IN THE PURSUIT OF JUSTICE:

Audio and Video Recordings— Weapons of Terrorism

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Abstract

The recent proliferation of audio and video recordings coming from various terrorist organizations around the world presents two distinct areas of concern to the forensic examiner. This article presents information on the authenticity methodology of videotapes, including a perspective on "implied evidence" and the continuing necessity for voice identification.

The powerful weapon cultivated in the realm of terrorism—the videotape—continues to burgeon. In recent years, the American public has witnessed the increased broadcast of audio and video recordings provided by terrorist organizations through foreign news agencies and anonymous sources. These tapes call for a much wider view of the circumstances and methods that are employed in the mind of the messenger. From a forensic point of view, the purpose of the examination of audio and video evidentiary recordings is to evaluate their overall credibility. The authenticity of evidentiary tapes can usually be established through scientifically based testing. In U.S. courts, rules for the admission of evidence are clearly stated and must be adhered to in order for recordings to remain credible in the process of litigation. Civil and criminal evidence is, in most cases, evaluated for authenticity prior to their influence on the perspective judge, jury, and public opinion. However, this emerging trend of influential video, which directly affects homeland security and influences world opinion, has exploded to epic proportions. Some of these videos are provided by respectable news agencies in an effort to report events to the best of their abilities. Other tapes and photographs are provided anonymously to spread propaganda and recruit terrorist members. Whatever the purpose, these recordings must be examined to evaluate the credibility of the images as well as their implied representations. In the world of public opinion, videotape recordings can forever influence the perspective of immediate and future events.

Key Words: video analysis, voice identification, audio enhancement, audio analysis, video authentication, audio authentication

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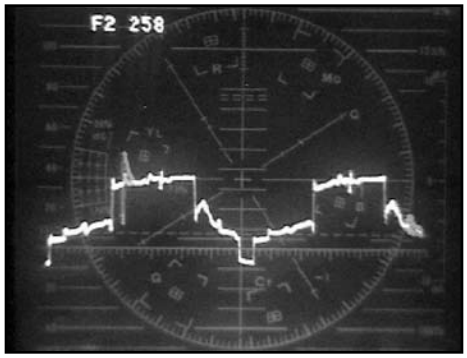
One recent example involved controversial reports associated with two videotapes obtained by a national news network in connection with a village near the Syrian border. One of these recordings depicted a typical wedding celebration with music, dancing, and festivities; however, the accompanying videotape, which was reportedly recorded the following day, displayed considerable destruction of a similar area. In combination, the recordings served as testimonial to an implied event not present on the videotapes. The news network questioned whether the tapes were authentic and whether enough factual evidence existed to verify that the visual images on tape one were consistent with the visual images on tape two, suggesting the possibility of a single location rather than the possibility of two different locations with similar characteristics.

Evidentiary tapes that do not capture an event in its entirety require additional verification in order to assess the overall validity of any implied representation. In the world of forensic science, uncertainty of this type must be investigated and resolved to an acceptable standard before credibility is substantiated. Scenarios suggested by this type of dynamic presentation are influential, if not convincing, to most viewers. The lack of a complete and thorough investigation before their disclosure is irreversible in many cases. It should be noted that every analysis is unique because of the individual circumstances associated with each specific assignment.

Using the aforementioned videotapes as a reference, the following outlines basic procedures and issues that should be considered before disclosing influential images. The first issue the examiner must determine is the scientific validity or authenticity of the videotape in question. Authenticity analysis provides scientifically based results in reference to the credibility of evidentiary recordings. The purpose of authenticity examinations is to verify if a recording is an original or a copy and whether it has been tampered with in any manner. Each recording should be independently evaluated before any comparative analysis is performed.

The forensic analyst should request that all relative information be provided and initiate the applicable analyses specific to the type of media provided. For example,



examining VHS recordings includes analyzing head switches, defective pixels, HBI/VBI anomalies, dihedral error, tension error, video hum, discontinuities, scene/color changes, time code issues, and relative audio/sync issues. Using non-destructive chemicals, the tape can also be examined microscopically to identify anomalies. These scientifically based tests can identify editing, alteration, and duplication, as well as determine what specific camera or recorder was used. Digitally based video recordings require alternate tests relative to their specific format. Digital recordings can often be analyzed to identify anomalies in the sequence of encoded data. Additionally, digital formats are evaluated for blocking, mosquito noise, static issues, and various other anomalies. These procedures provide the forensic analyst with scientifically based results to support conclusions of authenticity.

If the videotape recordings contain relative audio tracks, they may be examined for synchronization of events and consistency with ambient surroundings. When applicable, the audio portion of the recording is scientifically examined through spectrum analysis, magnetic development, waveform analysis, spectrographic analysis, critical listening, phase continuity, and speed fluctuation. The 12 Step Methodology for Audiotape Authenticity (Owen, 2003) and Methodology Procedures for Audio Authenticity, available through AES 43 of the Audio Engineering Society, are tests providing results that identify edits, alterations, and duplication in the audio portion of recordings. Every element associated with the recording can provide insight into the credibility of the videotape images. Any inconsistencies between the audio and video segments indicate an anomaly and decrease the credibility of the recording, assuming that no plausible explanation exists.

Consider the previous example and assume that both tapes are considered to be authentic. Does the fact that the recordings are scientifically authentic constitute their accuracy? The answer is yes; however, in this case, the most important issue that must be addressed is the sequence of events that are implied but not visually or acoustically documented by the recordings provided. Without an actual recording of the events in question, the scientific verification by the audio/video analyst is limited. The implied representations, or shock factor, is generally created and distributed in the hope that the message is delivered in the most graphic and emotional manner. These tapes are intended to outrage, intimidate, and possibly subject the viewer to an unsubstantiated issue promulgated by the messenger. The validity of any implied event should be analyzed from several different perspectives and should incorporate the professional opinions of other experts who specialize in these areas.

What other issues may be considered by the audio/video analyst in order for the videotapes to provide collaborative proof of an alleged event? Is there a plausible explanation for the fact that none of the transitional event was captured on videotape? Is there supportive evidence that suggests the recordings are accurate representations of the same location? Once again, additional investigation, examination, and comparison of evidence collected by other experts may be required in order to substantiate an opinion.

GPS, satellite imagery, and qualified experts in their respective fields may be employed to verify the existence of the location, take photographs of the location, and document its condition. The audio/video expert could use this documentation for comparison on a frame-by-frame basis for elemental consistency to assess the validity of the recorded representations. The comparative analysis could include elements associated with the type of event, eyewitness statements, clothing, terrain, verifiable landmarks, weather conditions, time of day, equipment, and structural dwellings. Identification of individual elements appearing in both videotapes would provide a reference for verification. Human-comparative elements such as bone structure, clothing, scars, moles, hair color, height, and weight

could be identified through individual frame analysis of the authenticated recordings. To aid in the investigation, experts in cultural and religious customs may identify elements or provide unique information associated with behavioral characteristics. Higher quality recordings may require using biometrics. Additionally, the proper identification of individuals may be evaluated through voice analysis or speech patterns from the audio portion of the recording. Investigation into the equipment used to create the recordings may be considered. Not all manufacturers have products available in every region and the appearance of uncommon devices or media processing may be suspicious. Financial records and equipment registrations may be researched to provide verification of any questionable representations. Most recording media is encoded with a lot number or manufacturer code that enables an examiner to verify its date of creation and availability. These results would produce additional evidence to consider before rendering an opinion.

Finally, enhancement procedures are often required to aid the examiner in the evaluation of both audio and video recordings. Video enhancement is often required to improve the quality of an image. Individual frames are isolated for analysis. Techniques, including frame averaging, stabilization, and magnification, are used to allow the examiner to identify critical elements. Enhancement techniques provide an essential role in identifying individual characteristics such as bone structure, scars, tattoos, moles, hair, eye color, and other elements for comparative analysis. Additionally, the audio portion of the recording frequently contains an unacceptable amount of environmental noise, static, or a low frequency hum. Identification of the problematic element allows the analyst to remove these hindrances and increase the intelligibility of speech or isolate a particular event. Although these procedures are not traditionally considered as part of the authenticity analysis, there is no doubt they play an important role in the examination process. In many cases, segments that focus on a particular location in each frame often use spotlight effects during broadcasts to the public.

Another common form of audio recordings familiar to homeland security include the statements of Osama bin Laden and

Video Authenticity: Basic Methodology

1. Receive, mark, and scan/photograph evidence tapes, recorders, and containers.
2. Physically inspect tapes. Record lot/batch numbers, color, and condition. Compare with manufacturer information. Remove and preserve safety tabs. Physically inspect recorders. Record serial numbers and condition.
3. Verify format, track configurations, control track, and audio signal.
4. Perform critical viewing/listening. Note all inconsistencies associated with alteration. Anomalies include discontinuities, scene/color changes, pixel irregularities, vertical smear type, relative audio/sync issues, and other anomalies.
5. Perform waveform analysis. Verify head switches, HBI width, video-hum phase continuity, RF envelope, front porch width, and time code issues.
6. Use pulse cross monitor for analysis of dihedral and tension error. H/V delay provides different view of HBI/VBI information.
7. Create test recordings for comparative analyses. Perform steps 5 and 6 for comparative analyses and verification.
8. Compare test tape signatures to evidentiary tape signatures/anomalies.
9. Note all anomalies. Document testing procedures as applicable—written notes, prints, photographs, etc.
10. Analyze the results and form conclusion/opinion.
11. Write report of your conclusions/opinion. Include all information pursuant to Federal Rule 26 for expert witness opinion.
12. Archive all case files. Send report to client. Return all original evidence (FedEx or Certified Mail) as directed by court order or client.

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Video Authenticity: Digital (Additional Issues)

1. Analysis of encoded data (improper headers, interruption of GOP, etc.)
2. Verification of frame-by-frame consistency
3. Time Code/Date Stamp Issues
4. Scene and color changes
5. Blocking
6. Mosquito noise
7. Static changes
8. Conversion and compression issues (encoding analog to digital copies)

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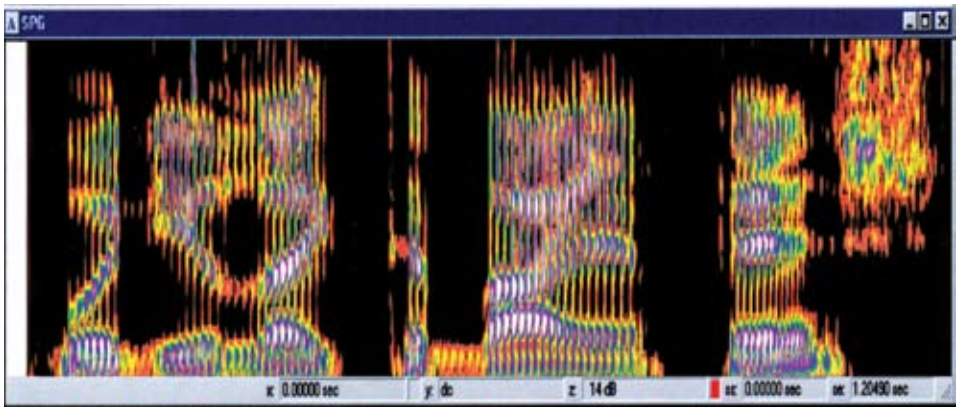

other terrorist leaders urging their followers to attack the United States and its allies. One of the most shocking videos to date delivered a terrorist statement and execution of an American hostage. Consulting experts have authenticated many of those recorded. These tapes contain individual speech patterns that may be evaluated through voice identification. Voice identification focuses on the audio portion of the recordings. The aural/spectrographic methodology provides a scientifically based opinion as to the identification or elimination of the voice in question (Owen, 2003). The aural portion of voice identification is the scientific evaluation of the fundamental quality of speech, rate, mannerisms, amplitude, pathology, breath, accent/dialect, and coupling of the speech patterns of a particular individual.

The spectrographic portion of voice identification is the scientific evaluation of the bandwidth, mean frequency, formats information, fricatives, plosives, word transition, rate, distribution, intensity, and other visual cues. The spectrographic portion transforms the speech into three-dimensional spectrograms for visual comparison of unknown recordings to previously identified recordings for comparison. These spectrograms represent time, energy, and frequency and may be displayed in normal or contoured options. In many regions around the world, very slight inflections can aid in the identification of an individual whose environmental influences are known. Although verbatim exemplars are usually not available for the majority of terrorist cases, non-verbatim speech is often used to provide a basis for the examiner's opinion.

Conclusion

The fact that a recording is authentic, as relative to the scientifically based criteria of being original and containing no signs of tampering, does not in itself mean that any unsubstantiated or implied representations not present or verifiable by additional investigative procedures should be construed as authentic by default. If the audio/video recording is not a complete account of the entire event in question, only those elements, which are verifiable, should be used in forming an opinion. This is not to imply that every event must be completely documented in order for it to be considered as factual or persuasive evidence. Each case is unique, and every applicable method should be considered. In general, the representations implied by recordings that do not contain the actual event in question are limited to the verifiable elements that exist within. Opinions subject to further investigation by additional experts may require caveats in order to clarify limitations and protect against misinterpretation.

As terrorist organizations around the world continue to deliver their messages through audio and video recordings, the need to authenticate this evidence and identify the participants will undeniably increase. Many countries have increased their efforts to monitor and record the activities around critical infrastructures. Surveillance technologies will continue to play a vital role in detecting suspicious activity, identifying the individuals involved and possibly preventing a terrorist act.

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Barry G. Dickey, DABRE, is a Diplomate of the American Board of Recorded Evidence, a member of the American College of Forensic Examiners, a member of the Audio Engineering Society, and a certified forensic analyst in the fields of forensic audio/video, and voice identification. He has over 13 years of forensic experience examining audio and video recordings for the U.S. Government, state and district attorneys, corporate law firms, state and federal law enforcement, civil and criminal attorneys, private investigators, insurance companies, and news broadcast agencies.

Forensic cases involving Mr. Dickey have been featured on The Learning Channel's "Science Frontiers," "Forensic Files," and on the CBS and Fox News Networks. He has consulted with news networks in reference to the Osama bin Laden tapes and tapes released by the Al-Jazeer network. With more than 20 years of experience in the engineering and production of audio and video recordings, he has examined evidence relative to civil and criminal matters in over 1000 cases in the United States and Europe, testifying on issues involving both audio and video evidence. For more information visit www.audioevidencelab.com or email BDforensic@aol.com.

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