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Justice Applications of Computer Animation

By Fred B. Cotton, SEARCH

Improvements in microcomputer graphics in recent years provide the opportunity for law enforcement agencies to take advantage of sophisticated applications that were previously restricted to high-cost mid-range and main-frame computers. One example is the adaptation of computer-aided design (CAD) and computer animation software to the criminal justice arena. While the use of animation technology is gradually being implemented for law enforcement purposes, it is increasingly finding a home in the courtroom.

Criminal justice applications

Modern microcomputer CAD software allows a user to create three-dimensional (3-D), graphic representations of a variety of events, including crime scenes, traffic collision scenes, and mechanical operation of complicated machinery. Once created, the operator can easily change visual perspectives within the 3-D drawing by using a variety of camera angles. Different views of a crime scene can help relate items of evidence and locations where evidence was recovered.

When fully animated, the finished product presents a

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Explore New Technologies**

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The *Bulletins* identify, describe and assess new and emerging technologies that have existing or potential application in criminal justice information management. They alert practitioners to the existence of technologies which can benefit their management of information.

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powerful illustration of a particular event. In recent months, computer animation has been used before juries to recreate and illustrate complex events. Computer animation and 3-D crime scene sketches have already been used successfully in both civil and criminal cases. Animation is also making its way into law enforcement agencies, which are beginning to use the technology to illustrate such events as traffic and accident patterns.

Operational experiences

In 1991, the San Francisco Police Department used CAD and 3-D animation software to recreate the events surrounding the Mitchell Brothers homicide case. In this case, Jim Mitchell, a self-proclaimed "porn king," was charged in the shooting death of his brother Artie, who was also his business partner. The case was particularly complex because many of the bullets fired inside the building traveled through walls and door



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frames, making their trajectory paths difficult to explain, but much easier to demonstrate.

Detective Alexander Jason, using a personal computer and 3-D Studio™ CAD/animation software from Autodesk Corporation of Sausalito, California, recreated the crime scene in a 3-D rendering. His recreation was based on detailed crime scene sketches, police reports, a 911 audiotape, and his own measurements at the scene. He combined his interest in computer animation with his technical training in wound ballistics to create a computer animation of the crime that illustrated the prosecution argument for the jury. His animation allowed the prosecutor to present a very complicated

case in a format that was easy for the jury to understand. The case subsequently resulted in a murder conviction, which the prosecution credited, in part, to the use of animation.

In a civil case involving the shooting death of a 12-year-old who was playing with a loaded .44-caliber magnum pistol, ForensiTech, Inc. animator Robert Stites was able to show that it was impossible for the deceased child to have pulled the trigger on the weapon as the other child in the room claimed. (See illustration below.) The animation reconstructed the shooting scene as it had to have occurred based on the blood spatter patterns and wound ballistics found at the scene. Based on the position that the gun and the child had to be in in order to create the blood and wound patterns, it was clear from the animation re-

construction that the deceased could not physically have pulled the trigger. It was apparent that the other child in the room pulled the trigger while wrestling with the deceased over the weapon.

Most jurors today have been raised in a multimedia world where much of the information they receive is in the form of live video and sound. Effective presentations to the general public today involve sophisticated video and film presentations combined with computer imagery. Most people can assimilate multimedia images of complex sequences of events much faster and more efficiently than they can verbal- or text-based descriptions. Current and future generations are even more likely to use multimedia as a primary learning tool. It stands to reason that arguments presented in an animated format are likely to be

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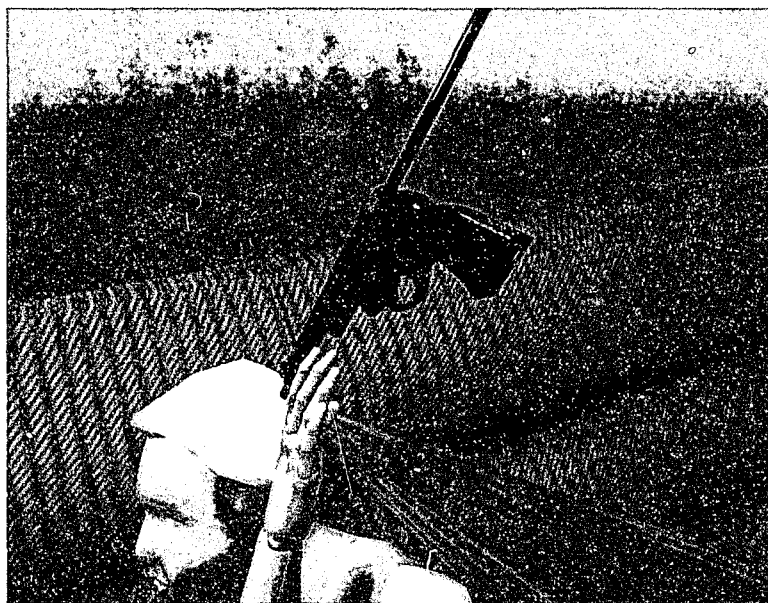
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Computer animation used blood spatter patterns and wound ballistics found at the scene to show that it was impossible for the victim's wound to have been self-inflicted, as the witness claimed.

...in criminal justice...

come the norm for courtroom presentations in a variety of cases.

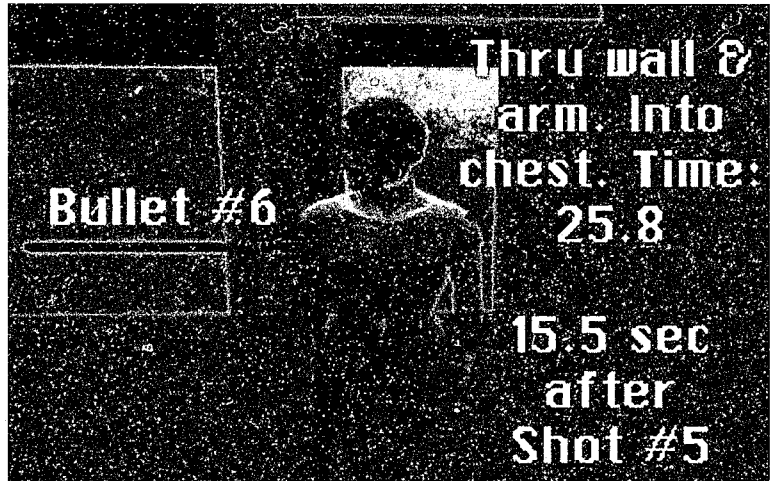
Since the success of the Mitchell homicide case, Detective Jason left the force to form his own company, ANITE Group, based in Pinole, California. The company has refined the use of animation in both criminal and product liability cases. It is regularly called upon to reconstruct officer-involved shootings or other incidents where serious liability to an agency is attached. In several incidents, the company has been able to forensically verify an officer's description of a shooting by illustrating wound ballistics and plotting the path of a moving object in 3-D detail. According to Mr. Jason, "A picture is worth a thousand words; animation is worth a thousand pages."

Law enforcement use of animation

Criminal justice agencies are also using 3-D animation in innovative ways. Dr. Frank H. Dowell, Senior Crime Analyst, Concord (California) Police Department, uses animation software to show changing crime and traffic collision patterns superimposed over a map of the city. One of his animations involved the display of traffic collision locations in the city for one month, broken down into one-hour segments. Each segment was plotted on the map and the image captured to disk. When the 24 images had been captured, they were assembled into a "flip-book" style of animation using Animator™ by Autodesk Corporation. Once the animation was played on

the computer, the average traffic collision patterns for the entire city were displayed in fluid motion. This technique can be used for the graphic display of long-term geographic trends simply by

nia. Another is Back Track™, written by Dr. Fred Carter of Carlton University in Ottawa, Canada. These programs use the investigator's measurements at the crime scene and a series of mathematical formu-



In this animated recreation from the Mitchell Brothers homicide case, the trajectory path of a bullet is shown as it passes through a wall and strikes the victim.

using six months, one year, or five years' worth of geographic-based data.

Another law enforcement use for computer animation is to conduct blood stain pattern analysis. This involves plotting the ballistics and trajectory of airborne blood droplets in violent injury/death investigations. CAD/animation software is being used effectively in reconstructing the points of origin of the blood droplets. By calculating the points of origin of key blood stain patterns, investigators are often able to reconstruct the events leading up to the injury or death. One software program for this purpose is the No More Strings™ Blood Spatter Analysis Program, available from Miller Forensic Software of San Jose, Califor-

las to calculate the origin of the blood droplets.

Benefits: increased understanding of complex events

Law enforcement agencies are routinely tasked with complex investigations. Many of these investigations involve serious crimes or torts where the accurate representation of locations and events is critical to successful litigation. Extensive testimony by a variety of experts using technical descriptions of events can be difficult to piece together and visualize, often serving only to confuse jurors during court proceedings. This is partly because sketches and still photographs offer a two-dimensional representation of a three-dimensional space. The jury often cannot visualize the

argument being presented to them. Three-dimensional computer animation can provide this critical visualization of an event for the jury, and can serve to clarify complex arguments.

Many arguments based on mathematical computations of time, rate, distance, spatial relationships or any combination thereof, lend themselves well to 3-D computer animation. The ability to change perspectives, zoom in or out or "fly" through a scale model of a crime scene from a variety of directions, provides jurists with a new tool to help them understand complex arguments. It also ensures some consistency in the jury's perceptions of events.

In the Mitchell Brothers case, using physical evidence such as the wounds on the victim, the bullet holes in the house and fragments left at the crime scene, a chain of events was illustrated, making the event easier for the jury to understand.

Animation, like words, however, can be misleading and may distort events, often with more devastating effects because of its visual impact. The power of "seeing" a crime through animation tends to make the event more realistic and is extremely persuasive. Although the recreation may look logical, the prosecution and defense can still add their own "twist" to the crime. Jurors must remember that behind the futuristic facade, the animation system is really only a high-tech drawing tool, used to illustrate an argument from the perspective of one of the litigants. It is not evidence in and of itself.

Cost considerations

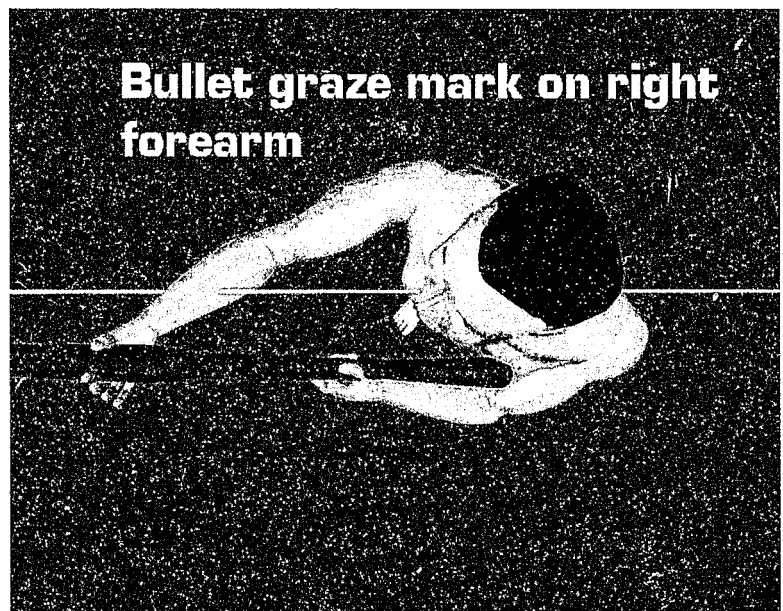
Both the initial equipment costs and finding someone with the training and interest in applying animation contribute to the difficulty in initially implementing the technology. Few programs on the market that run on 486 PCs and which require less technical experience, however, are initiating a trend in affordable animation applications that most people can use.

According to Mr. Jason, his complex trial animations require a high-speed personal computer (a 100MHz Pentium-based system is preferred), as much Random Access Memory as possible (Jason uses 48MB of RAM), a high-resolution graphics accelerator card and a high-quality graphics interface card to output the completed animation to videotape. The hardware alone can cost as

much as \$15,000. In addition to the hardware, the 3-D Studio™ software retails for \$3,000 from Autodesk Corporation. Mr. Jason can spend as many as 250 hours on an animation sequence, depending upon the complexity of the sequence of events being animated. Typical animations by ANITE Group cost between \$3,000 and \$12,000, depending upon the complexity involved. The cost of animation and forensic calculation of wound ballistics is often a bargain, considering the potential liability involved in these cases.

Smaller, more affordable and less complex systems are making their way onto the market. These systems run on a 486 PC and for the most part produce high-quality animations suitable for police department use.

One particular program capable of 3-D design is Micro



Computer animation showed that this suspect was pointing his shotgun at the officer when he was shot through the arm and stomach. A wrongful death suit had alleged that he was shot through the back while fleeing the scene.

Station™ by Intergraph Corporation, located in Huntsville, Alabama. Detective Brian Kennedy of the Sacramento County Sheriff's Department uses it for near-scale crime scene diagrams, operating it from his laptop computer at the scene. He has used crime scene sketches created with Micro Station™ in several criminal cases. Micro Station™ retails for \$3,000 and can render full-color, shaded animations.

The No More Strings™ Blood Spatter Analysis Program currently retails for \$750. Once an investigator is trained in this investigative technique, the software becomes a valuable tool which provides a high degree of accuracy combined with ease of use.

In the courtroom, however, animation combined with the cost of a defense team is a high-tech defense that often only wealthy defendants can afford. In some cases, the defense feels forced to use animation because the prosecution has decided to make its case through 3-D animation.

How the technology works

CAD/animation software works primarily upon a Cartesian coordinate system where points are connected by lines along any combination of three axes. By referencing points from a point of origin (generally located at the lower left rear corner by convention), other points and lines are represented by X (horizontal), Y (vertical), and Z (depth) coordinates. By drawing lines between a series of points, a "wire frame" 3-D image is created. The CAD/animation

software can quickly recalculate the relationships between lines and points, thus providing a virtually unlimited variety of perspectives and distances from the wire frame drawing. The software also has the ability to take a series of drawings with incremental changes and link them together, thus providing an animated sequence of events and apparent motion.

Once the wire frame animation is completed, the software can apply special effects to the drawing, including multiple colors, light sources, shading and shadowing relative to the changing perspective. This process is called "rendering the animation." A complex animation can take more than 15 hours to render on a 66 MHz 80486-based microcomputer, but once rendered, the animation can be played back with smooth motion on the computer, annotated with titles, illustrations and photographs, and output to videotape for courtroom presentation. A high degree of artistic talent is required to render professional-looking animations.

In the case of vertical market applications such as No More Strings™ or Back Track™, the software is menu-driven and designed to create a specific type of drawing. This type of software is generally user-friendly for investigators who have been trained in this type of forensic investigation. Investigators who are not trained, however, may not understand the critical crime scene measurements and evidence identification required of these specific types of analysis.

Conclusion

Due to its powerful illustrative value, animation is most prevalent in courtroom proceedings and will probably always receive its highest demand from those who must present the intricacies of a complex case for a judge or jury to contemplate. Animation can benefit law enforcement agencies with illustrations of blood spatter patterns and in analyzing traffic accident scenes. Use of animation software is most likely to grow in law enforcement agencies as the price of the software continues to fall and animation programs become more readily available for use on PCs.

This report was written by Fred B. Cotton, Manager, SEARCH Training Services. Points of view or opinions are those of the author and do not necessarily represent those of SEARCH or the SEARCH Membership Group.

Additional Information

Agencies seeking additional information about the technologies described in this *Technical Bulletin* can contact the following vendors:

ANITE Group
P.O. Box 375
Pinole, California 94564
(510) 724-1003

Autodesk Corporation
Sausalito, California
(415) 331-0356

Back Track Software
Ottawa, Canada
(613) 788-2600, Ext. 4366

ForensiTech, Inc. Forensic Animators
P.O. Box 1636
Beaverton, Oregon 97075-1636
(503) 646-6888

Intergraph Corporation
Huntsville, Alabama
(205) 730-2000

Miller Forensic Software Corporation
San Jose, California
(408) 246-7733



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