D27 Use of 3D Computer Animation to Evaluate Complex Shooting Events

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The goal of this presentation is to present to the forensic community a method for visualizing complex shooting events using 3D animation software.

This presentation will impact the forensic community and/or humanity by demonstrating how 3D computer animation was used successfully to better understand a complex and high-profile shooting event. In the future, they may use this tool to aid in their own analyses.

This presentation will examine how 3D computer animation was used to evaluate a complex and controversial shooting event. A man was killed when he was shot multiple times in the back by a police officer. A reconstruction of the event using 3D computer animation demonstrated how the event occurred.

A police officer investigating a noise complaint at a large Halloween party observed what he believed was a narcotics transaction. Standing in the backyard of a Hollywood Hills home, he looked into a bedroom window. Inside the darkened bedroom he saw three men making an exchange. When he illuminated the individuals with his flashlight, one of the men pulled a large handgun from his waistband and turned and pointed it at him. The officer reacted by drawing his gun and firing it nine times at the man through the glass panes of a French door.

The man fell to the ground and subsequently died from his injuries. The autopsy showed the man had been hit by four rounds. Three were in his back, and the other was to the back of his head. It was discovered that the man, an aspiring actor, had been holding a fake gun. The gun was a movie prop. The event immediately became controversial and received considerable attention in the media.

This particular incident would be difficult for the average person to conceptualize due to its complexity. Multiple shots were fired at various angles in a short period of time, and both the officer and the man were moving at the time. Computer animation allows one to visualize the complex interaction of objects with regard to time and space. Thus, it is an excellent tool for analyzing this kind of event.

Three important factors had to be considered in reconstructing the shooting: the paths of the bullets, the motion of the man who was shot, and the timing of the firing sequence.

To determine the bullet paths, a shooting reconstruction was conducted at the scene. The five shots that missed, hit the bedroom wall and a closet door. These bullet holes had been subsequently repaired, however repairs were clearly visible so the location of the holes could still be determined. The original French door had been preserved and was reinstalled with bullet holes in the glass still intact. By correlating the bullet holes in the glass with those in the bedroom walls, the paths of the bullets could be generally defined. Three-dimensional measurements were then taken of the scene and bullet hole locations using a surveyor's total station.

Next, a shooting exercise was conducted at a firing range. The same officer was told to draw his weapon and fire nine rounds in response to a visual cue. He was told to assume the same posture and step backward while firing, as he did the night of the incident. Several tests were recorded using high-speed video at 500 and 1000 frames per second. The tests showed that the officer was able to fire all nine shots in less than two seconds.

The officer and an eyewitness both stated that the man turned toward the officer and pointed the prop gun at him. However, in order for the shots to have hit man's back, he must have turned away during the event. A videotape was made of an individual pointing a gun as described and then suddenly turning away. The tape was used to determine a reasonable rotation speed for someone turning away from a threat.

Using this data, a computer animation was created. The shooting scene was modeled on the computer using a 3D animation program. This type of program allows the user to accurately define and visualize objects in 3D space. Once a scene is created, bullet paths through space can be defined.

Human-like computer models, called mannequins, were scaled to match the dimensions of the officer and the man. They were then placed in the scene according to witness statements. Bullet paths matching the descriptions in the autopsy report were plotted through the body of the mannequin representing man. (It should be noted that such mannequins are idealized representations of humans. Some torso and extremity dimensions may differ from those of the actual people involved, just as dimensions vary between individuals of the same height. Also, the mannequin's torso does not bend the same as a human's since it is made up of articulated polygons. However, a good approximation of human body positions is possible.)

By correlating the bullet paths through the body with the officer's line of fire, it was determined that the man had to bend at the waist and rotate to his left, presenting his back to the officer. The variation in the angles of shots laterally indicated that the man was in motion when he was shot. The vertical angle of each shot to the torso indicated that he was bending over as he rotated. His body position at the time of the head shot could not be determined because of the head's ability to rotate independently of the body. The timing of the shots was based on the data recorded at the firing range. The rotation speed for the mannequin representing the man was based on the videotaped reenactment.

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The resulting 3D computer animation was a real-time visualization of how this event likely occurred.

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