C11   Reliability of Time-Motion Surveillance Images as Evidence in Accident Causation: Case Study Involving Images of a Vehicle/Pedestrian Collision

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After attending this presentation, attendees will see that surveillance images, recorded at an accident scene, can in some cases bias an observer of the images as to what actually happened during the course of the event.

This presentation will impact the forensic community by demonstrating how surveillance images can bias the interpretation of the facts of a recorded event. It will show that jurors can be mislead into an incorrect conclusion about an event when they simply view the sequence of images as if it were a movie or video.

Surveillance cameras are very common in today's world. Many businesses and government buildings have a multitude of security cameras that continuously record scenes where people are going about their daily business. As a result, it is quite common for accidents to be recorded by a security camera and for the resulting images to become critical forensic evidence for reconstruction and for a demonstration to the jury as to how the accident occurred.

The subject case study involves a surveillance camera located in a parking lot adjacent to a cross-walk on a public road where a pedestrian was hit by an accelerating van. The camera system recorded a sequence of digital images of the event. The subject of this investigation is to address the degree to which the surveillance image sequence is reliable as forensic trial evidence on the issues of the motion of both the pedestrian and the van during the course of the event. It was found that when simply played back as a video in real-time, the image sequence demonstrated both perspective and temporal distortion when compared to what a hypothetical witness at the scene would have observed.

Perspective Distortion: It is well known by professional photographers, photogrammetrists, and imaging scientists that the effect of using a telephoto lens at a relatively long distance produces in the resultant photograph, when viewed normally, a perspective distortion known as "foreshortening", where an object dimension or the distance between objects appears unrealistically small. Conversely, when using a wide angle lens the opposite occurs.

For the subject case, a site inspection revealed that the surveillance camera's distant location and relatively long focal length lens produced a foreshortening effect that biases the viewer of the images toward perceiving the distance that the pedestrian travels before being struck by the van is shorter and therefore his speed slower than they would have perceived if they were eye witnessing the same event.

Temporal Distortion: The subject surveillance camera system recorded quarter frames (320 X 240 pixels) at a framing rate of about 4 images per second. Playback at 4 frames per second is significantly below the critical flicker frequency of the human eye, giving the impression of an extremely "choppy" motion that is commonly referred to as a stroboscopic effect or a flicker effect. For reference, the framing rate of a motion picture film at the theater is 24 images per second and typical home video is recorded at 30 frames per second. Playback of a sequence of images at 4 images per second distorts the perception of motion for the viewer into a choppy sequence of discrete images with visual information between images being non-existent. This is especially problematic, in the subject case, for the reliable perception and judgment of how fast the pedestrian was running or how rapidly the van was accelerating. At this slow framing rate, it is impossible for the viewer of the images to tell if the pedestrian's legs are making a running or walking motion.

Case Details: When the surveillance images are viewed as if a movie, and without the benefit of having visited the site of the event, it gives the impression that the pedestrian crossed the intersection at a "fast walk" and in plain view of the van driver who then accelerated into him. The impression is that the van driver had plenty of time to see the pedestrian crossing and should have avoided hitting him by waiting for him to cross before accelerating.

Photogrammetric analysis of the images in conjunction with visual observations and measurements at the site reveal a different story. The camera was found to be located 15 feet up on a pole that was 471 feet from the point of impact and covered a horizontal field of view of only 18.4 degrees (35mm equivalent of a 215mm telephoto lens). It was found that the pedestrian "ran" approximately 50 feet in 3.25 seconds (15.4 ft/s or 10.5 mph) from when he stepped off the curb to when he was struck by the van. Though the viewer of the images sees the pedestrian for a full 4.25 seconds before he is struck, photogrammetric analysis also determined that, for the van driver, the pedestrian was obstructed from view by a vehicle in an adjacent lane until less than 1.25 seconds before the van starts moving and only 2.0 seconds before impact.

The impact of this presentation is to show that surveillance images can bias the observer into concluding facts that are not true. Though the old adage that "the camera never lies" may be true, it is equally true that the observer of the images can easily misinterpret what the camera has recorded.

Surveillance Camera, Image Analysis, Accident Reconstruction