SEEING IS BELIEVING

graphical evidence and its effect on the viewer

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COURTROOMS, one of the last bastions of the oral tradition, are slowly morphing into cinematic display environments. The persuasive oral rhetoric of lawyers is increasingly being replaced by compelling visual media displays presenting a range of digital evidence in a convincing and credible manner. Recently, a number of courtrooms around the world have seen the presentation of forensic evidence within reconstructed virtual environments.

It is important to realize that the use of such computer-generated presentations in a courtroom is only the current manifestation of evidence illustration and visualization in a long history of evidential graphics used in litigation. However, computer animations and interactive virtual simulations are unparalleled in their capabilities for presenting complex evidence. The use of such enabling visualization technology can influence the way evidence is assimilated and correlated by the viewer.

At first glance, these graphical reconstructions may be seen as potentially useful in many courtroom situations, and they are often treated like any other form of digital evidence regarding their admissibility. Perhaps, however, this specific form of digital media warrants special care and attention due to its inherently persuasive nature, and the undue reliance that the viewer may place on the evidence presented through a visualization medium.

Admissibility of Computer Generated Reconstructions

Computer-generated displays—and, more specifically, scientific animations or simulations—must meet certain criteria before being admitted as evidence in court due to potential bias and unfairness. Legislation and case law exists in most countries that govern the admissibility of computer-generated displays (and in fact, any visual or scientific evidence or display) in court, in order to ensure fair, unbiased, and appropriate use of this evidence.

Digital visualizations have been widely used in courts in the United States courts for the last 20 years; hence, much of the applicable case law is from the U.S. The technology has only relatively recently been introduced into many other global jurisdictions. Although this top-end technology is more common in civil trials, it is seeing greater use in the criminal arena and has been used in high-profile criminal cases such as the O.J. Simpson and Oklahoma City bombing trials in the U.S.

Due to the critical nature of criminal trials, any computer-generated evidence put forward should be thoroughly examined. The use of a jury in criminal cases is another important reason for carefully assessing the prejudicial effect, accuracy, and relevance of computer-generated evidence. Juries are particularly vulnerable—often more so than judges and coroners—to any prejudicial effect and inaccuracy of scientific animations. Perhaps this is because juries do not have the same level of cynicism that years of experience with analyzing evidence has given judges and, to a lesser degree, coroners. As a result of the possible loss of an individual's freedom—and sometimes life—the use of computer animations and simulations in criminal cases must be analyzed carefully.

One example of the potentially emotive influence of such digital evidence is the case of *State of Connecticut v. Michael Skakel* that involved significant use of computer-generated imagery. Michael Skakel's audiotaped

Figure 1*—An image taken from a forensic animation of a road-traffic accident.*

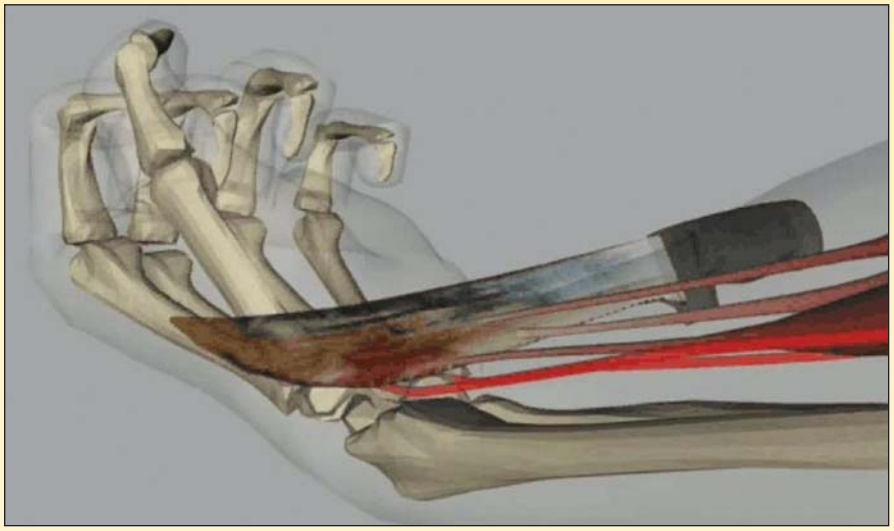

***Figure 2**—An image from a virtual model of a suicide incident.*

interviews were digitized and re-formatted into an interactive multimedia audio tool. This was developed into a closing argument presentation, during which jurors heard Skakel describe the panic he felt when the victim's mother asked him about her daughter the morning after the murder. Simultaneously, jurors saw on the screen photographs of the lifeless body beside the transcript of Skakel's words.

The defense appealed to the Supreme Court of Connecticut on this point, among others. The appeal was rejected. See: **www.jud.ct.gov/external/supapp/Cases/AROcr/CR276/276CR155.pdf**

In *Queen v. Maloney* (EWCA Crim 1373, [2003] All ER (D) 277), in preparation for an appeal against conviction, an accident reconstruction expert for the defense created a reconstruction using a computer-simulation program—a technology that had not been available at the time of trial. With the consideration that the opinion of that expert was not conclusive, the members of the court of appeal decided that the evidence would have no effect upon the safety of the conviction. The court did not receive the new evidence and dismissed the appeal.

It is a matter for the trial judge to decide whether to admit such evidence, and—upon reaching a decision—a number of matters will need to be canvassed:

1) An animation is a sequence of illustrations that create the illusion that the objects are in motion. A computer-generated animation is admissible where it can be demonstrated that the animation portrays the evidence fairly and accurately, and the events it portrays are significantly similar in all material respects to the underlying evidence.

2) Simulations can comprise reconstructions and recreations of events. They are based on a model, comprising a number of operating assumptions that aim to represent a set of facts in mathematical terms. The accuracy of the simulation depends on how well the relevant elements and possible actions that occur in the physical world are matched to the assumptions included in the model of the simulation. If the simulation is effective, it is possible to illustrate the probable consequences of any theory of a case.

The proponent wishing to adduce a computer animation or simulation will be required to provide evidence of the underlying mathematical model used in preparing the simulation, together with the factual premise upon which the evidence is predicated. In addition, it will be necessary for the expert introducing the evidence to explain their opinion at the preliminary stage in order for the trial judge to decide whether the evidence of the animation or simulation, together with the opinion of the expert, embraces the ultimate issue to be decided.

The Viewer and the Evidence

The vast majority of people called to be on a jury have grown up watching visual media on screens: cinemas, televisions, computers, and even their mobile phones and other portable media players. Research has shown that many people tend to believe what they see in the mass media and merge mediated fictions into their beliefs about the world. The cognitive default when viewing visual media is to believe what is seen, only later engaging in the effort needed to suspend or reject belief. Pictures that move on a screen tend to be even easier to believe. These are usually more engaging and entertaining, and may thus decrease the mental resources of the viewer that are available for doubt.

This ability of viewers to place undue reliance on visual evidence has profound implications for the use of any form of animated visual digital technology to present evidence in courtrooms. The potential life-and-death weight of the issues means that those undertaking this important civic duty by acting as jurors need to able to make an objective assessment of the evidence before making their decisions. The way the evidence presented must be probative, not unfairly prejudicial.

Visual Evidence

Improvements in forensic science and the introduction of new digital technology have led to an increasing amount of complex, technical evidence being presented in courts. The issues in question can be extremely complicated and difficult to explain without some form of graphical representation. A survey by the American Bar Association found that members of a jury are often confused, bored, frustrated, and overwhelmed by technical issues or complex facts. Other research has indicated that the attention span of the average member of a jury in a court is only about seven minutes long.

Many lawyers and expert witnesses recognize that there is now a need to reduce lengthy verbal explanations and increase the use of visual tools for their media-literate modern audience. This technology, in turn, offers the possibility of improving the capacity

of a jury to retain the evidence presented, to maintain their interest in the proceedings, and to allow the jury to understand the nature of the case more fully.

In courtroom settings, static images such as diagrams and charts have been traditionally used to explain the complex testimony of an expert witness. Three-dimensional graphical technology (including forensic animations and real-time virtual reconstructions) are unique in their ability to visually manipulate, animate, and illustrate the passing of time. This extra-temporal dimension can be extremely useful when explaining a chronological sequence of events, such as in the reconstruction of a vehicle accident, where the dynamic movement of the vehicles involved may be dependent on complicated and difficult-to-explain engineering or mathematical principles (*Figure 1*).

Presenting data related to road-traffic accidents in the courtroom is a prime example of the need to relate spatial and temporal data; accordingly, the use of computer-graphics-based media has been extensively adopted for the presentation of this kind of evidence. In such cases, computer-generated forensic evidence is generated using a three-dimensional virtual environment replicating the accident scene using actual measurements usually taken by the police or investigators at the time of the incident. Dynamic vehicle movements are often simulated using scientific calculations based on those measurements and the experience of the reconstruction engineer. It is important that these forensic reconstructions of the vehicle accident, when viewed in court, support and corroborate existing evidence and are hence admissible as substantive evidence in any courtroom.

A particularly relevant aspect of the computer-graphics-based evidence under discussion is the ability to visualize unseen or imaginary environments. In a courtroom context, this manifests itself as the ability to visualize evidential information that may not be naturally or readily visible to the naked eye. The virtual camera can break free of the physical restrictions restraining real-world cameras and show processes that occur on too large or too slow a scale (from the unfolding of a storm to the replication of DNA), or processes that are occluded by other objects (the complex mechanics of a machine or the internal workings of the human body, as shown in *Figure 2*).

The digitization, modeling, and rendering process allows the output to be manipulated, combined, and juxtaposed as never before. The media produced can be readily adapted to any communicative or argumentative context; hence, the rhetorical potential of the evidential images produced has been tremendously expanded by the introduction of computer-graphics-based technology.

There is little argument regarding the effectiveness of animated visual media as a tool for communication and knowledge transfer. The technology can offer significant benefits over traditional static (photographic) or moving (film) media captured in the real world. The rendered images from virtual worlds are not bound by the limitations of available lighting. They can avoid extraneous information, focusing only on salient evidential items. And they can be colorful, animated, and lively enough to guarantee the attention and engagement of the viewer.

Guidelines for Use

Modern culture is dominated with images that may simultaneously have over-determined value as well as indeterminate value…and only with difficulty can their layers of significance be teased apart.

Different academic disciplines (including critical theory, psychology, education, media studies, art history, semiotics, etc.) have been developed to help explain how audiences interpret this visual imagery. As courts begin to use multimedia and cinematic displays, this has profound implications for the legal processes that utilize such technology. It must be questioned whether the decisions made in courts when using such technology are affected by the manner in which the evidence is presented.

Analyses of computer-generated displays have shown that they can be extremely advantageous when used to elucidate expert testimony, providing they are used appropriately. Such displays may be used in different ways in the court: as substantive evidence, or to illustrate or demonstrate a point. However, when reconstructions are examined in further detail, a number of issues and questions can arise. The consequences of these problems cannot be underestimated, since errors, inaccuracies, misuse, tampering, or bias within visualizations are capable of leading to miscarriages of justice.

Specific issues relating to the technology are too convoluted and complex to be discussed in any detail within this article, but may include such things as:

❏ Viewpoint—Correlating witness viewpoint from the real world with a virtual camera.

❏ Correlating Location—Positioning virtual objects accurately within the environment.

❏ Realism—Deciding upon the use of photorealistic or abstract representations.

❏ Media Mode—Computer graphics, photographs, video, and plans diagrams, and the interaction between these different media forms.

❏ Audio—Integration of real-world or simulated audio within the virtual environment.

❏ Resolution—Screen resolution (projected image or iPod video) is one of the facets of this.

❏ Accuracy—Accuracy is the foundation of all evidence, and the ability to validate the accuracy of the reconstruction in an evidential context is imperative.

❏ Simulation—Definition of the mathematical models used to simulate real-world activities within the computer model.

❏ Narrative—Linear or non-linear narrative forms are both possible using interactive virtual environments to display evidence.

❏ Lighting—Consideration needs to be given to the correlation between lighting in the virtual world and that available in the scene at the time of the incident.

By their very nature, any recommendations and guidelines formulated regarding the use of computer-generated displays are likely to be broadly defined and generic. Any recommendations in an article such as this can be little more than general suggestions that users of the technology be aware of the issues listed above when they are involved in developing and using forensic animations and virtual reconstructions. Unfortunately, many of these issues have been ignored in the past when such technology has been used, and this may have been a contributing factor to admissibility problems in certain jurisdictions.

One piece of advice is that designers of virtual environments that are used to create evidential graphics ought to study filmmaking techniques. The reason for this may be to aim to achieve the same effects as a filmmaker—perhaps getting the viewer to identify emotively with a particular character in a reconstruction to enhance the power of the message. Alternatively—and perhaps more importantly—an animator or reconstruction engineer may wish to eliminate these effects and remove the emotive content to provide an objective, understandable view of an evidential data set, with no distracting emotive attachment. An awareness of the ways in which the viewer can be manipulated (for example, through the use of egocentric and exocentric viewpoints) is essential to achieving this.

Some experts cite a hypothesis that visual media can be "loaded" with emotive content that may have a prejudicial effect on the viewer. This process of adding emotive content has even been called "Disneying-up" the evidence.

A Balanced View of the Technology

There is little doubt regarding the need to reduce lengthy verbal explanations and increase the use of visual tools for a media-literate modern audience. The precise effect that this increasing reliance on visual media over the more traditional mechanism of oral presentation is having on members of a jury, witnesses, and other viewers in the court is not fully understood. Concerns are beginning to be articulated that the use of modern computer-generated visualization technology may distort perceptions, memories, attitudes, and decision-making in the court.

A number of studies have examined how members of a jury retain details in their memory from different forms of evidence. All show that juror's memory retention improves drastically when comparing visual evidence to oral testimony. Experiments undertaken to assess the effects of computer-animated displays on mock jurors have shown that when the claimant and defense used an animation to depict their own partisan theories, participants increasingly made judgments that contradicted the physical evidence. This suggests that computer-animated displays can have a greater effect than oral testimony.

The memory of a witness to an event can also be biased by computer-generated visual evidence. Critical variables in such visualizations may include the representation of depth, speed, color, and distance. The question of how much detail or realism is needed in order for a visualization to be effective (i.e. believable) can be considered crucial.

Research has also found that when people believe they have a sufficient volume of evidence, they feel more confident about making judgments, even when the information is irrelevant. Computer-generated visualizations can provide just such an illusion of sufficiency. Members of the public are often more comfortable with visual simulations over legal discourse, and hence the visualizations may be considered more believable.

In any trial, a judge is usually required to balance the probative value against the prejudicial effect of the evidence proffered. There will always be a concern that the simulation may have the effect of being overly persuasive to the members of a jury. The use of computer-generated simulations and animations can be very effective in helping the trier of the facts reach a decision.

Many of the issues touched upon within this article also apply to other forms of digital evidence, such as computer-enhanced audio and the products of digital photography and enhanced videotapes. Whatever the form of computer-generated evidence that a party seeks to adduce, careful consideration ought to be addressed with respect to the underlying authenticity and reliability of the techniques used to generate the evidence.

Finally, an assertion by the opposing party about the ease by which digital evidence can be altered or manipulated is not a sufficient claim to prevent the proponent of the evidence from adducing it. If the opponent cannot offer an objection of substance that acts to undermine the methods by which the authenticity of the evidence has been preserved, it is questionable as to whether the objections of the opponent are meritorious.

Conclusions

Computer-graphics technology can provide an effective means of conveying complex evidence to the judge and jury in a courtroom. Visual memory has been found to be highly detailed and almost limitless, in contrast with memory for verbal material. Hence, these forensic animations and virtual reconstructions have the potential to improve the comprehension and retain complex spatial and temporal data and evidence.

Visual media can also provide an increase in the attention span of the viewer, since attention is drawn to animated images. A modern audience will usually prefer audio-visual forms of communication, rather than relying solely on verbal modes of discourse.

Studies that compared oral, textual, and static visual presentations to computer-generated presentations containing the same information found the visual media to be more memorable. This has implications not only for the retention of information, but also the weight given to the evidence by the member of a jury or other trier of fact.

The very fact that images generated by computer graphics technology impress themselves on the memory—and are persuasive and convincing—is also their greatest disadvantage: they can leave a strong impression on viewers. Moving images tend to mesmerize, and they can relax an individual's

(Continued on Page 33)

GRAPHICAL EVIDENCE

(Continued from Page 18)

critical nature. This means that viewers are inclined towards a "seeing is believing" attitude, as they do with television, potentially reducing the standards expected of the evidence. Small alterations to a digital representation of an incident can have a substantial effect on the impression it gives. For example, judgments of speed and recklessness are critical in determining responsibility for road accidents. A driver traveling at speed may seem to be reckless if the reconstruction includes young children near the road, but reasonable if adults are represented. Hence, apparently innocuous decisions about virtual object representation are often critical.

When using computer-graphics technologies to present evidence, one should endeavor to ensure that the evidence accurately reflects the scientific data available and augments the testimony of the witnesses. However, to be effective, the evidence must not only tell "the story"—it must also be understood easily. To that end, forensic scientists and media specialists must strive continuously to develop new and creative ways to accurately represent complex evidence.

Additional Reading

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