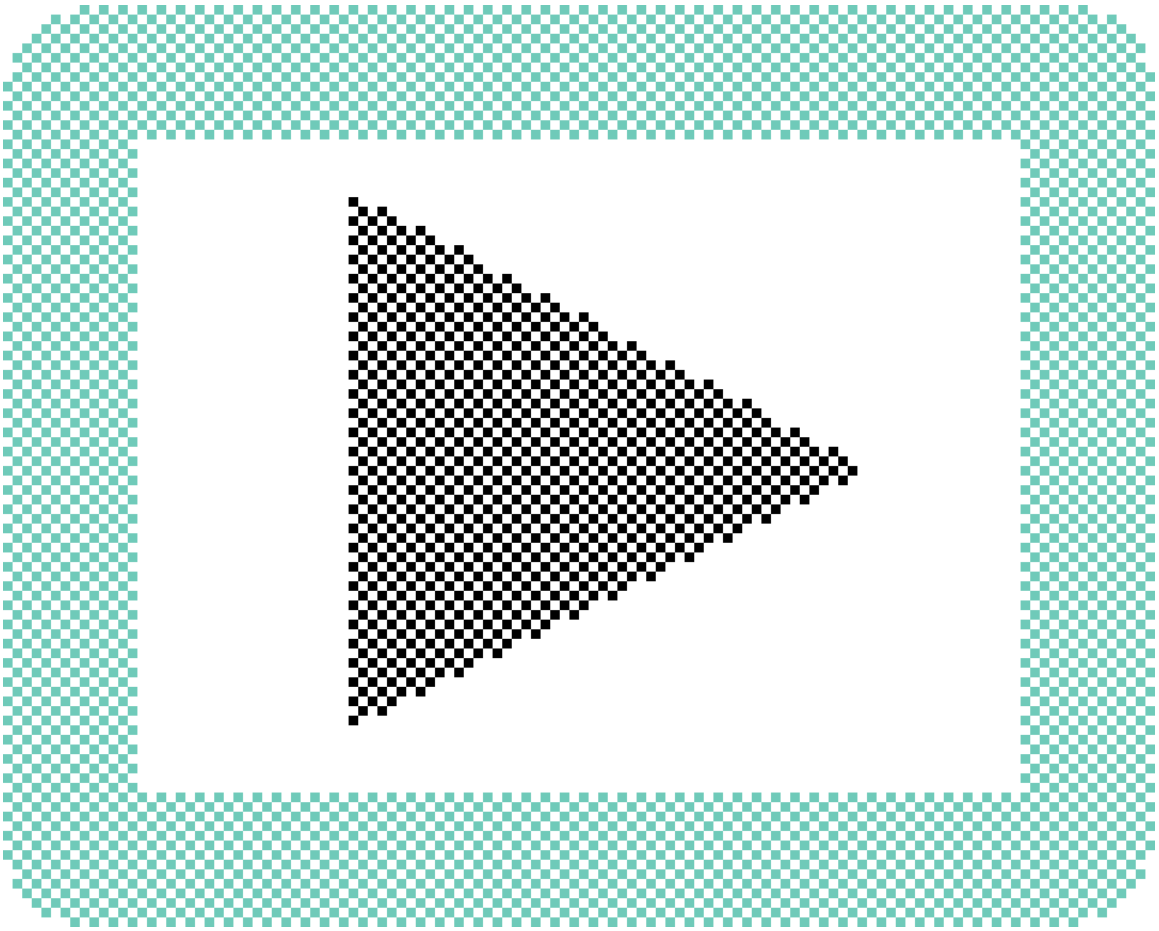


A Simplified Guide To Forensic Audio and Video Analysis

Introduction

Unlike other forms of forensic evidence, audio and video recordings can provide a real-time, eyewitness account of a crime so investigators can watch or hear what transpired. For instance, a surveillance video captures a bank robbery in progress, or a hidden camera records an undercover sting operation.

Over the past decade, sources of recorded audio and video that can assist in an investigation have increased exponentially. Closed circuit television systems (CCTV) and video and audio recorders can be found in businesses, at traffic intersections, parking lots, bank machines, on police-vehicle dashboards and of course, in cell phones.

For large-scale events or crimes, the sheer amount of recorded audio and video evidence can be massive. During the riots that occurred in Vancouver, British Columbia after the 2011 Stanley Cup Finals, more than 5,000 hours of recordings were captured. Law enforcement has since brought charges against more than a hundred rioters using video evidence and more charges are expected.

For most crimes, however, high-quality audio and/or video recordings are often not available. This is where forensic audio and video expertise can help. Forensic experts have many techniques to enhance recordings that can bring out details and provide a clearer picture of what occurred, or make an audio recording more

audible. This in turn helps investigators, lawyers and jurors better conduct their duties.

Principles of Forensic Audio and Video Analysis

To assist in an investigation, forensic experts can repair, recover, enhance and analyze audio and video recordings using an array of scientific tools and techniques.

Repair and Recovery of Evidence

Before audio and video evidence can be analyzed, it may first need to be repaired or recovered from damaged media or a damaged recording device.

Repairing evidence is especially common for analog and digital magnetic tape. It may need to be spliced back together or put into a new audio/video housing in order to recover the audio or video. In today's digital world, CDs, DVDs, cell phones, portable cameras and other sources of digital media and recording devices can be damaged by heat, misuse, the environmental conditions of a crime scene, or simply on purpose by an offender. Even in these situations, the digital files can be recovered and used for analysis.

Evidence Enhancement

The most common function of forensic video and audio experts is to clarify a recording so that it is more apparent to investigators, attorneys and jurors what the evidence demonstrates.

To enhance a video recording, filters can be used to adjust the brightness and contrast, correct the color, crop and resize an image, enhance edge detail and reduce visual distortion. The speed of playback can also be adjusted to more accurately display the frame rate at which it was recorded.

To enhance an audio recording, filters can be employed to improve clarity. This may entail removal of unwanted noise or enhancing the intelligibility of speech. Recordings will often be made in less than ideal circumstances, such as when someone is wearing a body wire. Utilizing audio engineering techniques may allow faint voices or events to be heard more clearly on playback.

Analysis, Interpretation and Identification

Authentication of recordings – In many criminal cases, the authenticity of the recording and the content of the recording may be called in to question. Forensic audio and video experts can examine a variety of characteristics of the audio or video recording to determine whether the evidence has been altered. This includes confirming the integrity (verification) of the recording, as well as authenticating that the content of the image or audio is what it purports to be.

If the ambient sound present on an audio recording changes abruptly, this could indicate that the environment where the recording took place suddenly changed. The volume and tone of a voice on the recording can provide clues as to distance and spatial relationships within a scene. Lighting conditions can be examined to estimate the time of day or environmental conditions at the time of the recording.

Technical details may also confirm information about a recording. For instance, an unnatural waveform present in the audio or video signal may indicate that an edit has been made. A physical identifier may be present in the signal on magnetic tape that can identify it as a copy or indicate that it was recorded on a particular device. Sometimes, a perpetrator will try to destroy audio or video evidence; however, using these methods, the recording can be analyzed to determine what occurred.

In the famous Watergate investigation, a great deal of effort was spent examining an 18½-minute gap in an audio recording of President Richard Nixon discussing the Watergate break in with his Chief of Staff. Analysis of the audio signature[1] left behind in this erased portion allowed investigators to determine which White House tape recorder made the erasure and how many different erasures were made. Examining the level of AC hum recorded to tape even provided details on whether the recording took place in Nixon's secretary's office or in another location.

And new techniques are constantly being developed. A unique approach employed in the United Kingdom examines the low-frequency hum captured when a recorder is plugged into an electrical outlet or near a strong electrical current. This frequency will alternate slightly depending on the power load experienced at that time of day. By examining minute fluctuations of this frequency, analysts can determine whether a recording took place at the stated time and whether the recording is continuous and unaltered. This technique has been in use in the UK for over eight years; in the United States, this technique is still being researched and databases are being built for comparison.

[1] Mellinger, Philip T., "Cracking Watergate's Infamous 18 1/2 Minute Gap", **FORENSIC MAGAZINE** (online), February 18, 2011, **http://www.forensicmag.com/article/cracking-watergates-infamous-18-12-minute-gap** (accessed September 4, 2012)

Identifying people or objects on a recording - Identifying a person or object from an image on a video or voice on an audio recording requires training in Image Content Analysis or speech science. These examinations are detailed comparisons of an unknown recording to a known recording, or an unknown object to a known object in an attempt to make a positive identification. For instance, an image of a hat at the crime scene may be compared with a hat found on a suspect. The comparison techniques used in image analysis follow the same detailed comparison techniques as Fingerprint and Document examiners. The analysis and comparison of voices is an evolving area of practice that can be controversial in criminal cases.

Why and when is audio-video evidence used?

In the movie, **THE FUGITIVE**, Dr. Richard Kimble, played by Harrison Ford, is on the run from police. He calls the Chicago Police Department to proclaim his innocence. He ends the phone call before it can be traced, but there was one thing he didn't anticipate--the sound of the L train can be heard in the background. By analyzing the recording, the police know he's calling from Chicago.

While most audio evidence won't launch a city-wide manhunt, it may aid the investigators in piecing together the facts of a case. Audio from a recorded 911 phone call, for instance, can provide key information—not only from the words of the caller, but from sounds in the background. Can the assailant be heard in the distance? How many parties are audible on the tape?

To Corroborate Statements

In many cases, audio and video evidence can be used to corroborate subject or witness statements. For instance, video from a security camera can provide information on the direction or means of travel into or away from the crime scene. Did the subject flee in a four-door, red Ford? Did he depart the scene heading north or south? The recorded footage can confirm a witness statement.

Sometimes a video surveillance camera is the only eyewitness to a crime. Video evidence was key in finding and identifying the perpetrator in the abduction and killing of 11-year-old Carlie Brucia of Sarasota, FL. Video from security cameras showed her being taken from a carwash parking lot and led away by a middle-aged man wearing a work uniform. The video of the abduction circulated nationwide on television and a housemate of the perpetrator called police when she saw the footage.

Upon enhancement of the video recording, investigators were able to provide clearer images of the man's face, tattoos on his forearms, and even the name tag on his uniform.

To Identify Suspects

The power of video evidence in aiding an investigation is illustrated by a website created by the Vancouver Police[2] to identify suspects from the infamous 2011 Stanley Cup riots. After painstakingly reviewing the video evidence, photos of rioters have been extracted from these videos and posted on the site for identification by the general public.

Even if video or audio evidence does not capture key actions of the crime, the recording may be able to add information or provide additional details such as the appearance of the perpetrator or what they were wearing.

How It's Done

Audio and Video Evidence That May Be Analyzed

Audio and video evidence can be found at more locations and from more diverse sources than ever before. From convenience stores to fast food restaurants, malls to banks, traffic intersections to parks, CCTV systems are virtually everywhere. And cell phone cameras extend a watchful eye to nearly every corner of every town. Audio evidence may be available from 911 calls, telephone answering machines, voicemail recordings, video cameras, cell phones and computer files.

How the Evidence Is Collected

Depending on the circumstance, the surroundings, and the witnesses who may have been present, several different recordings of an event may be available. The responding officers or crime scene investigators should first identify all video or audio evidence that may exist. In addition to surveillance cameras at the scene, surveillance systems nearby may provide valuable footage, such as recordings of a perpetrator approaching or fleeing a scene.

Even if the recording does not appear to be very clear or useful, all relevant footage should be collected. Forensic enhancement may recover details that aren't noticeable when viewing or listening to the unprocessed recording.

[2] Vancouver Police Department, Integrated Riot Investigation Team, Vancouver Riot 2011: Help Identify Suspects (**https://riot2011.vpd.ca/identify-a-suspect**)

Digital video and audio - Well over half of all closed-circuit television evidence seized by police today is digital and file-based, although some systems can record to digital magnetic tape. Digital video recorders come in two general types: embedded stand-alone and PC-based. Both types generally record the audio and video to hard drives; however, some systems record to secure digital (SD) cards and other removable media.

Digital video and audio evidence from CCTV systems are generally proprietary in nature and require a special software player produced by the manufacturer to play back the collected recordings properly. When the video and audio is collected from the device it needs to be retrieved in a manner that produces the best quality possible, which is usually the proprietary recorded files. There are numerous types of digital video and audio recording devices, with a variety of methods of exporting these files. Some will have CD/DVD writing capabilities, some use USB for output, and some, although digital, may only have analog outputs. Find further information on proper collection methods at **http://www.tswg.gov/subgroups/isf/electronic-evidence/DCCTV_Web_.doc.pdf**

Analog video and audio - Analog video systems are rapidly becoming a recording technology of the past; however, many are still in use today. If a system uses analog tape, the investigator should bear in mind that every playback of the tape will degrade the recorded images. Prior to ejecting the tape, the investigator will make sure the tape is stopped, document everything on the display, then eject the tape and remove the write protection tab to prevent it from being recorded over. A copy of the tape should then be made for all future viewing, preserving the original video evidence.

Regardless of whether the evidence was recorded by a digital or analog system, the investigator should note the make and model of the recording device and important details about the recording system (e.g., how many cameras are connected and recording, whether it is recording in time-lapse mode, the current time/date, and the time/date on the recorder's display). It is also preferable to sketch the cameras' positions.

Who Conducts the Analysis

The disciplines of forensic audio analysis, forensic video analysis, image analysis and computer forensics are recognized as four separate disciplines by the American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB) (**http://www.ascld-lab.org/**). Many Federal, State and local law enforcement and private agencies are now developing Digital and Multi-Media Sections within their agencies that may include some or all of these disciplines. In some agencies, examinations may be conducted by the same person. In large

agencies, and on the Federal and State level, most examiners specialize in one discipline and become a subject matter expert after years of experience.

Agencies may have an in-house training program that includes vendor-based training, training with senior examiners and competency testing. This ensures analysts have the specific skills to match the services their agency provides. Additional information on training requirements is available from guidelines of the Scientific Working Groups on Digital Evidence and Imaging Technology (**https://www.swgit.org/pdf/Guidelines and Recommendations for Training in Digital and Multimedia Evidence?docID=57**).

Two certification programs currently exist in the discipline of Video Analysis: Law Enforcement and Emergency Services Video Association (LEVA) (**http://www.leva.org/**) and the International Association for Identification (IAI) (**http://www.theiai.org/certifications/video/index.php**). In the field of forensic audio, training courses are available, but no specific certification currently exists.

Courtesy of Target® Forensic Services

How the Analysis Is Performed

The first step of an analysis is for the examiner to simply listen to or view the recorded footage. The examiner will then begin to locate the area of interest to be enhanced and examined in closer detail using specialized devices and software.

Before processing audio and video evidence, a working copy of the evidence may be created. This assures that the original evidence is always available in its unaltered state. In addition, the original will always be available for comparison to the processed copy.

All examination procedures are carefully constructed so that the image or video is a true and accurate representation of the scene. Investigators never change the recorded data—they only enhance what is already present.

Video Enhancement Techniques - A variety of enhancement techniques can be employed on video evidence. It is important that the best video recording be submitted to obtain the best enhancement results. Limitations on the enhancement process may exist if an analog copy or digital file that has undergone additional compression is submitted for analysis. Techniques can include:

Sharpening - Makes edges of images in the recording become more clear and distinct.

Video stabilization - Reduces the amount of movement in the video, producing the smoothest possible playback.

Masking - Covers the face or areas of the video that may protect a witness, victim or law enforcement officer.

Interlacing - In an analog system, interlaced scanning is used to record images (a technique of combining two television fields in order to produce a full frame of video). A process called de-interlacing may be used to retrieve the information in both fields of video.

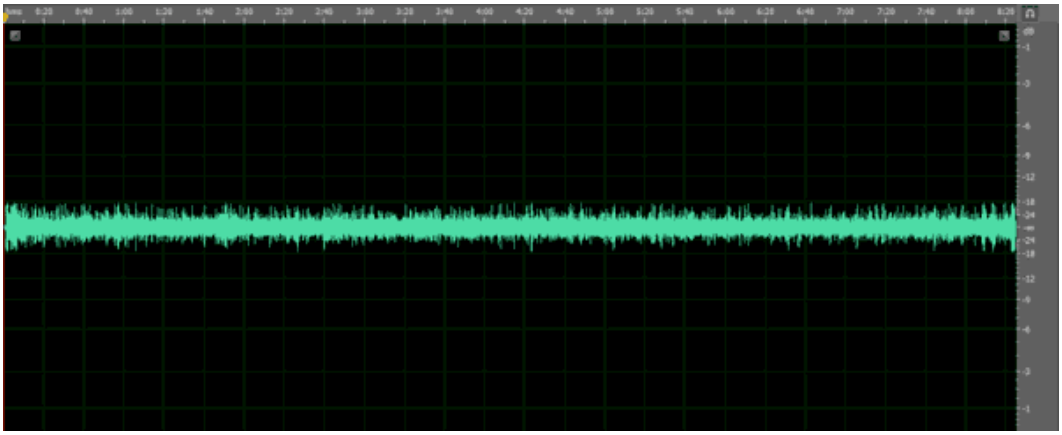
Demultiplexing - Allows for isolation of each camera. In CCTV systems, a device called a multiplexer is used to combine multiple video signals into a single signal or separate a combined signal. These devices are frequently used in security and law enforcement applications for recording and/or displaying multiple camera images simultaneously or in succession.

Audio Enhancement Techniques - For audio recordings, a variety of filters can be applied to enhance the material, bringing out specific aspects or events contained in the recording.

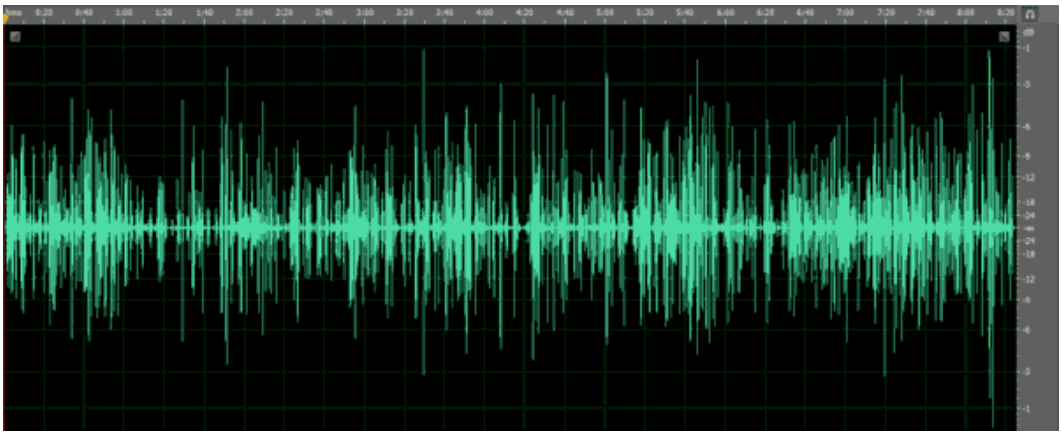
Frequency Equalization - Highly precise equalizers can be used to boost or cut specific bands of frequencies. To help make speech more intelligible, the frequency band containing most speech content, 200Hz–5000Hz, can be amplified or isolated. If amplification is applied to a frequency range, other information residing in this frequency range will be boosted as well. If noise resides in this same range, this noise will also be increased, limiting the ability to clarify voices.

Loud background noises may be analyzed by a spectrum analyzer and the corresponding frequencies reduced so that these noises are less noticeable.

Compression - Faint sounds in the recording can be boosted by compressing or leveling the signal so that the dynamic range of the material is reduced, making soft sounds more apparent.



Waveform of a recording made at a low volume with significantly loud ambient noise that is masking the speech content of the recording.



The same recording after enhancement. The noise is attenuated and the volume of the speech is increased.

FAQs

What kind of results should be expected from enhancement or analysis of video and audio evidence?

In most cases, the goal of the forensic audio or video professional is to provide the absolute best representation possible of the video or audio evidence. Low-lit video might be enhanced to provide more details, and muffled audio may be clarified so that the words are intelligible. However, each circumstance and recording is unique. While some dramatic improvements in clarity are possible, the results of a forensic audio or video exam are highly dependent on the quality of the source material.

What are the limitations of the analysis?

Enhancement of video and audio are limited by the resolution of the original recorded image. For video recordings, the higher the pixel count or resolution of the image, the more detail is present in an image. A recording may depict a suspect walking across the crime scene, but if the camera optics are poor and the digital video recorder's resolution was reduced, then zooming into the image may not provide additional details of the perpetrator's appearance. The information was simply not recorded in the detail necessary to improve it. The configuration of the CCTV system and placement of the cameras is also imperative.

Common limiting factors include low light conditions for video recordings or noisy environments for audio recordings. Damage to the video or audio recording equipment can sometimes be compensated for; however, this varies widely by circumstance.

How is quality control and quality assurance performed?

As with all forensic science disciplines, forensic laboratories, law enforcement agencies and private agencies put in place policies and procedures that govern facilities and equipment, methods and procedures, and analyst qualifications and training. Depending on the state in which it operates, a crime laboratory may be required to achieve accreditation to verify that it meets quality standards. There are two internationally recognized accrediting programs in the U.S. that are focused on forensic laboratories: The American Society of Crime Laboratory Directors Laboratory Accreditation Board (**http://www.ascld-lab.org/**) and ANSI-ASQ National Accreditation Board / FQS (**http://www.ascld-lab.org/**)

The Scientific Working Group on Digital Evidence (SWGDE) (**http://www.swgde.org/**) and the Scientific Working Group on Imaging Technology (SWGIT) (**https://www.swgit.org/**) each publish best practices and guidelines for ensuring quality and consistency across digital and multimedia examinations. They also incorporate best practice guidelines for managers, supervisors and quality assurance managers.

What information does the analysis report contain?

A report of findings is usually provided to the investigator or person who submitted the evidence for examination. The examination report may provide the following details:

- The nature of the request
- The results that were obtained
- Identification of the format/type of audio/video
- The type of processing that was performed
- Dates and time stamps that were visible

- Description of the subjects, if visible
- Description of the final product provided (e.g., enhanced video prints or video recording)
- Limitations in the examination

Are there any common misconceptions or anything else about this topic that would be important to the non-scientist?

Not all audio or video evidence can be enhanced to provide clear details. While enhancements of recorded audio/video evidence can be made, those depicted on television crime dramas are often unrealistic. The amount of resolution required for the extreme magnification used in these shows usually is not recorded with cell phone or CCTV recordings.

Common Terms

The following terms are commonly used in the area of forensic audio and video analysis. These definitions are provided by the Scientific Working Group on Digital Evidence (SWGDE) and the Scientific Working Group on Imaging Technology (SWGIT). A full comprehensive glossary (**https://www.swgit.org/pdf/SWGDE and SWGIT Digital and Multimedia Evidence Glossary?docID=60**) is also available online.

Archive Copy - A copy of data placed on media suitable for long-term storage, from which subsequent working copies can be produced.

Artifact - A visual/aural aberration in an image, video or audio recording resulting from a technical or operational limitation. Examples include speckles in a scanned picture or "blocking" in images compressed using the JPEG standard.

Capture - The process of recording data, such as an image, video sequence or audio stream.

Compression - The process of reducing the size of a data file. (See also, "Lossy Compression" and "Lossless Compression".)

De-interlacing - Separating an interlaced frame into two discrete fields.

Field - An element of a video signal containing alternate horizontal lines. For interlaced video, the scanning pattern is divided into two sets of spaced lines (odd and even) that are displayed sequentially. Each set of lines is called a field, and the interlaced set of the two sets of lines is a frame.

Frame - Lines of spatial information of a video signal. For interlaced video, a frame consists of two fields, one of odd lines and one of even lines, displayed in sequence.

For progressive scan (non-interlaced) video, the frame is written through successive lines that start at the top left of the picture and finish at the bottom right.

Image Analysis - A sub-discipline of Digital & Multimedia Evidence, which involves the application of image science and domain expertise to examine and interpret the content of an image and/or the image itself in legal matters.

Image Comparison - The process of comparing images of questioned objects or persons to known objects or persons or images thereof, and making an assessment of the correspondence between features in these images for rendering an opinion regarding identification or elimination.

Image Content Analysis - The drawing of conclusions about an image. Targets for content analysis include, but are not limited to: the subjects/objects within an image; the conditions under which, or the process by which, the image was captured or created; the physical aspects of the scene (e.g., lighting or composition); and/or the provenance of the image.

Interlaced scan - A technique of combining two television fields in order to produce a full frame. The two fields are composed of only odd and only even lines, which are displayed one after the other but with the physical position of all the lines interleaving each other, hence interlace[3].

Interpolation - A method of image processing whereby one pixel, block, or frame is displayed or stored based on the differences between the previous and subsequent pixel, block or frame of information. [Taken from the **ENCYCLOPEDIA OF PHOTOGRAPHY 3RD EDITION**] This is often done to increase the apparent clarity of an image[4].

Multiplexer/Demultiplexer - A device used to combine multiple video signals into a single signal or separate a combined signal. These devices are frequently used in security and law enforcement applications for recording and/or displaying multiple camera images simultaneously or in succession.

Nominal resolution - The numerical value of pixels per inch as opposed to the achievable resolution of the imaging device. In the case of flatbed scanners, it is based on the resolution setting in the software controlling the scanner. In the case of digital cameras, this refers to the number of pixels of the camera sensor divided by the corresponding vertical and horizontal dimension of the area photographed.

[3] Damjanovski, V. **CCTV NETWORKING AND DIGITAL TECHNOLOGY**, Butterworth-Heinemann: Waltham, MA, 2000.

[4] Zakia, R. D. **THE FOCAL ENCYCLOPEDIA OF PHOTOGRAPHY, 3RD ED.**, Focal Press; Butterworth-Heinemann: Waltham, MA, 1993.

Sharpening - A process used to emphasize edge detail in an image by enhancing the high frequency components.

Time lapse video recording - Process by which images are recorded at less than the standard rate of frames per second (NTSC-29.97; PAL-25.00) thus extending the period of time that can be covered by the storage medium.

Video stabilization - The process of positioning individual frames so that a selected object or person will remain in the same location as the video is played.

Work copy - A copy or duplicate of a recording or data that can be used for subsequent processing and/or analysis.

Resources & References

You can learn more about this topic at the websites and publications listed below.

Resources

Law Enforcement & Emergency Services Video Association (LEVA) (**http://www.leva.org/**)

International Association for Identification (IAI) (**http://www.theiai.org/certifications/video/index.php**)

Scientific Working Group on Imaging Technology (SWGIT) (**https://www.swgit.org/**)

Scientific Working Group on Digital Evidence (SWGDE) (**https://www.swgde.org/**)

American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB) (**http://www.ascld-lab.org/**)

National Technical Investigators Association (NATIA) (**http://www.natia.org/i4a/pages/index.cfm?pageid=1**)

References

BEST PRACTICES FOR THE ACQUISITION OF DIGITAL MULTIMEDIA EVIDENCE, VERSION 3.0 (April 14, 2010), LEVA.

Cohen N, MacLennan-Brown K. "Retrieval of Video Evidence and Production of Working Copies from Digital CCTV Systems v2.0," (**http://tna.europarchive.org/20100413151426/http:/scienceandresearch.homeoffice.gov.uk/hosdb/publications/cctv-publications/66-**

08_Retrieval_of_Video_Ev12835.pdf?view=Binary), Home Office Scientific Development Branch, (accessed 8/25/12).

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CRIME LABORATORY EVIDENCE SUBMISSION MANUAL, Florida Department of Law Enforcement, Gerald M. Bailey, Commissioner, 2009.

GUIDELINES FOR THE BEST PRACTICE IN THE FORENSIC ANALYSIS OF VIDEO EVIDENCE, LEVA.

Housemate tips police to Smith after seeing video (**http://articles.cnn.com/2004-02-05/us/missing.girl_1_susan-schorpen-carlie-brucia-carwash-parking-lot?_s=PM:US**) (CNN report) (accessed 6/1/2012).

LEVA Forensic Video Analysis Certification Program, (**http://leva.org/index.php?option=com_content&view=article&id=66&Itemid=144**) (accessed 4/2/2012).

"Section 7: Best Practices for Forensic Video Analysis," (**https://www.swgit.org/pdf/Section 7 Best Practices for Forensic Video Analysis?docID=51SWGIT**) guidelines document, (accessed 2/3/2012).

Technical Support Working Group (TSWG). "Best Practices for the Retrieval of Digital CCTV Systems," (**http://www.tswg.gov/subgroups/isf/electronic-evidence/DCCTV_Web_.doc.pdf**) Home Office Scientific Development Branch, (accessed 8/25/12).

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Forensic Evidence Admissibility and Expert Witnesses

How or why some scientific evidence or expert witnesses are allowed to be presented in court and some are not can be confusing to the casual observer or a layperson reading about a case in the media. However, there is significant precedent that guides the way these decisions are made. Our discussion here will briefly outline the three major sources that currently guide evidence and testimony admissibility.

The *Frye* Standard - Scientific Evidence and the Principle of General Acceptance

In 1923, in *Frye v. United States*[1], the District of Columbia Court rejected the scientific validity of the lie detector (polygraph) because the technology did not have significant general acceptance at that time. The court gave a guideline for determining the admissibility of scientific examinations:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting experimental testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be **sufficiently established to have gained general acceptance** *in the particular field in which it belongs.*

Essentially, to apply the "*Frye* Standard" a court had to decide if the procedure, technique or principles in question were generally accepted by a meaningful proportion of the relevant scientific community. This standard prevailed in the federal courts and some states for many years.

Federal Rules of Evidence, Rule 702

In 1975, more than a half-century after *Frye* was decided, the Federal Rules of Evidence were adopted for litigation in federal courts. They included rules on expert testimony. Their alternative to the *Frye* Standard came to be used more broadly because it did not strictly require general acceptance and was seen to be more flexible.

The first version of Federal Rule of Evidence 702 provided that a witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:

[1] **293 Fed. 1013** (1923)

a. the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
b. the testimony is based on sufficient facts or data;
c. the testimony is the product of reliable principles and methods; and
d. the expert has reliably applied the principles and methods to the facts of the case.

While the states are allowed to adopt their own rules, most have adopted or modified the Federal rules, including those covering expert testimony.

In a 1993 case, *Daubert v. Merrell Dow Pharmaceuticals, Inc.,* the United States Supreme Court held that the Federal Rules of Evidence, and in particular Fed. R. Evid. 702, superseded *Frye's* "general acceptance" test.

The *Daubert* Standard - Court Acceptance of Expert Testimony

In *Daubert* and later cases[2], the Court explained that the federal standard includes general acceptance, but also looks at the science and its application. Trial judges are the final arbiter or "gatekeeper" on admissibility of evidence and acceptance of a witness as an expert within their own courtrooms.

In deciding if the science and the expert in question should be permitted, the judge should consider:

- What is the basic theory and has it been tested?
- Are there standards controlling the technique?
- Has the theory or technique been subjected to peer review and publication?
- What is the known or potential error rate?
- Is there general acceptance of the theory?
- Has the expert adequately accounted for alternative explanations?
- Has the expert unjustifiably extrapolated from an accepted premise to an unfounded conclusion?

The *Daubert* Court also observed that concerns over shaky evidence could be handled through vigorous cross-examination, presentation of contrary evidence and careful instruction on the burden of proof.

In many states, scientific expert testimony is now subject to this *Daubert* standard. But some states still use a modification of the *Frye* standard.

[2] The "Daubert Trilogy" of cases is: **DAUBERT V. MERRELL DOW PHARMACEUTICALS**, **GENERAL ELECTRIC CO. V. JOINER** and **KUMHO TIRE CO. V. CARMICHAEL**.

Who can serve as an expert forensic science witness at court?

Over the years, evidence presented at trial has grown increasingly difficult for the average juror to understand. By calling on an expert witness who can discuss complex evidence or testing in an easy-to-understand manner, trial lawyers can better present their cases and jurors can be better equipped to weigh the evidence. But this brings up additional difficult questions. How does the court define whether a person is an expert? What qualifications must they meet to provide their opinion in a court of law?

These questions, too, are addressed in **Fed. R. Evid. 702**. It only allows experts "qualified ... by knowledge, skill, experience, training, or education." To be considered a true expert in any field generally requires a significant level of training and experience. The various forensic disciplines follow different training plans, but most include in-house training, assessments and practical exams, and continuing education. Oral presentation practice, including moot court experience (simulated courtroom proceeding), is very helpful in preparing examiners for questioning in a trial.

Normally, the individual that issued the laboratory report would serve as the expert at court. By issuing a report, that individual takes responsibility for the analysis. This person could be a supervisor or technical leader, but doesn't necessarily need to be the one who did the analysis. The opposition may also call in experts to refute this testimony, and both witnesses are subject to the standard in use by that court (*Frye, Daubert*, Fed. R. Evid 702) regarding their expertise.

Each court can accept any person as an expert, and there have been instances where individuals who lack proper training and background have been declared experts. When necessary, the opponent can question potential witnesses in an attempt to show that they do not have applicable expertise and are not qualified to testify on the topic. The admissibility decision is left to the judge.

Additional Resources

Publications:

Saferstein, Richard. **CRIMINALISTICS: AN INTRODUCTION TO FORENSIC SCIENCE**, Pearson Education, Inc., Upper Saddle River, NJ (2007).

McClure, David. Report: Focus Group on Scientific and Forensic Evidence in the Courtroom (online), 2007, **https://www.ncjrs.gov/pdffiles1/nij/grants/220692.pdf** (accessed July 19, 2012)

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About This Project

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