance and death. The essence of the forensic video analysis in this case was the clarification of the surveillance images and identification evidence regarding the driver of the car and the identification of the car itself.

The defendant argued that forensic video analysis as used in this case was not accepted as reliable within the scientific community. He asked the Court to exclude this evidence or alternatively, to conduct a ***Frye*** hearing to determine the scientific reliability of forensic video analysis.

Pennsylvania Rule of Evidence 702 controls the admissibility of expert testimony in areas of scientific knowledge. Rule 702 provides as follows:

> **Rule 702. Testimony by Experts**
>
> If scientific, technical or other specialized knowledge beyond that possessed by a layperson will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education may testify thereto in the form of an opinion or otherwise.

The Court noted that the ***Frye*** test was adopted in Pennsylvania in ***Commonwealth of Pennsylvania v. Topa***[58] and is part of Rule 702. As stated in ***Frye***, novel scientific evidence is admissible if the methodology that underlies the evidence has gained general acceptance in the relevant scientific community. However, it only applies when a party seeks to introduce <u>novel</u> scientific evidence. It does not apply every time science enters the courtroom.

In ***Commonwealth of Pennsylvania v. Dengler***,[59] with regard to scientific evidence, the Court said that "novel" means new, original, striking, unusual, strange, etc. In applying this test, the Court in ***Wilson*** held that:[60]

> We find the technology used to clarify the ATM video in this case does not constitute novel scientific evidence, an issue previously addressed by our Superior Court in ***Commonwealth v. Auker***, 681 A.2d 1305 (Pa. 1996). In the ***Auker*** case, digital image enhancement was used to clarify a picture from an ATM machine depicting a vehicle. In a footnote, the Pennsylvania Supreme Court noted how the enhancement did not add or take away from the subject matter of the picture; rather it lightened or darkened the field of the picture. ***Id.*** at 1313, fn.2. Likewise, in the present case, Grant Fredericks testified at the Pre-Trial Hearing how the technology he used to clarify the ATM video did not add or take away from the information on the video. (N.T. 11/24/03, at 15, 21, 30-31, 32, 76-77, 84). Based on the foregoing, it is evident video clarification and/or enhancement technology has been used and accepted by the courts for a number of years. It is,

[58] 369 A.2d 1277 (Penn. 1977)
[59] 2004 W.L. 318518 (Penn. Super. Ct. 2004)
[60] At pages 29-30

> therefore, not considered novel scientific evidence. Because we find the technology used in this case does not constitute novel scientific evidence, it is not necessary to conduct a ***Frye*** analysis. Accordingly, Wilson's Motion with regard to this issue is denied. Grant Fredericks' testimony is, therefore, admissible.

This is a significant ruling regarding the threshold admissibility of forensic video analysis evidence as it appears to be the first decision on the issue of whether forensic video analysis constitutes novel scientific evidence and whether it therefore requires a ***Frye*** or ***Daubert*** hearing. In short, the Court held that such evidence was not novel and accordingly, no ***Frye*** hearing was required.

In ***State of Texas v. Stevenson***,[61] a murder case arising out of a convenience store robbery, Mr. Fredericks overlaid 911 calls onto the store's surveillance video and developed a PowerPoint™ presentation to show what occurred during the robbery. As the presentation was shown, the expert narrated the events as they occurred. The defendant objected to the expert's evidence, relying on a ***Daubert*** analysis.

The Court noted that before admitting expert testimony under Texas Rules of Evidence 702, the trial court must be satisfied that three conditions are met:

1. The witness qualifies as an expert by reason of his knowledge, skill, experience, training or education.
2. The subject matter of the testimony is an appropriate one for expert testimony.
3. Admitting the expert testimony will actually assist the fact finder in deciding the case.

The Court noted that a trial judge need not exclude expert testimony simply because the subject matter is within the comprehension of the average jury. If the witness has some special knowledge or additional insight into the field that would be helpful, then the expert can assist the trier of fact to understand or to determine a fact in issue.

> An expert may add precision and depth to the ability of the trier of fact to reach conclusions about subjects that lie well within common experience. Because the possible spectrum of education, skill and training is so wide, a trial court has great discretion in determining whether a witness possesses sufficient qualifications to assist the jury on a specific topic in a particular case.[62]

When considering whether a trial judge should permit expert testimony, the court must consider the qualifications of the expert. The following factors are relevant:

1. The more complex the field of expertise, the more important the expert's qualifications become.

[61] 304 S.W.3d 603; 2010 WL 323562 (Tex. App. – Fort Worth 2010)
[62] At page 34

2. The more conclusive the expert's opinion, the more important the expert's qualifications become.
3. If the expert's evidence is critical to solving the issue before the court, the more important the expert's qualifications become.

After noting that there had been an unsuccessful ***Daubert*** challenge at trial, the Court held that it was reasonable for the trial judge to conclude that the expert could assist the jury by clarifying what they were seeing in the video, particularly with regard to height comparisons. This case is helpful in describing what use may be made of a forensic video analyst at trial.

In ***United States v. McKreith***,[63] discussed earlier in Section 3.3.2, comparison evidence was led by the FBI analyst regarding known images of clothing, a vinyl bag and the defendant himself and questioned images from a series of robberies. The jury convicted on seven of the eight bank robberies.

The defendant appealed his convictions to the United States Court of Appeal for the Eleventh Circuit arguing, amongst other things, that the District Court wrongly allowed the comparison evidence of the FBI analyst. The Court of Appeal held that the District Court did not abuse its discretion in allowing the comparison evidence, noting that the Court held a ***Daubert*** hearing before allowing the evidence to be admitted. The convictions were upheld.

State of Minnesota v. Brown[64]

The defendant was charged with aiding and abetting murder. He was tried and convicted. He appealed his conviction and for reasons unrelated to FVA he was granted a new trial. He was convicted at his second trial and appealed his conviction to the Minnesota Supreme Court alleging, amongst other errors, that the trial court erred in admitting certain video evidence.

At the first trial, the prosecution tendered a time lapse VHS surveillance videotape. A VCR capable of playing the time lapse video was used at trial so that the jury could see the relevant images in slow motion and on a frame by frame basis. By the time of the second trial, the State could not find a VCR that would play the surveillance tape. Midway through the trial, the State asked that the VHS tape be released so that a "real time" copy could be made. The Court permitted that to occur and a forensic video analyst digitized the VHS tape and then transferred that content to a VHS tape that could be played for the jury. The specific process that was employed was that the original video content was digitized without any clarification, as none was required. Three segments were created. One was at the original speed, one at 15% of the original speed and one at 5% of the original speed. Still images were also printed using Photoshop™ to adjust the contrast and brightness.

[63] (8 July 2005), Docket No. 03-11199 & 03-16083 (11th Cir. 2005)
[64] 739 N.W.2d 716 (2007)

Appellate counsel for the defendant argued on appeal that the digital version of the original VHS tape should not have been admitted in the absence of a ***Frye/Mack*** hearing. The Supreme Court stated that it was aware of no authority (nor could counsel produce any) for the proposition that digitizing analog video is a novel science. The Supreme Court was satisfied that a proper foundation had been laid at trial for the digitized video, that it was a faithful duplicate of the original and that therefore the evidence was properly admitted at trial. The Court did however caution:[65]

> But prosecutors should be on notice that the trial court has broad discretion to exclude digital copies if defense counsel is not provided with adequate notice and opportunity either to observe the conversion process or retain an independent expert to make a similar conversion or, in the alternative, to allow the court to arrange for supervision of the process.

The evidence was ruled admissible with the foregoing caveat.

Should a court somewhere decide to conduct a ***Frye***, ***Daubert*** or similar hearing, forensic video analysis, if properly explained by the analyst and argued by counsel, should have no difficulty passing such a threshold admissibility hearing. Reviewing the major considerations in such an analysis is instructive.

5. Conclusion

Forensic video analysis evidence is used with increasing frequency and continues to be of significant value in criminal and civil litigation. As such, challenges to forensic video analysis evidence should be expected. Challenges to date have been fairly consistent and predictable. The purpose of this paper is to help both the expert and attorneys in responding effectively to these attacks. Proper preparation will serve both the expert and attorneys well. Central to all forensic video analysis cases is a competent and proven expert.

[65] At page 723